Beetaloo Sub-Basin Multi-Well Drilling, Stimulation and Well Testing Program
Environment Management Plan (ORI10-3)
EP 98, EP76

APPENDIX F to APPENDIX J

Beetaloo Sub-basin Multi-well EMP originally prepared by Origin B2 Pty Ltd, and updated by Tamboran B2 Pty Ltd

REV	DATE	REASON FOR ISSUE	COMPILER	REVIEWER	APPROVER
0	09/12/2021	EMP released for acceptance	T Khoo	R Ully	M Kernke
1	30/03/2022	Regulation 10 and 11 revisions	L Pugh	M Kernke	M Kernke
2	17/05/2022	Added Section 3.18.2	L Pugh	M Kernke	M Kernke
3	26/03/2025	EMP update to consolidate Regulation 22 submissions	A Court	L Pugh	M Kernke

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APPENDIX F

Spill Management Plan

BEETALOO EXPLORATION PROJECT
SPILL MANAGEMENT PLAN

Review record

Rev	Date	Reason for issue	Consolidator	Approver
2.2	21/09/2023	Edits to Appendix A and DEPWS contacts	LP	MK
2.3	25/03/2024	Addresses regulation 10 and regulation 11 feedback from DEPWS, 29-Feb-2024	LP	MK
2.4	09/05/2024	Baker Hughes chemicals added to Appendix A	LP	MK
3.0	08/07/2024	Inclusion of SPCF	LP	MK
4.0	27/09/2024	Addresses regulation 10 feedback from DEPWS, 26-Sept-2024. Includes additional chemicals assessed under regulation 22 modifications.	LP	MK
5.0	14/10/2024	Update for inclusion of 3D seismic EMP	AC	MK
5.1	06/03/2025	Minor update for 3D seismic EMP	AC	MK

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1. Purpose

This Spill Management Plan (SMP) has been prepared to support Tamboran's Beetaloo exploration program. The SMP is a mandatory requirement prepared in accordance with the *Code of Practice for Petroleum Activities in the Northern Territory* (the Code). This SMP is designed to provide the strategy for the management of spills across Tamboran's Beetaloo exploration activities.

The SMP covers all regulated activities described in the Environment Management Plans (EMPs), currently in force under the Petroleum (Environment) Regulations 2016 (the Regulations). EMPs that are currently in force under the Regulations are available at: https://depws.nt.gov.au/onshore-gas/environment-management-plan/approved-emps.

Activities undertaken by Tamboran and its subsidiaries in the Northern Territory (NT), within its exploration permit (EP) areas (EP 76, EP 98, EP 117, EP 136, EP 143, EP 161 and EP(A) 197 (Figure 1)) include:

- civil works
- drilling and stimulating gas wells for exploration and appraisal purposes
- 2D and 3D seismic programs
- construction and operation of the temporary Sturt Plateau Compression Facility (SPCF)
- rehabilitation and routine maintenance/monitoring activities.

The SMP will reference the relevant sections within each EMP to avoid duplication. The SMP should be read in conjunction with the chemical risk assessment and operation risk assessment appended to each EMP, in accordance with section 3.4 of the Code. The chemical risk assessment is not applicable for seismic surveys.

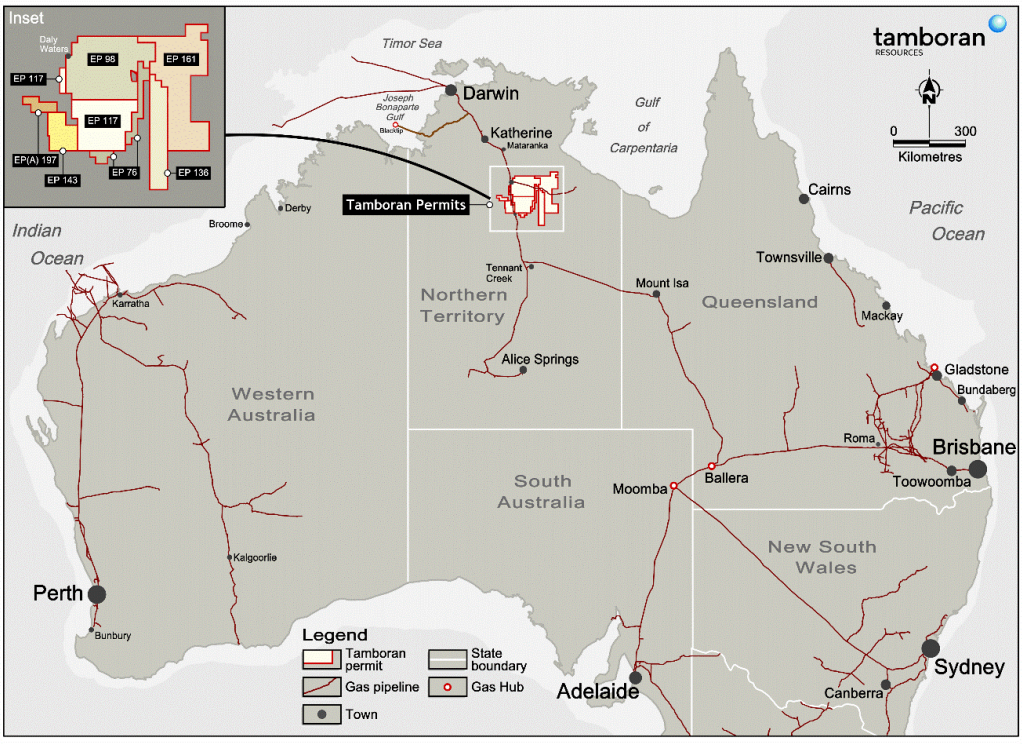

Figure 1: Location of Tamboran exploration permit areas (EPs)

2. Key legislation

Key legislation and documents consulted in the development of this plan are provided below (a full list of applicable legislation is provided in the corresponding management plans):

- **Code of Practice: Onshore Petroleum Activities in the Northern Territory (NT):** Mandatory code of practice legislating the management of chemicals and wastewater onsite, including the use of secondary containment, lined tanks and spill management plan.
- ***Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2010:*** Covers the transportation of goods by road in the NT. This also covers licences for vehicles and drivers carrying dangerous goods.
- ***Workplace Health and Safety (National Uniform Legislation) Act 2011***: Covers the storage and handling of chemicals on site.
- ***Waste Management and Pollution Control Act 1998:*** Covers the requirements for the transportation and disposal of waste within the NT. This includes the requirements for contractors, vehicles and facilities managing listed wastes to be licenced.

3. Chemicals and wastewater description

The chemicals and wastewater typically stored within Tamboran's exploration areas include:

- Chemicals used for drilling
- Waste drilling fluids, cuttings and muds
- Chemicals used for stimulation
- Flowback wastewater
- Completions and well suspension fluids
- Waste and wastewater streams from the SPCF
- General use chemicals such as incidental condensate and oil, diesel and fuels, general equipment maintenance chemicals (hydraulic oils, degreasers etc.)

The full list of chemicals and wastewater stored onsite, including their volume, location and hazardous status is provided in Appendix A for current EMPs. The types of chemicals used under drilling and hydraulic fracture stimulation EMPs covered by this SMP is provided in Table 1, which also identifies the relevant sections and appendices per EMP. A copy of these EMPs and appendices can be found on the Department of Land, Planning and Environment (DLPE) website[1] at: https://depws.nt.gov.au/onshore-gas/environment-management-plan/approved-emps.

The assessment of chemicals, including evaluation of the environmental hazard of the chemical additives in the hydraulic fracturing fluid systems, based on their environmental persistence, bioaccumulation and aquatic toxicity properties; evaluation of human health effects; and exposure assessment can be reviewed by accessing in the relevant hydraulic fracturing chemical risk assessment appended to each approved EMP. All chemicals and wastewater stored on site will be in accordance with cl A.8.3 of the Code.

[1] Please note recent changes in the Northern Territory Government includes the update of Department names as follows: Department of Environment, Parks and Water Security (DEPWS) is now referred to as Department of Lands, Planning and Environment (DLPE)

Table 1: Types of chemicals and wastewater relevant to each drilling and HFS EMP

EMP	Drilling chemicals and waste fluids	Stimulation chemicals	Flowback wastewater	Completion and well suspension fluids	SPCF process wastewater-drip trays and bunds	General use
NT-2050-15-MP-032 Velkerri 76 S2 EMP: • Chemical RA Appendix C • Risk assessment Appendix N	x	x	x	x	N/A	x
CDN/ID NT-2050-35-PH-0018 Amungee NW-1H (ORI7): • Section 2.1.1, Table 2, Table 3.	N/A	N/A	x	x	N/A	x
NT-2050-15-MP-039 Beetaloo W-1 EMP (ORI8): Section 3.9, Table 8.	N/A	N/A	N/A	Incidental volumes may be generated	N/A	x
NT-2050-MP-040 Kalala S1 EMP (ORI9): Section 3.8, Table 8.	N/A	N/A	N/A	Incidental volumes may be generated	N/A	x
NT-2050-15-MP-041 Beetaloo Sub-basin Multi-well EMP (ORI10): • Chemical RA Appendix E • Risk assessment Appendix M	x	x	x	x	N/A	x
NT-2050-15-MP-0088 Amungee NW Delineation Program EMP (ORI11): • Section 4.13 and Section 3.15 • Chemical RA Appendix D	x	x	x	x	N/A	x

EMP	Drilling chemicals and waste fluids	Stimulation chemicals	Flowback wastewater	Completion and well suspension fluids	SPCF process wastewater-drip trays and bunds	General use
• Risk assessment Appendix L						
TB2-HSE-MP-08 Shenandoah South E&A Program EMP (TAM1-3) • Section 3.10 and Section 3.12 • Chemical RA Appendix E and Appendix E.1 • Risk assessment Appendix M	x	x	x	x	N/A	x
TB2-HSE-MP-13 Sturt Plateau Compression Facility – Appraisal gas (TAM2-2) • Section 3.17.18 and Section 3.8 • Risk assessment Appendix K	N/A	N/A	N/A generated and managed under TAM1-3	N/A generated and managed under TAM1-3	x	x
TB2-HSE-MP-14 Shenandoah South 3D Seismic Program EMP (TAM3-2) • Section 3.8.3 • Risk assessment Appendix I	N/A	N/A	N/A	N/A	N/A	x

4. Spill failure scenarios

Potential spill scenarios associated with appraisal activities are summarised in Table 2. These scenarios include:

- spills from chemical, waste and wastewater handling, transfer and storage activities onsite
- spills from chemical, waste and wastewater during transportation - trucking and gathering
- tank, drilling sump and containment vessel overflows and structural failures

The loss of containment due to the failure of well barriers is covered under the Well Operations Management Plan (WOMP).

Table 2: Spill scenario summary table

Spill scenario	Activity duration	Mechanisms	Location	Quality[1]	Quantity	Key management controls	Monitoring	Receptors	Effectiveness of controls
Spills from chemical and waste / wastewater handling and storage activities onsite.	• Drilling – 45 days • Stimulation – 15-30 days. • Well testing – 30– 180 days. • SPCF construction and commissioning – 18 months. • SPCF operation for extended appraisal – 36 months. • Duration of seismic – 3-4 months	• Container rupture • Spill during chemical storage, handling and mixing • Runoff from drilling waste management and composting. • Contaminants in water and soil pass through the food chain and bioaccumulate.	• Chemical storage area. • Chemical, oils and waste oil storage area on the SPCF. • Drilling rig. • Stimulation spread. • Drilling sumps. • Flowback storage tanks. • Well testing equipment. • Seismic lines and storage areas.	Potentially hazardous fluids such as: • Saline and drilling fluids. • Saline flowback. • Chemicals listed in EMP. • SPCF oils, coolants, antiscalants and other chemicals. **NB:** All added drilling and hydraulic fracturing chemicals have been assessed and verified to not be toxic and persistent and bio-accumulative (see EMP chemical risk assessment).	<10,000 L	• Designated storage areas with appropriate segregation of incompatible chemicals. • Secondary containment to be deployed under high-risk spill/leak storage and handling areas. • Spill kits available. • Routine inspection of chemical stores. • Sites are manned during operations, with continuous leak detection and level monitoring at all other times. • Wastewater management plan.	• Routine inspection of chemical stores, sumps and tanks during operations. • Tank leak detection.	Retained on-site	High – use of secondary containment reduces the probability of a spill. High – controls managing the storage of chemicals and wastes are mature with secondary containment measures limiting potential receptor impacts. The scientific certainty around the effectiveness of secondary containment in preventing groundwater contamination is high and mature.
Loss of containment during transfer onsite (e.g. leakage from the SPCF, gathering lines, pipes, hoses, fittings, refuelling/maintenance of seismic equipment etc).	• Drilling – 45 days • Stimulation – 15-30 days. • Well testing – 30– 180 days. • SPCF construction and commissioning – 18 months. • SPCF operation for extended appraisal – 36 months. • Duration of wastewater transfer – 30 – 45 days. • Duration of seismic – 3-4 months	• Coupling, valve, hosing and equipment failure. • Failure of buried / aboveground gathering lines. • During the seismic survey, leaks and spills would most likely result from: ○ loss of containment of fuels from storage area ○ spill during refuelling or fuel transfer ○ hydraulic oil leaks from seismic survey vehicles. • Contaminants in water and soil pass through	• Chemical mixing and transfer areas on the drill rig, mixing hoppers and wastewater storages. • SPCF chemical and oil storage and transfer areas. • Gathering/wastewater lines between well pads and SPCF and wastewater tanks. • Seismic lines and storage areas.	Potentially hazardous fluids such as: • Saline and drilling fluids and flowback wastewater. • Chemicals listed in EMP chemical risk assessment. • SPCF chemicals listed in EMP and managed in accordance with safety data sheets. **NB:** All added drilling and hydraulic	<1,000 L	• Secondary containment to be deployed under high-risk spill/leak storage and handling areas • Spill kits available • Routine inspection of chemical stores • Sites are manned during operations, with continuous leak detection and level monitoring at all other times • Wastewater management plan • Hydrostatic testing of gathering lines prior to operation	• Routine inspection of all chemical handling areas, including wastewater transfer points and chemical mixing areas, seismic survey area. • Monthly inspection of buried gathering lines and weekly inspection of surface gathering lines when in operation.	Retained on-site	High – use of secondary containment reduces the probability of a spill High – use and continuous monitoring of flow and pressure meters during operations reduces the probability of a spill High – controls managing the storage of various fluids are in accordance with the requirements of the Code, which limit potential receptor impacts. The scientific certainty around the effectiveness of secondary containment and transfer in preventing groundwater

Spill scenario	Activity duration	Mechanisms	Location	Quality[1]	Quantity	Key management controls	Monitoring	Receptors	Effectiveness of controls
		the food chain and bioaccumulate.		fracturing chemicals have been assessed and verified to not be toxic and persistent and bio-accumulative (see EMP chemical risk assessment).		• Seismic survey maintenance truck fitted with spill prevention equipment. • Hydraulic fluid and fuel drums stored within portable bunding and bulk fuel stored within tankers equipped with safety features such as double skins (or temporary bunding), safety cut-off valves, top accessing etc. • Spill leak and drip trays used to address the risk of minor drips and spills associated with re-fuelling operations. • In/out volume discrepancy and pressure monitoring during transfer operations • Valve pits installed at approximately 1 km intervals so if a leak is detected, flow can be shut off and the line repaired • Gathering lines will be purged of wastewater and valves will be shut-in when not in operation			contamination is high and mature.
Spills from chemical and wastewater during transportation (off-site-including transport on unsealed roads during the wet season)	• Drilling chemical transfer—1–5 days of bulk chemical transfer generally pre-drilling • Stimulation chemical transfer 2–3 truckloads of chemicals per week for approximately 6 weeks • Wastewater disposal over 3 weeks—up to approximately 22 truck movements total over the duration • Duration of seismic – 3-4 months	• Transport spill due to road condition, flooding or another event. • Traffic accident (total or partial release). • Contaminants in water and soil pass through the food chain and bioaccumulate.	Off-site along highway or access tracks	Potentially hazardous fluids such as: • Combustible fluids (e.g. diesel). • Various chemicals as listed in EMP chemical risk assessment. • SPCF chemicals listed in EMP and managed in accordance with safety data sheets for the SPCF.	<1,000 L for transport spill <50,000 L for total loss of B- triple carrying flowback	• All transport companies to be appropriately licenced to transport chemicals and waste (*Dangerous Goods Act* and *Waste Management and Pollution Control Act*) including the requirement to detect and respond to spills • No chemical or wastewater transportation during wet season, unless a risk assessment determined the activity is safe and low risk • Transportation will not occur on tracks where the surface is not safe to allow transportation	Performance of contractors to be monitored as a part of transportation contractors	• Chemical transport between Darwin/South Australia and Queensland/ and Daly Waters • Wastewater transportation between Daly Waters and Queensland via Tennant Creek	High – The transportation of wastes and chemicals is a tightly controlled industry with mature practices designed to prevent, detect and respond to transportation spills. Transport will only be undertaken in the wet season as per the specified controls to ensure the risks are ALARP. High - Any accident is likely to be restricted to road corridors and result in "serious", short term (days-weeks) reversible impacts. The scientific certainty around the transportation of chemicals and wastes is high and mature, and well

Spill scenario	Activity duration	Mechanisms	Location	Quality[1]	Quantity	Key management controls	Monitoring	Receptors	Effectiveness of controls
				• Saline wastewater. **NB:** All added drilling and hydraulic fracturing chemicals have been assessed and verified to not be toxic and persistent and bio-accumulative (see EMP chemical risk assessment).		• Wastewater and chemical transportation will not be undertaken through flooded waterways • Driving on unsealed roads and access tracks will be avoided 24 hours following a >20 mm rainfall event • Area is remote with major urban centres to be avoided. • Wastewater management plan			understood across Australia, limiting exposure to personnel, the public and surrounding receptors.
Tank, drilling sump and containment vessel overflows and structural failures	• Duration of all activities plus ongoing wastewater storage which may be extended beyond 12-months to allow for ongoing evaporation of fluids	• Overfilling of a sump and flowback tank • Structural failure of embankment or tank wall • Contaminants in water and soil pass through the food chain and bioaccumulate	• Sumps and tanks on well pad	Potentially hazardous fluids such as: • Saline wastewater with total dissolved solids >50,000 mg/L **NB:** All added drilling and hydraulic fracturing chemicals have been assessed and verified to not be toxic and persistent and bio-accumulative (see EMP chemical risk assessment).	1L to >10,000 L	• Lease pads bunded during the storage of flowback • Enclosed tanks used during wet seasons operations • Open tanks with 1:1000 ARI freeboard • Tanks constructed to Australian Standards Routine tank and sump inspections • Drilling sump to be designed and operated to handle the drilling of multiple wells • Sump solid levels to be periodically removed from the sump between wells to maintain sump capacity • Any removed drilling muds and cuttings from the sump will be stored on an impermeable liner with a permeability of less than 6×10^{-14} m/s- and fluid captured in the sump directed to the wastewater tank	Routine tank and sump level and structural integrity (visual) inspections	Retained on lease pad within bund	High – controls managing the storage of various fluids are in accordance with the requirements of the Code, which limit potential receptor impacts. The scientific certainty around the effectiveness of conservative freeboard as a mitigation is high and mature.

[1] Refer Table 1 for a summary of the types of chemicals used under drilling and hydraulic fracture stimulation EMPs covered by this SMP.

5. Potential receptors

The location of Tamboran's Beetaloo exploration activities is remote. A description of the environment, including environmental and cultural sensitivities, with the potential to be impacted by a spill is provided in each of the EMPs. Figure 2 illustrates the separation distance from sensitive receptors such as:

- Watercourses and drainage features/ depressions
- Communities
- Homesteads
- Heritage places
- Vegetation communities
- Protected areas
- Water bores

Maps regarding sacred sites and restricted work areas are also applicable and will be provided to work crews to ensure awareness of these features.

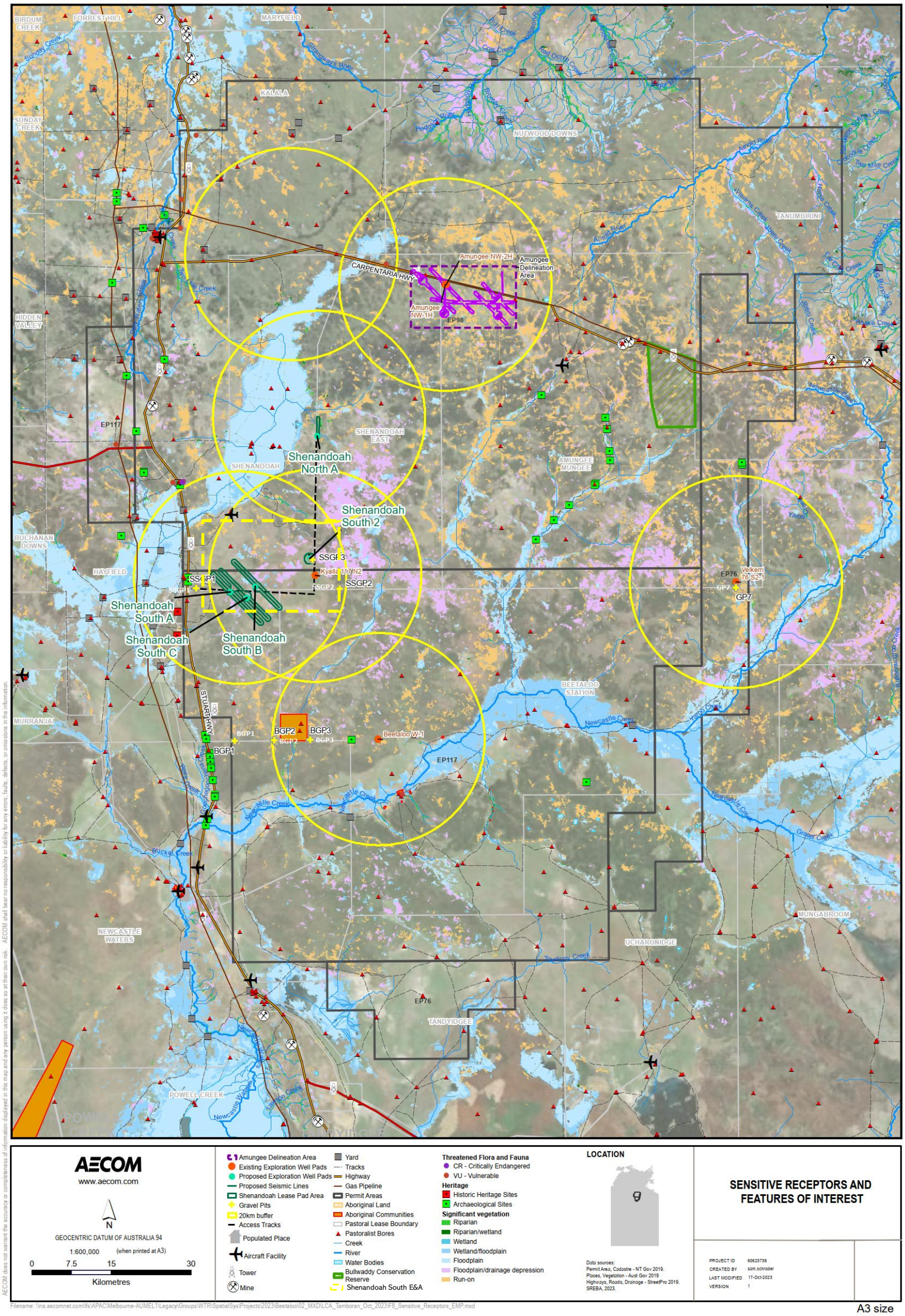

Figure 2: Location of activities and potential receptors and features of interest[2]

[2] Strategic Regional Environmental and Baseline Assessment (SREBA) 2022 mapping data has been used to draft this figure: Department of Environment, Parks and Water Security 2022. *Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin*. SREBA Data Catalogue, viewed May 2023.

6. Risk assessment

The risk of spills associated with all Tamboran activities is covered under the respective EMP for each activity.

7. Control measures

Control measures to manage spills associated with Tamboran activities are provided in the EMPs and summarised in Table 2. The key management controls include:

- Contractors are required to develop spill management procedures to comply with the requirements of this SMP.
- All chemicals, oils and waste oils to be stored within secondary containment.
- All flowback, completion fluids, chemicals, oil and fuel storage will be equipped with secondary containment (or dual liners), as per the Code.
- Drilling sumps will be lined, with enough freeboard to manage a 1:1000 Average Recurrence Interval (ARI) wet season (~1300 mm).
- Flare pits will be designed to manage a 1:1000 ARI 24-hour storm event (377 mm).
- Tanks will be designed, installed and operated as per the manufacturer's specifications and Code.
- Where flowback is being stored, the wastewater tanks shall be earthen bunded to prevent release to surrounding areas in the case of a catastrophic failure.
- The earthen bund shall be designed to hold 110% of the volume of the largest wastewater tank onsite.
- The earthen bund shall be constructed to withstand a failure event, with the bund appropriately compacted and stabilised.
- Well sites are designed and constructed to prevent spills of hazardous chemicals; this includes:
  - compacting the lease pad surface to 100 kPa to prevent infiltration.
  - provision of bunded (lined) chemical segregation areas.
- Gathering/wastewater transfer lines to have leak detection
- Monitoring to detect spills will be undertaken in accordance with Section 9.
- Procedures will be developed by contractors designed to detect, remediate and report any spills. This includes:
  - Chemical handling procedures
  - Chemical storage and handling inspection procedures
  - Spill prevention, detection and response procedures
- The transport of hydraulic fracturing chemicals and wastewater during the wet season (October to April inclusive) will be avoided, unless a risk assessment determined the activity is safe and low risk. Any necessary transportation will be undertaken in accordance with the following:
  - Transportation will not occur on tracks where the surface is not safe to allow transportation vehicles to drive upon.

  - Wastewater and chemical transportation will not be undertaken through flooded waterways.
  - The transportation of wastewater/ chemicals during rainfall events will be avoided.
  - Driving on unsealed roads and access tracks will be avoided 24 hours following a >20 mm rainfall event.
  - After a rainfall event >20 mm, or when the integrity of any unsealed road may be compromised due to prolonged rainfall, each unsealed access track proposed to be used for wastewater/ chemical transportation will be inspected to ensure the integrity of the road is sufficient to allow safe passage of the proposed transport vehicle.
  - Chemicals will not be unloaded during rainfall events.
- Effective spill clean-up material readily available at each work site and on all mobile service trucks or vehicles, where hydrocarbons and chemicals are stored and/or used.
- Inspection reports and maintenance records of secondary containment shall be kept and available for review upon request.
- Spill response mock-up drills to be completed as a part of routine emergency response training.

8. Spill response and management

The following section provides an overview of the response to spills during drilling, stimulation and well testing activities, as well as seismic program activities. Where the spill is the result of an emergency that is still active, the Beetaloo Exploration Emergency Response Plan (TBN-HSE-MP-05) will take precedence over this plan.

8.1 Rapid spill assessment

When a spill occurs, the on-site Supervisor will carry out a rapid assessment to determine the potential hazards and the type and location of emergency assistance required. This assessment shall include the following:

- Determine the physical (volume and state) and location of the spill
- Determine the appropriate spill category and type of response as per section 12.1.
- Assess the hazard of the material spilled, including any potential hazards associated with chemical mixing (such as oxidising and reducing agents)
- Determine the safety hazard to immediate response personnel and whether additional resources (such as emergency services or specialised equipment or advice) are required to manage the spill safely
- Determine spill movement, factors affecting the movement (i.e. impending weather, topography, drainage lines, seasonality etc) and spill response priorities, as per Table 3.

Table 3: Spill response priorities

Spill priority	Response considerations
People and communities	• Evacuate and muster (if deemed necessary) • Account for all people and determine missing persons • Stop unauthorised access • Provide a technical resource to the Emergency Services (if required) • Protect community (including indigenous community members) and pastoralists
Environment and sacred sites	• For emergencies that are safe to manage, onsite personnel will respond with available resources to limit the extent of the impact to the environment or a protected site • For larger incidents, or where it is unsafe for onsite personnel to respond, trained people will be mobilised to control and contain the emergency to minimise the impact to the environment or protected site
Regulators	• Notify Regulators as per incident reporting requirements
Assets	• Monitor automatic shutdown of the equipment or part thereof, or initiate manual shutdowns where it is safe to do so • Mobilise emergency services to intervene
Landholders/ leaseholders/ Native Title holders	• Notify neighbours • Notify NLC

8.2 Spill containment and clean up procedures

Generic spill containment clean-up procedures must be developed and implemented by each contractor engaged by Tamboran for significant onsite activities, aligning with the requirements of this plan. These procedures shall be adapted (where appropriate) to consider the site and chemical specific hazards associated with each spill event.

The procedures shall consider the following generic spill containment and response procedure:

- Move all people out of harm's way.
- Alert others nearby.
- Assess the situation—determine what substances are involved, the volumes, the potential receptors (people and the environment) and if additional support is required. The substance must be known prior to taking any action (refer to the safety data sheet).
- If applicable; remove any possible risk escalating factors (e.g. ignition hazards in case of flammable/combustible spills); approach from up-wind to reduce fume risks, isolate the spill source (close containment valve, similar). Ensure appropriate controls requirements are met, e.g. personal protection equipment, first aid support, etc., prior to conducting spill clean-up.
- If it is safe to do so; stop the source of the leak (if possible) and contain the spill using onsite equipment to:
    - Prevent from leaving site or entering a waterway or sensitive feature (including flood water).
    - Recover free liquid and contaminated material as soon as possible to mitigate infiltration. Material recovery should consider the benefit of recovery versus the additional impact recovery of all contaminated material could cause, as per the National Environment Protection (Assessment of Site Contamination) Measure.
- Prevent people, livestock and wildlife access to hazardous material through fencing or other barriers.
- Store contaminated material in a manner to minimise the risk of additional contamination
- Collect and retain information on the volume of extent of the spill, including photographs.
- For Level 2 spills and higher, the Project Manager shall be notified as soon as it is safe to do so, but within 2-hours.
- Project Manager to ensure appropriate external incident reporting requirements are actioned in accordance with the impact of the spill.
- For Level 2 spills and higher, Tamboran Project Manager to seek expertise as to whether additional testing and remediation is required upon completion of the initial containment and clean up. This consideration will be undertaken in in accordance with the National Environment Protection (Assessment of Site Contamination) Measure.
- Upon rectification of a reportable spill, an incident investigation shall be completed as per the Regulations. This shall include the root cause of the incident, actions taken to mitigate the impact and ongoing monitoring, and maintenance required to ensure the site is stable and non-polluting.
- Where spills have occurred in proximity to a surface water feature (such as a water course or drainage depression) ongoing monitoring of that feature may be required if impacts are reasonably expected. This includes leaks from gathering lines and transport accident. This shall be considered on a case-by-case basis and included in the incident response to DLPE Petroleum Regulation Branch.

8.3 Contaminated material disposal

Contaminated material disposal will be undertaken in consideration of the following:

- Depending on the nature of the spill (i.e. size, duration and chemical involved), contaminated material may be identified visibly during clean up (i.e. identify the extent of the wetting front) or may require in situ analysis (such as soil EC/pH testing). Where it is difficult to ascertain whether all contaminated material has been removed, additional lab analysis verification may be required (i.e. for extensive spills typically a category 3 and beyond).
- During a spill clean-up, the storage of contaminated material must be undertaken in a manner that minimises additional contamination.
- Offsite disposal must be undertaken in accordance with the *Waste Management and Pollution Control Act 1998.*
- All listed waste transportation shall be undertaken by licenced contractors, be tracked and disposed of at licenced waste management facilities.

9. Monitoring and inspections

The monitoring and inspection programs to identify spills is summarised in Table 4.

Table 4: Spill monitoring and inspections

Monitoring program	Frequency	Methodology	Purpose	Minimum volume of leak
Flowback wastewater tank and sump level monitoring (when wastewater is stored on-site)	During operations: • Daily • All other times: • Weekly during the dry season (May to September) • Daily during the wet season (October to April)	• Instrument or • Level dip/ visual assessment	Prevent the overtopping of tanks	<10 L
Tank leak detection (when flowback wastewater is stored on-site)	Continuous	Instrument	Detect the migration of fluid through primary containment into the interstitial space	<50 L
Chemical and oil storage areas (when chemical stored on-site)	During operations: Daily All other times: Weekly	Visual (a camera may be used where sites are unmanned)	Detection of leaks	<5 L
Wastewater tank structural integrity (when wastewater is stored onsite)	Weekly	Visual inspection	Detect potential structural weakness	N/A

Monitoring program	Frequency	Methodology	Purpose	Minimum volume of leak
Gathering/wastewater lines	Continuous flow and pressure monitoring during wastewater transfers of gathering lines	Instrument and visual inspection	Detection of leaks	<110 L gathering line
	Surface pipework and infrastructure: weekly during operations			<10 L surface pipework
	Buried pipework: monthly during operations			<50 L for a buried pipeline
SPCF liquid waste handling system	Monthly during operations	Instrument and visual inspection	Detection of leaks	<1 L
Field service truck and refuelling trucks during seismic program	Daily during operations Continuous during refuelling operations	Visual inspections	Detection of leaks	1-200 L

10. Roles and responsibilities

The critical roles and responsibilities set out in Table 5 are for the main members of the spill response group. This team represents the core group of resources that will lead a spill response with the support of the broader Tamboran team.

Table 5: Roles and responsibilities

Position	Role and responsibility
Project Manager/ Drilling and completions VP/ Seismic VP	Ultimately accountable for the implementation of the spill management plan (SMP). Role, or delegate, will liaise with Tamboran environment specialists to determine remediation requirements and external reporting obligations.
On-site Supervisor/ Onsite Company representative	Responsible for the initial response to a spill. This role will be delegated to the well site representative or nominated contractor in charge of a work program. Role will undertake the initial spill assessment, engage emergency services (if required) and co-ordinate immediate spill clean-up operations associations to minimise the potential impacts to people, places and the environment.
VP Environment and Permit Approvals	Report spill to regulatory authorities. Provide expertise on clean up requirements and ongoing monitoring and management requirements. Interface with government and regulatory bodies for communication and consents.
HSE Manager	Provide specialist technical advice (emergency response) to support spill management activities.

11. Waste transportation and disposal

All contractors engaged to undertake waste transportation and disposal will be required to comply with this plan. A bridging SPMP will be developed by each contractor summarising the activities to be undertaken to comply with this plan and the Code.

12. Spill reporting

12.1 Spill rating

All spills shall be reported, with volumes of spilled material/ substances recorded.

Table 6 provides a summary of the spill classification based upon the volume and location of spill. The hazards of the potential spill to people and the environment should be assessed independently, to ensure incident specific hazards are considered in the spill response. This table provides guidance as to the likely spill scenarios that may trigger the different incident reporting requirements.

When classifying spills and determining the reporting requirements, Ministerial conditions and environmental performance objectives and criteria should also be considered when determining whether the event is a recordable or reportable event.

The spill tiers include:

- **Internal Record:** Minor routine spills readily dealt with during normal operations (i.e. minor diesel spills during refuelling, hydraulic oil hose leaks etc.). Spills below 200 L and restricted to the facility or activity area. Spills contained within existing bunds below 2,500 L and low hazardous materials (i.e. sediment, grey water, and low toxicity substances) fall within this category. Clean up time is generally hours, with no residual contamination.
- **Level 1:** Spills contained within the facility or activity area and can be cleaned up without involvement of external organisations. Tier 1 spills include spills with clean up time greater than 3 hours but less than 1-day and leave no residual contamination. These spills are not trivial or routine and are therefore classified as recordable incidents as per section 12.2.
- **Level 2:** Spills that have not been completely contained within the site boundary and/or may require additional resources to clean up. These include larger spills with cleanup time greater than 1 day but less than 7 days. Level 2 spills are recordable and may be reportable depending on the actual or potential for downstream environmental impact, as defined in section 12.2. These spills may require notification under the *Waste Management and Pollution Control Act 1998.*
- **Level 3:** Severe spills that cannot be contained by the operator and requires substantial additional resources to manage the spill. Clean up time is generally greater than a week. Level 3 spills are reportable incidents.

Table 6: Spill tier levels

Receiving environment	Spill (L)		
	20-200 L	200-2,500 L	>2,500 L
Spills contained in bunds	**Internal record***		**Level 1**
Onsite *(well pad, camp pad, hardstand, road, or work area)* compacted or sealed surface**	**Internal record***	**Level 1**	**Level 2**
Offsite - areas adjacent to well pads, camp pads, roads, seismic lines where spills have moved beyond the approved activity area**	**Level 1**	**Level 2**	**Level 3**
Sensitive environmental or cultural feature (such as a waterway, drainage lines, wetland, high valued habitat and sacred site) or where the spill has, or has the potential to, cause material or serious environmental harm **	**Level 2**	**Level 3**	**Level 3**

Notes:

* Internal records in Tamboran's incident management system, with monthly reviews. For certain substances, such as flowback, there may be site specific requirements outlined in the EMP approval notice. The approvals notice should be reviewed.

** Spills of dangerous goods or wastes offsite may need to be reported under NT *Dangerous Goods Act 1998* or *Waste Management and Pollution Control Act 1998*.

12.2 Incident reporting

Incidents may require reporting under the Petroleum (Environment) Regulations and Waste Management Pollution Control Act.

12.2.1 Petroleum (Environment) Regulations incident reporting

12.2.1.1 Reportable environmental incident reporting

The Regulations define a reportable incident as an incident arising from a regulated activity that has caused, or has the potential to cause, material environmental harm or serious environmental harm as defined under the Petroleum Act.

An interest holder must notify DLPE Petroleum Regulation Branch of a reportable incident as soon as practicable but no later than two-hours after the first occurrence of the incident or after the time the interest holder becomes aware of the incident. The preferred method of notifying DLPE Petroleum Regulation Branch is email:

1. Email: Onshoregas.depws@nt.gov.au[3]
2. Phone: 1800 064 567 NT Environment Protection Authority (NT EPA) Pollution Hotline (caller to state it is a petroleum matter)

Any verbal report to DLPE Petroleum Regulation Branch must be followed up by a written report from the Project Manager within three days in accordance with the Regulations.

[3] Effective 20 September 2023, the preferred method of DPLE notification is email.

12.2.1.2 Recordable incidents

The Regulations define a recordable incident as an incident arising from a regulated activity that:

I. Has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or

II. Has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or

III. Is inconsistent with an environmental outcome specified in the current plan for the activity; and

IV. Is not a reportable incident.

These types of spills are typically a Level 1 type spill as defined in Table 6.

An interest holder must notify DLPE Petroleum Regulation Branch of a recordable incident as soon as practicable but no later than 15-days after the reporting period (agreed period or each 90-day period after the day on which the EMP is approved). The preferred method of notifying DLPE Petroleum Regulation Branch is email: Onshoregas.depws@nt.gov.au.

12.2.2 Waste Management and Pollution Control Act incident reporting

In accordance with the *Waste Management and Pollution Control Act,* where contaminants or waste is not confined within the land on which the petroleum activities are undertaken (i.e. the approved disturbance areas where the petroleum activity is occurring), Tamboran will notify the NT EPA of any incident causing or threatening to cause pollution as soon as practicable, but no less than 24 hours after becoming aware of the incident.

A notifiable incident is defined as an incident that causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm.

A notification must include:

a) the incident causing or threatening to cause pollution;

b) the place where the incident occurred;

c) the date and time of the incident;

d) how the pollution has occurred, is occurring or may occur;

e) the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident; and

f) the identity of the person notifying.

The notification shall be made to the NT EPA Pollution Hotline 1800 064 567 (caller to state it is a petroleum matter) and the DLPE Petroleum Regulation Branch email: Onshoregas.depws@nt.gov.au.

13. Acronyms and Abbreviations

Acronym / abbreviation	Meaning
km	Kilometre
kPa	kilopascal
mm	Millimetre
m/s	Metres per second
L	Litre
ARI	Average Recurrence Interval
DEPWS	Department of Environment, Parks and Water Security (previous Department name)
DLPE	Department of Lands, Planning and Environment (new Department name)
EMP(s)	Environment management plan(s)
EP	Exploration Permit
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
SPCF	Sturt Plateau compression facility
SMP	Spill Management Plan
SREBA	Strategic Regional Environmental and Baseline Assessment
WOMP	Well Operations Management Plan

Appendix A Chemical volumes per well and storage areas (based on maximum 3 wells per pad)

NOTE: In accordance with the Code, a chemical risk assessment has been completed on all listed chemicals, which have been verified to not be toxic and persistent and bioaccumulative.

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Acetic acid – 60%	3,000	9,000	L	Stimulation chemical storage area	No
BE-9 Biocide	17,000	51,000	L	Stimulation chemical storage area	Yes
Caustic Soda Liquid	15,000	45,000	L	Stimulation chemical storage area	No
DCA-11001 Breaker activator	5,000	15,000	L	Stimulation chemical storage area	Yes
DCA-13002 Breaker	300	900	kg	Stimulation chemical storage area	Yes
DCA-13003 Breaker	10,000	30,000	L	Stimulation chemical storage area	Yes
DCA-16001 Clay Stabiliser	42,000	126,000	L	Stimulation chemical storage area	No
DCA-17001 Corrosion inhibiter	1,000	3,000	L	Stimulation chemical storage area	Yes
DCA-19001 Crosslinker	600	1,800	kg	Stimulation chemical storage area	Yes
DCA-19002 Crosslinker	10,000	30,000	L	Stimulation chemical storage area	Yes
DCA-23001 Friction reducer	5,000	15,000	kg	Stimulation chemical storage area	No
DCA-23003 Friction reducer	18,000	54,000	L	Stimulation chemical storage area	No
DCA-25005 Gelling agent	35,000	105,000	kg	Stimulation chemical storage area	No
DCA-30001 Scale inhibitor	15,000	45,000	L	Stimulation chemical storage area	No
DCA-32002 Surfactant	15,000	45,000	L	Stimulation chemical storage area	Yes
DCA-32014 Surfactant	200	600	L	Stimulation chemical storage area	Yes
FE-2 Buffer	200	600	kg	Stimulation chemical storage area	No
Hydrochloric acid – 32%	50,000	150,000	L	Stimulation chemical storage area	Yes
Alcohols, C11-14-iso-, C13-rich,ethoxylated- Surfactant	5,285	15,855	L	Stimulation chemical storage area	Yes

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Sodium (C14-16) olefin sulfonate - Surfactant	4,658	13,974	L	Stimulation chemical storage area	Yes
Diisobutyl glutarate - plasticiser	627	1,881	L	Stimulation chemical storage area	No
Diisobutyl succinate - plasticiser	209	627	L	Stimulation chemical storage area	No
Diisobutyl adipate- plasticiser	179	537	L	Stimulation chemical storage area	No
Sodium thiosulphate- stabilising agent	4,763	14,289	L	Stimulation chemical storage area	No
Sodium sulphate stabilising agent	913	2,739	L	Stimulation chemical storage area	No
Sodium sulphite stabilising agent	794	2,382	L	Stimulation chemical storage area	No
Ethylene glycol- crosslinker	5,112	15,336	L	Stimulation chemical storage area	Yes
Choline Chloride- Clay stabiliser	10,301	30,903	L	Stimulation chemical storage area	No
Glutaraldehyde- biocide	14,930	44,790	L	Stimulation chemical storage area	Yes
Ammonium sulphate- breaker	4,479	13,491	L	Stimulation chemical storage area	Yes
Polyacrylamide- friction reducer	4,479	13,491	L	Stimulation chemical storage area	No
Sodium polyacrylate- gelling agent	746	2,238	L	Stimulation chemical storage area	No
Sodium bisulfite- stabiliser	149	447	L	Stimulation chemical storage area	No
Alkyl alcohol- surfactant	149	447	L	Stimulation chemical storage area	Yes
2-Propenoic acid, homopolymer, ammonium salt- biocide	149	447	L	Stimulation chemical storage area	Yes
Potassium persulfate-breaker	149	447	L	Stimulation chemical storage area	Yes
2-Ethoxy-naphthalene-surfactant	149	447	L	Stimulation chemical storage area	Yes
Sodium gluconate- stabiliser	8,576	25,728	L	Stimulation chemical storage area	No
Boric -crosslinker	4,288	12,864	L	Stimulation chemical storage area	Yes
Potassium hydroxide- pH control	10,745	32,235	L	Stimulation chemical storage area	Yes

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Mannanase- crosslinker	2	6	L	Stimulation chemical storage area	Yes
Ammonium persulphate- breaker	7,451	22,353	L	Stimulation chemical storage area	Yes
Talc- buffer	384	1,152	L	Stimulation chemical storage area	No
Sodium bromate- breaker	50,441	151,323	L	Stimulation chemical storage area	Yes
Hepta sodium phosphonate- emulsifier	3,176	9,528	L	Stimulation chemical storage area	No
Distillates, hydrotreated light- friction reducer	54,231	162,693	L	Stimulation chemical storage area	No
Guar gum- viscosity regulator	15,141	45,423	L	Stimulation chemical storage area	No
Poly-oxyethylene nonylphenol ether- surfactant	4,466	13,398	L	Stimulation chemical storage area	Yes
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite- biocide	4,466	13,398	L	Stimulation chemical storage area	Yes
1,6-Hexanediol- cross linker	447	1,341	L	Stimulation chemical storage area	Yes
Hydrochloric acid- pH control	44,715	134,145	L	Stimulation chemical storage area	Yes
N-benzyl-alkyl pyridinium chloride- pH control	28	84	L	Stimulation chemical storage area	Yes
Formic acid- corrosion inhibitor	38	114	L	Stimulation chemical storage area	Yes
Sodium erythorbate- scaler prohibitor	334	1,002	L	Stimulation chemical storage area	No
Citric acid- pH control	15,878	47,634	L	Stimulation chemical storage area	No
Acetic acid- pH control	15,878	47,634	L	Stimulation chemical storage area	No
Isopropanol- clay management	83	249	L	Stimulation chemical storage area	Yes
Ethoxylated C12-C16 alcohol - surfactant	57	171	L	Stimulation chemical storage area	Yes
Ethoxylated decanol - surfactant	19	57	L	Stimulation chemical storage area	Yes
Cinnamaldehyde- biocide	57	171	L	Stimulation chemical storage area	Yes

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Ethoxylated tallow alkyl amine - surfactant	9	27	L	Stimulation chemical storage area	Yes
Methanol- corrosion inhibitor	2	6	L	Stimulation chemical storage area	Yes
Polyacrylamide - friction reducer	49,093	147,279	L	Stimulation chemical storage area	No
Polyethylene glycol trimethylnonyl ether - clay manager	87	261	L	Stimulation chemical storage area	Yes
Water in additive- stabiliser	66,804	200,412	L	Stimulation chemical storage area	No
Potassium sorbate food grade- corrosion inhibitor	14	42	L	Stimulation chemical storage area	No
Mannanase (Mannan endo-1,4-beta-mannosidase)- cross linker	2	6	L	Stimulation chemical storage area	Yes
Nonoxynol-9- surfactant	9	27	L	Stimulation chemical storage area	Yes
2-Ethylhexanol PO/EO polymer- stabiliser	9	27	L	Stimulation chemical storage area	No
Corn oil- friction reducer	662	1,986	L	Stimulation chemical storage area	No
Sodium chloride	15,000	45,000	kg	Completion chemical storage area	No
ALDACIDE G	500	1,500	L	Completion chemical storage area	Yes
OXYGON	100	300	kg	Completion chemical storage area	No
BARACOR 100	2,000	6,000	L	Completion chemical storage area	Yes
Sodium Hypochlorite 10–30%	10,000	30,000	L	Completion chemical storage area	Yes
CON-DET	50	150	kg	Drilling chemical storage area	No
SAPP	50	150	kg	Drilling chemical storage area	No
Bentonite	3,000	9,000	kg	Drilling chemical storage area	No
Caustic soda	1,400	4,200	kg	Drilling chemical storage area	No
EZ MUD DP or EZ MUD Liquid	2,000	6,000	kg	Drilling chemical storage area	No
ALDACIDE G	336	1008	kg	Drilling chemical storage area	Yes
STOPPIT	1,000	3,000	kg	Drilling chemical storage area	No
Soda ash	350	1050	kg	Drilling chemical storage area	Yes
BARACOR 100	250	750	kg	Drilling chemical storage area	Yes
Sodium chloride (flossy salt)	96,000	288,000	kg	Drilling chemical storage area	No

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Barite	500	1,500	kg	Drilling chemical storage area	No
BARACARB	500	1,500	kg	Drilling chemical storage area	Yes
Citric acid	500	1,500	kg	Drilling chemical storage area	Yes
BARADEFOAM HP	500	1,500	kg	Drilling chemical storage area	No
Sodium Bicarbonate	500	1,500	kg	Drilling chemical storage area	No
PERFORMATROL	500	1,500	kg	Drilling chemical storage area	Yes
SOURSCAV	500	1,500	kg	Drilling chemical storage area	No
DRIL-N-SLIDE	500	1,500	kg	Drilling chemical storage area	No
STEELSEAL	500	1,500	kg	Drilling chemical storage area	Yes
BARAZAN D or BARAZAN D Plus	4,150	12,450	kg	Drilling chemical storage area	No
PAC L	2,300	6,900	kg	Drilling chemical storage area	Yes
Potassium chloride	22,500	67,500	kg	Drilling chemical storage area	No
QUIK-FREE	500	1,500	kg	Drilling chemical storage area	No
BAROFIBRE, BAROFIBRE Superfine and BAROFIBRE COARSE	500	1,500	kg	Drilling chemical storage area	No
BaraBlend-657	500	1,500	kg	Drilling chemical storage area	Yes
N-DRIL HT Plus	500	1,500	kg	Drilling chemical storage area	Yes
DEXTRID LTE	4,600	13,800	kg	Drilling chemical storage area	No
BARABUF	500	1,500	kg	Drilling chemical storage area	No
BDF 933 or BaraLube W-933	864	2,592	kg	Drilling chemical storage area	Yes
BAROLIFT	500	1,500	kg	Drilling chemical storage area	No
OXYGON	500	1,500	kg	Drilling chemical storage area	No
ENVIRO-THIN	500	1,500	kg	Drilling chemical storage area	No
Lime	500	1,500	kg	Drilling chemical storage area	Yes
Calcium chloride	37,000	111,000	kg	Drilling chemical storage area	Yes
Sodium bromide	8,610	24,480	kg	Drilling chemical storage area	Yes
Evolube TR	14,500	43,500	L	Drilling chemical storage area	Yes
Radiagreen EME	4,800	14,400	L	Drilling chemical storage area	Yes
Radiagreen EBL	4,800	14,400	L	Drilling chemical storage area	Yes
Polydrill	7,500	22,500	kg	Drilling chemical storage area	Yes
Alpine spotting beads	1,000	3,000	kg	Drilling chemical storage area	Yes
Barite- weighting agent	354,000	1,062,000	kg	Drilling chemical storage area	No
Bio-Paq HT filtration control	1,134	3,402	kg	Drilling chemical storage area	Yes
Brine-Pac XTS corrosion inhibitor	3,400	10,200	L	Drilling chemical storage area	Yes
Calcium chloride -salinity	180,000	540,000	kg	Drilling chemical storage area	Yes
CF Desco deflocculant	2,270	6,810	kg	Drilling chemical storage area	Yes

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Chek-Loss fibrous LCM	1,360	4,080	kg	Drilling chemical storage area	No
Citric acid pH control	1,360	4,080	kg	Drilling chemical storage area	No
Ecco-Temp HT extender	8,000	24,000	L	Drilling chemical storage area	Yes
Flowzan viscosifier	5,000	15,000	kg	Drilling chemical storage area	No
Mil-Lime (calcium hydroxide alkalinity)	1,361	4,080	L	Drilling chemical storage area	No
Magnesium oxide pH buffer	7,500	22,500	kg	Drilling chemical storage area	No
Mil-bio SEA 98 biocide	1,800	5,400	L	Drilling chemical storage area	Yes
Mil-carb LCM / bridging	5,000	15,000	kg	Drilling chemical storage area	No
Milstarch filtration control	5,000	15,000	kg	Drilling chemical storage area	No
Navi-Lube lubricant	16,650	49,950	L	Drilling chemical storage area	Yes
New-Drill Plus shale stabiliser	1,000	3,000	kg	Drilling chemical storage area	No
Noxygen XT oxygen scavenger	884	2,652	kg	Drilling chemical storage area	No
Ova Col 110 HC cloud point glycol	13,000	39,000	kg	Drilling chemical storage area	Yes
Potassium chloride salt / shale stabiliser	41,000	123,000	kg	Drilling chemical storage area	Yes
Potassium hydroxide pH source	1,250	3,750	kg	Drilling chemical storage area	Yes
Pyro-Trol II HT filtration control	25	75	kg	Drilling chemical storage area	No
Pyro-Vis II HT viscosifier	1,400	4,200	kg	Drilling chemical storage area	Yes
Soda ash pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	Yes
Sodium bicarbonate pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	No
Sodium chloride salt	54,400	163,200	kg	Drilling chemical storage area	No
TEQ-Lube II	28,800	86,400	kg	Drilling chemical storage area	Yes
New-Thin – polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	Yes
LC-Lube – lubricant (graphite)	9,090	27,270	Kg	Drilling chemical storage area	No
W.O. defoam defoamer	600	1,800	L	Drilling chemical storage area	Yes
Xan-Plex D viscosifier	3,000	9,000	kg	Drilling chemical storage area	No
TEQ-LUBE II - lubricant (25322-6-3)	14,400	43,200	kg	Drilling chemical storage area	Yes
TEQ-LUBE II - lubricant (39464-69-2)	14,400	43,200	kg	Drilling chemical storage area	Yes
NEW-THIN - Polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	No
LC-LUBE - lubricant (graphite)	9,090	27,270	kg	Drilling chemical storage area	No
MAX-GUARD EA	26,000	78,000	L	Drilling chemical storage area	Yes
MAX-GUARD PLUS	26,000	78,000	L	Drilling chemical storage area	Yes
MAX-GUARD PLUS A	26,000	78,000	L	Drilling chemical storage area	Yes

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
SARALINE 185V	18,603	55,809	kg	Drilling chemical storage area	Yes
General operation chemicals					
Diesel	250	750	KL	Diesel storage tanks	Yes
Hydraulic oil	1,000	3,000	L	Workshop	Yes
Engine oil	1,000	3,000	L	Workshop	Yes
Degreasers	100	300	L	Workshop	Yes
Waste drilling fluids	2,500	7,500	m^3	Drilling mud sump	Yes
Completion fluids	1.4	4.2	ML	Drilling mud sump	No
Condensate	10	10	KL	Drilling chemical storage area	Yes
Flowback	~10.8 ML per well		ML	Flowback tanks	Yes
Lubricants	-	6,600	L/pa	SPCF chemical storage	Yes
Triethylene glycol	-	150,000	L/pa	SPCF chemical storage	Yes
Methanol	-	36,000	L/pa	SPCF chemical storage	Yes
Corrosion inhibitor	-	9,000	L/pa	SPCF chemical storage	Yes
H_2S scavenger	-	160,000	L/pa	SPCF chemical storage	Yes
Biocide	-	2,000	L/pa	SPCF chemical storage	Yes
Bulk diesel	-	50,000	L/pa	SPCF chemical storage	Yes
Engine coolants	-	25,000	L/pa	SPCF chemical storage	Yes
Hydraulic oil	-	25,000	L/pa	SPCF chemical storage	Yes
Engine oil	-	10,000	L/pa	SPCF chemical storage	Yes
Greases, solvent, paints, solvents	-	100	L/pa	SPCF chemical storage	Yes
Chemical inhibitors	-	5,000	L/pa	SPCF chemical storage	Yes
Condensate (trace levels)	-	<160	L/pa	SPCF chemical storage	Yes
Proppants*					
100 mesh sand	91,000	273,000	kg	Stimulation chemical storage area	No
Quartz or organophilic phyllosilicate- proppant	1,084	3,252	L	Stimulation chemical storage area	No
40/70 sand	1,650,000	4,950,000	kg	Stimulation chemical storage area	No
30/50 sand	610,000	1,830,000	kg	Stimulation chemical storage area	No
Silicon dioxide (quartz/sand) 100% Sand	4,757,614	14,272,842	kg	Stimulation chemical storage area	No
Silicon dioxide (quartz/sand) 40/70	5,435,287	16,305,860	kg	Stimulation chemical storage area	No

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
* Proppants are sand which is inert. They do not require special chemical bunding but are co-located in the stimulation chemical storage area, within the well pad bund. Residual proppant from a stimulation campaign is often used to assist with chemical spills on the well pad, where contaminated spill material is removed.					
Cleaning chemicals and spill response					
Soda ash – sodium carbonate	3,750	11,250	kg	Stimulation chemical storage area - spill response for acid spills	Yes
Flush fluid - distillates (petroleum), hydrotreated	1,500	4,500	L	Stimulation chemical storage area - Equipment cleaning	Yes

Appendix E Wastewater Management Plan

THE BEETALOO EXPLORATION PROJECT WASTEWATER MANAGEMENT PLAN

Review record

Rev	Date	Reason for issue	Author	Reviewer	Approver
2.0	27/10/2023	2023 works update	LP	MK	MK
2.1	15/03/2024	Addresses regulation 10 and regulation 11 feedback from DEPWS, 29-Feb-2024	LP	MK	MK
2.2	26/04/2024	Addresses regulation 10 and regulation 11 feedback from DEPWS, 19-Apr-2024	LP	MK	MK
3.0	5/07/2024	2024 update to include SPCF	LP	BO	MK

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1. Introduction

This Wastewater Management Plan (WWMP) has been prepared to support Tamboran's Beetaloo exploration program. The WWMP is a mandatory requirement prepared in accordance with the *Code of Practice for Petroleum Activities in the Northern Territory* (the Code).

The WWMP covers the management of wastewater from all regulated activities described in the Environment Management Plans (EMPs) listed in Table 1 that are currently in force under the Petroleum (Environment) Regulations 2016 (the Regulations). EMPs that are currently in force under the Regulations are available at: https://depws.nt.gov.au/onshore-gas/environment-management-plan/approved-emps.

Activities undertaken by Tamboran and its subsidiaries in the Northern Territory (NT), within its exploration permit (EP) areas (EP 76, EP 98 and EP 117 (Figure 1)) include:

- civil works
- drilling and stimulating gas wells for exploration and appraisal purposes
- construction and operation of the temporary Sturt Plateau Compression Facility (SPCF)
- rehabilitation and routine maintenance/monitoring activities.

The WWMP will reference the relevant sections within each EMP to avoid duplication. The WWMP should also be read in conjunction with the Spill Management Plan and Emergency Response Plan.

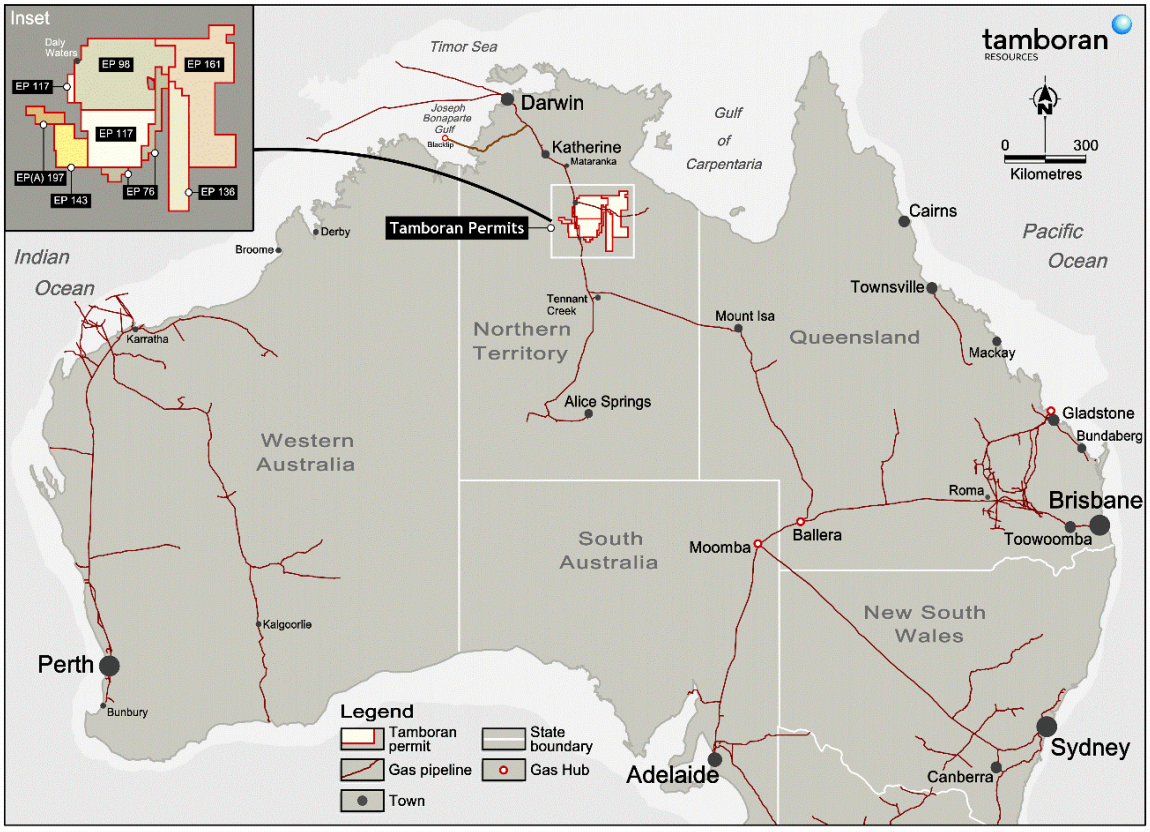

Figure 1: Location of Tamboran exploration permit areas (EPs)

2. Description of activity

Wastewater, as defined in the Code, includes the following:

- Drilling fluid, drill cuttings and cement returns
- Flowback fluid, generated during the well testing phase
- Completion fluids, kill fluids and well suspension fluids
- Other wastewater meeting the definition of waste under the NT *Waste Management and Pollution Control Act 1998.*

Wastewater is produced through the following activities:

- **Drilling**: waste drilling fluids are generated from drilling activities. The main objective of using drilling fluids is to provide the primary well barrier during well construction (unless underbalance drilling is preferred drilling technique) where bottom hole hydrostatic pressure exerted by drilling fluids is used to overbalance formation pore pressure. Drilling fluids are also used to cool the drill bit and assist in transporting formation cuttings to surface (rock such as shale, mudstone, siltstone etc.). Excess cement from cementing a casing string, waste drilling fluids and cuttings are stored in a lined mud sump, tested and either disposed of on-site or disposed of off-site at a licensed waste facility.
- **Stimulation 'flow back' water:** After the completion of hydraulic fracture stimulation, the exploration/appraisal well is "flowed back" to remove all recoverable injected fluid from the formation. Flowback wastewater is stored in on-site tanks and recycled / reused where possible, with the balance subject to evaporation and the residual volume then disposed of off-site at a licenced facility.
- **Well production test:** During production testing (appraisal) the well flows gas and a minor quantity of water to the surface. The water coming to surface is defined as 'production water' and is separated from the gas stream and is stored in the on-site tanks, evaporated and then disposed of at a licenced facility. The production water is the same quality and indistinct from the flow back water from stimulation.
- **Completion activities:** Completion fluids, such as kill fluids or well suspension fluids, are used to suppress the formation pressure within the reservoir. The use of these fluids is a form of well control and may need to be removed from the well and disposed of where well interventions are required (i.e. the well may be suspended with fluid post drilling, with the fluid removed prior to completion and stimulation activities).
- **SPCF operation**: Minor volumes of wastewater will be generated during operation of the SPCF. Most of these streams are produced when removing residual moisture from the gas during processing or through the collection of stormwater/ washdown water in drip trays and bunds.

The wastewater generating activities within the scope of each EMP covered by this plan is presented in Table 1.

Table 1: Wastewater generating activities per Beetaloo EMP

EMP	Drilling	Stimulation	Well production test	Completions	SPCF Operations
NT-2050-15-MP-032 Velkerri 76 S2 Section 3.11	x	x	x	x	N/A
CDN/ID NT-2050-35-PH-0018 Amungee NW-1H (ORI7) Section 7.1	N/A	N/A	x	x	N/A
NT-2050-15-MP-039 Beetaloo W-1 EMP (ORI8) Section 7 and Section 10	N/A	N/A	N/A	Not anticipated- with incidental volumes possible	N/A
NT-2050-MP-040 Kalala S1 EMP (ORI9) Section 3.13	N/A	N/A	N/A	Not anticipated- with incidental volumes possible	N/A
NT-2050-15-MP-0088 Amungee NW Delineation Program EMP (ORI11-3) Section 3.15	x	x	x	x	N/A
TB2-HSE-MP-08 Shenandoah South E&A program EMP (TAM1-3) Section 3.10 and Section 3.12	x	x	x	x	N/A
TB2-HSE-MP-10 Sturt Plateau Compression Facility – Appraisal Gas EMP (TAM2-3)	N/A	N/A	x	N/A	x

3. Waste management framework

Wastewater will be managed with the objective of achieving optimal environmental outcomes and in accordance with the following hierarchy principals:

1. **Avoid:** eliminate the generation of waste through design modification.
2. **Reduce:** reduce unnecessary resource use or substitute a less resource intensive product or service.
3. **Re-use:** re-use a waste without further processing.
4. **Recycle:** recover resources from a waste.
5. **Treatment:** treat the waste to reduce the hazard of the waste prior to disposal.
6. **Disposal:** disposal of waste if there is no viable alternative.

It is recognised that the options for avoiding, reducing or re-using wastewater generated during exploration and appraisal are limited. This is largely restricted to:

- Maximising the re-use and recycling of drilling fluids during operations.
- Minimising the use of suspension fluids by minimising re-entry activities (i.e. multiple entries into a well requiring fluid to be unloaded).

- Minimise the off-site transportation of flowback through maximisation of recycling / re-use, and evaporation within the designated treatment tanks.
- Minimise the generation of wastewater from the

The volume of cuttings produced during the drilling activity is dictated by the regional stratigraphy (target zone depth) and lateral length of the horizontal well, whereas the volume of the flowback is a function of stimulation design and number of stages completed during stimulation. There is however an ability to minimise the volume of waste disposed of off-site, through careful flowback recycling / re-use. A compacted hard stand area has been designated for the installation of wastewater management and treatment infrastructure.

4. Wastewater risk assessment

The risks associated with wastewater are covered in the risk assessments within each of the EMPs.

Detailed assessments of the site-specific risk associated with the disposal of drilling fluids and muds as per condition C.4.1.2 of the Code, will be undertaken upon completion of drilling activities.

Geogenic chemical composition of flowback water was sampled as a part of the Amungee NW-1H, Kyalla 117 N2-1H and Shenandoah 1 hydraulic fracture activities. These data indicate the risks associated with flowback are largely to do with salts—specifically chlorides. The presence of other compounds, such as hydrocarbons and heavy metals are also likely.

The hazards associated with flowback, and other wastewater management have been addressed by the Code and within individual EMPs. Specific controls covered by the Code and EMPs preventing environmental harm include:

- Well operations management plan designed to ensure the risk of the well to surrounding aquifers is mitigated; including the requirement for multiple, verified well barriers containing steel and cement.
- Use of enclosed tanks.
- Gathering/ SPFC wastewater line leak detection
- Freeboard requirements to accommodate a 1:1000 Average Recurrence Interval (ARI) total wet season.
- Use of double lined tanks with leak detection.
- Secondary containment requirements for all pumps and high-risk spill locations.
- Prohibition of wastewater discharges and reinjection.
- Groundwater monitoring bores.
- Spill management plan.

5. Wastewater management overview

A summary of how each wastewater stream is managed to optimise the environmental outcomes is provided in Table 2. An individual description of each wastewater stream is provided in the following sections.

5.1 Drilling fluid and cuttings

Approximately 750 – 1000 m^3 of solid drilling muds and cuttings and 1 – 2 ML of drilling fluids will be generated from the drilling of each exploration well. Water-based drilling fluids and wastes are saline, polymer/bentonite-based material which are stored in lined sumps on-site. The primary contaminants associated with drilling fluids and wastes are likely to be from chlorides.

Drilling fluids and muds will be managed in accordance with the following:

- All drilling fluids, water-based drilling muds and drilling cuttings stored in engineered lined Coletanche (or similar) sumps or wastewater tanks.
- Sumps/ tanks will be designed with a 1:1000 ARI freeboard calculated in accordance with the methodology outlined in Appendix A.
- The maximum water level (1.3 m wet season and 0.3 m dry season freeboard) will be clearly marked on the side of the sump.
- Transfers of wastewater to the sump must not cause the freeboard to be exceeded. All operational inflows to cease prior to exceeding the freeboard requirements. Disposal of fluid and waste to sumps/tanks must not occur where the fluid level in the sump is above the relevant freeboard.
- Additional controls must be implemented where the sump capacity falls below the 1:1000 ARI 7-day total rainfall design criteria of 580 mm within the sump.
- All well pads will be fenced to prevent livestock and fauna ingress into open sumps.
- Muds and cuttings contained in lined sumps will be allowed to dry out, with fluid transfers to wastewater storage tanks undertaken where required to assist in dewatering.
- Drilling cuttings and muds may be removed from the sump between wells, or as required, to maintain the safe operating level of the sump. Drilling waste material will be stored in pit/sump (in compliance with the Code) with an impermeable liner, with any free water removed to the sump or wastewater tanks.
- Dry drilling muds and cuttings may be removed from a sump and blended on the well pad during the dry season in preparation for final disposal.
- Dry drilling cuttings is defined as cuttings and muds that do not have any visible free liquid that pools/ is released from the material when worked.
- Dry, blended drilling cuttings/ muds removed from the sump may only be stored temporarily onsite (well pad or laydown) without secondary containment in preparation for offsite transportation or onsite disposal. This is required as heavy equipment, and trucks are likely to damage liners during material management. Storage of dry material will be undertaken in accordance with the following:
    - the storage of dry cuttings storage without secondary containment must be temporary and only for the duration required for the material to be transported offsite/ in preparation of mix bury cover (for example, some landfills may only take certain volumes over a given time)
    - Unlined storage only permissible in the dry season (May to September)

- The material must be dry, with no free water released from the material or pooling where the material is stored
- the location where the material is stored must be a compacted clay liner or geomembrane type liner meeting the requirements of clause B.4.16.2(h) and C.4.1.2 (b) of the Code.
- Where rainfall is predicted within a 7 day period, the dry cuttings are to be removed from site where possible or covered with a tarp to prevent fluid access to the material

- Any leachate or water generated must be removed immediately and disposed of to the sump or wastewater tanks.
- Drilling muds and fluids may be moved between sites to manage sump volume and disposal requirements.
- Any residual liquids will be transported to a licenced interstate disposal facility (e.g. Westrex, Jackson, Queensland) with the appropriate interstate waste transport consignment authority as per the *National Environmental Protection (Movement of Controlled Waste between States and Territories) Measure 1998* (NEPM) as implemented under the NT *Waste Management and Pollution Control Act 1998* and Queensland *Environmental Protection Act 1994.*
- Leachability testing of drill cuttings and muds will be undertaken in accordance with Table 10 of the Code.
- A disposal option assessment will be completed by a suitably qualified person (as outlined in section C.4.1.2 of the Code), with on-site disposal to land only undertaken where environmental harm will not result from the disposal activities. This assessment will be submitted to the Department of Environment, Parks and Water Security (DEPWS) for approval prior to implementation.

5.1.1 Drilling waste compost/soil conditioner trial

To investigate the potential future re-use of drilling cuttings and solid waste material, a small trial to create a suitable compost/ soil conditioner for use in rehabilitation may be undertaken on a well pad. This objectives of the trial will be designed to:

- confirm whether the material can be successfully composted/ blended into a suitable compost/ soil conditioner to support future rehabilitation (such as gravel pit void backfilling).
- Develop the required procedures and know-how for future larger scale disposals
- Build capacity with local traditional owners to take over the activity in the future
- Obtain the required information to support future approvals

Material generated by this trial will be either sent to a licenced landfill or additional approvals sought for onsite disposal as per section C.4.1.2 of the Code.

The trial will involve the following steps:

- A dedicated trial area will be located on either the formed well pad/ laydown yard and will be demarcated and signed. The size of the trial area will typically be no greater than 50 m x 50 m, at either Kyalla 117 N2 or Shenandoah S2.

- The trial area will be a compacted clay liner or geomembrane type liner meeting the requirements of clause B.4.16.2(h) and C.4.1.2 (b) of the Code.
- The trial area will be bunded (using available material onsite) and graded to prevent both run-on and run-off of stormwater.
- Up to 200 m^3 of dried drilling waste (moisture content <20%) will be transferred to the trial area and stored in stockpiles. In the unlikely event free liquids are encountered, they will be cleaned up immediately and recorded as per the spill management plan.
- Organic manure will be trucked in and stored on the trial pad in small stockpiles (~500 m^3). If manure is used, this will be sourced from local cattle stations in the region to reduce the risk of introducing weeds.
- Waste material will be blended with manure using a front end loader/tractor/bob cat onsite at several different ratios (such as 1 part waste: 1 part manure etc.).
- The material will be stockpiled in windows/ static piles to allow aerobic composting for ~60 – 90 days.
- The material will be turned/worked monthly.
- The material will be tested in accordance with the suite in Table 9 of the Code.
- A selection of material (~1 m^3) will be used in large pots/ bags to assess the re-establishment of vegetation, with a seed mix and additional nutrients (specifically nitrogen) added where required. This will be left open over the wet season, with observation taken.
- Upon completion of the trial, the material will be either a) returned to the sump b) stockpiled on a liner with a cover or c) trucked offsite to a licenced landfill.
- The trial area will have all potential contaminated material removed, with validation testing to confirming concentrations of contaminants of concern (notably EC, chlorides, barium and strontium) are consistent with background soil levels.

A report will be generated at the end of the trial summarising the trial results.

5.2 Produced water and flowback management

All produced water and flowback fluids will be stored in accordance with the Code.

It is anticipated that up to 12 ML of flowback may be produced from each well (subject to appraisal duration and recovery % observed). Flowback and production water will be highly saline, with a summary of the anticipated quality provided in Appendix B. Further details on the wastewater generated and stored on-site is found in the water balance section of each EMP.

Management controls for flowback implemented during the program include:

- Flowback will be separated at the wellsite or SPCF inlet separator and sent to Wastewater tanks.
- Recycling of flowback in make-up fluid will be prioritised.
- No disposal of flowback wastewater to surface water or land.
- Flowback wastewater stored in above ground tanks.
- Tanks to be double lined with built in leak detection.

- All flowback wastewater to be stored in enclosed tanks unless being treated (i.e. evaporated)
- The wastewater storage areas will have enough enclosed storage to deal with the total volume of flowback wastewater stored at any time.
- Should the freeboard of an open tank storing flowback be exceeded, wastewater transfers must commence asap to return the fluid under the freeboard requirements.
- Appropriate venting of enclosed tanks to prevent the build-up of explosive gasses.
- Tank design, construction and operation will consider environmental factors, such as wind loading, temperature bushfires and structural integrity.
- All working open evaporation tanks will have a minimum freeboard to allow for a 1 in 1000-year ARI wet or dry season (depending on which season operations are undertaken in) as calculated in Appendix A.
- Off-site wastewater disposal will be minimised through the treatment of wastewater through evaporation. Evaporation tanks will be used to treat wastewater all times, except during periods of significant rainfall.
- Mechanical evaporators may be used in each tank to increase evaporation to reduce the volume of flowback. Evaporators will be positioned in a manner to ensure all drift is contained within the wastewater tank and have automated wind direction and speed cut-offs. Any drift outside of the wastewater tank will be treated as an incident, as defined in the EMP.
- Wastewater may be transferred between approved sites to maximise the efficient use of tank capacity. Transferral may be via truck or surface/subsurface gathering lines.
- Long term (12 month +) transfers of fluid will utilise buried gathering lines.
- Where solid salt crystallising appears (through visual inspection) to occur, the fluid to be transferred to a higher puncture resistant liner, to minimise the potential for punctures from solidified materials.
- Surface gathering lines/wastewater lines will only be utilised for temporary water transfers, with pipelines to be purged and decommissioned after use.
- The freeboard requirements will be clearly marked on each of the open tanks as the Maximum Water Level (MWL).
- During the wet season, flowback wastewater will be stored in enclosed tanks, with some additional treatment capacity available via evaporation tanks.
- During the dry season, evaporation tank capacity will be increased to facilitate flowback wastewater treatments.
- Flowback wastewater on location must be able to be transferred into enclosed tanks within 72-hours of becoming aware of a significant rainfall event (noting a minimum volume of wastewater will be required to be maintained with a tank to secure the liners). This transfer must be completed at least 8- hours prior to the predicted commencement of the significant rainfall event. The determination of a significant rainfall event is provided in section 7.1.

- Pumping infrastructure will be available to transfer flowback wastewater into enclosed storage within 24-hours (noting wastewater will be transferred 8-hours prior to the onset of the rainfall event). Sufficient pumping redundancy will be available to accommodate pump failures.
- Storage tanks that are inter-connected will be designed to prevent uncontrolled release from multiple tanks.
- Tanks are to be designed and constructed to the relevant Australian Standard (including AS1554.1 and AS3990) with a quality assurance and quality control (QA/QC) plan and installation procedures implemented by the contractor.
- Tanks will be designed to prevent the ingress of stock and fauna, with each exploration site fenced to prevent stock and public access.
- Monitoring of flowback wastewater tank levels will be undertaken daily, with management response criteria implemented to prevent tank overtopping. This includes shutting in operations where freeboard requirements cannot be met. Monitoring may be in person or via remote methods.
- Residual flowback liquids after recycling / re-use and evaporation will be evaporated and transported to a licenced interstate disposal facility (e.g. Westrex, Jackson, Queensland or alternative approved locations) with the appropriate interstate waste transport consignment authority as per the NEPM as implemented under the NT *Waste Management and Pollution Control Act 1998* and Queensland *Environmental Protection Act 1994.*
- When the wastewater tanks are decommissioned the associated residual solids, brines and liners are removed and disposed of at an appropriately licensed waste disposal facility by a licenced contractor as per NT *Waste Management and Pollution Control Act.*
- During removal of the solids within the liner, efforts will be deployed to contain any residual fluid . This includes the use of vac trucks and temporary bunding during tank deconstruction
- Tank decommissioning will not occur during the months of December to March. Tank decommissioning will not occur where there is forecasted rain.
- Daily inspections of all wastewater storages will be implemented during operations (active well testing), with continuous level logging and leak detection implemented when sites are unmanned.
- Flowback will be transferred between operating sites via a wastewater gathering network (see section 8.1 to enable wastewater storage, treatment and recycling activities).

5.3 Drilling and completion fluids (suspension and kill fluids)

Drilling and completion fluids (suspension and kill fluids) may be used to maintain bit lubrication and circulation and for well control/suppress formation pressure. Drilling and completion fluids are likely to have an elevated salinity, with calcium, sodium and potassium-based salts being the main compounds.

It is anticipated that up to 0.5–1.0 ML of drilling and completion fluids could be produced per well, with fluids stored in the drill sump or tanks (depending on whether tanks have been installed on-site at the stage). The fluids will be evaporated, and any residual transported off-site for final disposal at a licenced facility.

5.4 SPCF wastewater

Minor volumes of process wastewater will be generated during operation of the SPCF. Most of these wastewater streams are produced when removing residual moisture from the gas during processing (condensation) or from drip trays/ bunds collecting stormwater or washdown water. These wastewater streams are subject to initial treatment at the SPCF oily water treatment system (primarily to remove hydrocarbons), before being pumped to the wastewater tanks.

Wastewater from the process areas within the SPCF will typically be low EC water with trace levels of residual hydrocarbons.

Some residual flowback will be separated at the SPCF inlet separator and discharged to wastewater tanks at the Shenandoah S2 wastewater storage area. Flowback will be managed in accordance with section 5.2.

Table 2: Wastewater management summary and implementation plan

Wastewater	Quantity produced	Properties	Hazards	Implementation plan					Final management	Final disposal volume[1]	Alternative management options considered
				Storage	Handling	Operational controls	Routine inspections	Monitoring			
Flowback	3 – 12 ML per well, depending on stimulation volume	Composition influenced by chemical composition of shale formation. Geogenic sourced contaminants include: Salinity (Typical Electrical Conductivity 50,000 µs/cm with elevated, sodium, chloride, boron, barium and hydrocarbons as per Appendix B.	High salinity wastewater representing a hazard to groundwater, surface water and soils from chloride dominated salts if released into the environment	• Stored on-site or at other approved exploration sites within the basin in double lined above ground enclosed tanks and double lined working evaporation tanks with leak detection. • All tanks have been sized with regards to the 1:1000 ARI rainfall event as per Appendix A. • Maximum water levels (MWL) to be clearly marked on each open tank.	• Transferred to storage tanks from on-site separators or directly from the well as required under B.4.13.2 (k) of the Code. • Transfer between sites via surface/ subsurface gathering lines • Secondary containment used under all pumps and connections.	• Flowback separated at the well head or SPCF inlet separator and transferred to wastewater tanks • Wastewater stored in enclosed tanks during wet season, with some evaporation tank surplus capacity. • Evaporation tank capacity increased during dry season to facilitate treatment. • Flow/pressure meters to be used to monitor flowback transfers. • Evaporators to be strategically located on or within the boundaries of the pond with drift prevention controls (automated wind direction	• Storage facilities and handling areas inspected daily during operations via electronic or manual means. • Visual inspections of tanks completed weekly. • Weekly inspection of surface gathering lines when in use.	As per section 6	Evaporated on-site using fractionating evaporators to reduce final volumes. Potentially onsite treatment using brine crystallisation to create solid salt. Then trucked off-site to a licenced waste disposal facility (where locally available or Westrex in Queensland (QLD)) in accordance with *NT Waste Management and Pollution Control Act* waste consignment authority approval.	Up to 2 ML / well	• Treatment using reverse osmosis or other mechanical filtration has been considered; salinity and scaling constraint posed by wastewater restricted the use of conventional water treatment.

[1] Note these values are indicative and the final values are outlined in the respective EMP.

Wastewater	Quantity produced	Properties	Hazards	Implementation plan					Final management	Final disposal volume[1]	Alternative management options considered
				Storage	Handling	Operational controls	Routine inspections	Monitoring			
						and speed cut offs). • Recycling of flowback in make-up fluid • Storage volumes of ponds to be monitored daily through visual inspections or telemetry during wastewater storage.					
Drilling muds, cuttings and fluids	750 m^3 – 1000 m^3/ well	Saline (KCl and NaCl) polymer / bentonite based drilling fluids with formation cuttings)	KCl and NaCl may represent a hazard in residual drilling muds and cuttings if not segregated prior to disposal. Formation cuttings may contain low level of hydrocarbons as per Appendix B, which are likely to be degraded quickly in the open sump.	• Stored on-site in lined drilling sumps with sufficient freeboard to accommodate a 1:1000 ARI rainfall event as per Appendix A • MWL to be clearly marked on each tank and sump • Muds and cuttings allowed to dry out • Dry, blended drilling muds and cuttings may be stored onsite in a manner that prevents leaching.	• Transferred directly from rig via the shakers into the sump • Dry muds and cuttings may be blended onsite with clean material to aid recycling/ disposal.	• Storage volumes of sumps to be monitored daily • Material to be dried out after completion of activity, with supernatant fluids evaporated in a separate tank (Code compliant storage) • Dry material may be periodically removed from sump and blended to achieve stability and reduce leachability potential making tit suitable for re-use/ lower hazard disposal. • Material to be tested prior to	• Sump level to be monitored daily during operations via electronic or manual means • Sump liner and embankments to be inspected weekly during operations	As per section 6	• Supernatant fluids will be evaporated from muds prior to disposal • Residual fluids to be transported to a licenced waste disposal facility (where available locally or Westrex in QLD) in accordance with NT Waste Management and Pollution Control Act and related interstate waste consignment authority approval • Final disposal solution of muds and cuttings to be determine through on-site characterisation and risk assessment by third party • For on-site disposal, muds and cuttings to be either mixed, buried and covered on-site or blended with material to allow for material recycling • For off-site disposal, material will be transported to a	750 m^3 – 1000 m^3/ well	• Cuttings cannot be re-used- they are a waste product consisting of shales, siltstones and clays which do not have any additional usage. • Drill muds are continuously recycled during the drilling process as much as possible. Out of specification muds a to being discharged to the sump when the fluids are no longer in specification. Out of specification drilling muds cannot be re-used as they can (and do) create well integrity issues. • Drilling wastes could theoretically be composted with organic material in the future. Tamboran is looking

Wastewater	Quantity produced	Properties	Hazards	Implementation plan					Final management	Final disposal volume[1]	Alternative management options considered
				Storage	Handling	Operational controls	Routine inspections	Monitoring			
						determining final disposal requirements			licenced waste disposal facility (where available locally or Westrex in QLD) in accordance with NT Waste Management and Pollution Control Act and related interstate waste consignment authority approval		into this as a future opportunity; however a significant amount of R&D and
Drilling, completion, suspension and kill fluids	0.5–1.0 ML / well (or incidental volumes during maintenance)	KCl or NaCl based fluids with a TDS >33,500 mg/L	High salinity wastewater representing a hazard to groundwater, surface water and soils from chloride dominated salts if released into the environment.	• Stored on-site in the sump and transferred (as required) to the double lined above ground enclosed tanks and evaporation tanks with leak detection. • All tanks have been sized with regards to the 1:1000 ARI rainfall event as per Appendix A. • Maximum water levels (MWL) to be clearly marked on each tank and sump.	• Transferred to flowback storage facilities directly from well. • Secondary containment used under all pumps and connections.	• Storage volumes of ponds to be monitored daily during operations. • Evaporators to be strategically located on or within the boundaries of the pond with drift prevention controls (automated wind direction and speed cut offs). • All wastewater to be transferred into enclosed storage when a significant rainfall event is predicted as per section 7.1.	• Storage facilities and handling areas inspected daily during operations. • Visual inspections of tanks completed weekly.	As per section 6.	Stored in flowback tanks. Evaporated on-site using fractionating evaporators to reduce final volumes. Potentially for recycling within stimulation. Residual fluids to be trucked off-site (if required) to a licenced waste disposal facility (e.g. Westrex in QLD) in accordance with *NT Waste Management and Pollution Control Act* waste consignment authority approval. Currently, it is assumed all drilling wastewater will be evaporated with limited water removed from site.	0–0.5 ML	• Due to the saline nature of the material, recycling during exploration may be possible and will be prioritised. • Treatment using reverse osmosis or other mechanical filtration has been considered; salinity and scaling constrain the use of conventional water treatment. • Request for proposal (RFP) has been released to identify additional technologies for a potential future trial.
SPCF process wastewater	1Kl/day	Wastewater containing low conductivity water condensation, oily water and potential other chemicals such as coolants and	Wastewater represents a potential hazard to soils, surface water and groundwater from hydrocarbons present	• Oily wastewater stored in double lined wastewater tanks. • Treated water discharged to the	• Water from bunds and drip trays collected and transferred to separation tank • Oil separated and sent to	• Liquids separated in oily water separation tank • Hydrocarbon levels are monitor and transferred periodically to	• Storage facilities and handling areas inspected daily during operations via electronic or	As per section 6	Waste oil removed form site by licenced contractors Treated water discharge to wastewater tanks for management as flowback.	1 kL/day	• Treated water from oil separation system could be released directly to sediment basin for disposal via soaking trench/ release to environment.

Wastewater	Quantity produced	Properties	Hazards	Implementation plan					Final management	Final disposal volume[1]	Alternative management options considered
				Storage	Handling	Operational controls	Routine inspections	Monitoring			
		cleaning chemicals		Shenandoah S2 wastewater tanks for management	oily water storage tank • Treated water sent to wastewater tanks	double lined oily water tanks. • Waste oil removed periodically to licenced disposal facility	manual means. • Visual inspections of tanks completed weekly. • Weekly inspection of surface pipelines lines when in use.				

6. Wastewater monitoring program

A wastewater sampling program will be implemented to characterise the quality of the wastewater during flowback activities. The monitoring program is summarised in Table 3 below.

Table 3: Minimum monitoring requirements

Monitoring Program	Location	Monitoring Requirements	Frequency
Significant rainfall event detection	Each site	Daily review of 8-day total rain forecast as per section 7.1.	Daily during wastewater storage.
Flowback characterisation	Post separator — prior to entering storage tanks	Electrical conductivity, pH, temperature and volume of flowback.	Continuous (at least one sample every 24 hours).
		Testing samples of flowback for analytes listed in Appendix C.	Weekly until the EC level stabilises (<10% change over 2 weeks) and then monthly until practical completion of flowback activities.
Stimulation fluid —pre-injection	Post blender — prior to injection	Testing sample of stimulation fluid for analytes listed in Appendix C.	1 sample pre-injection for each stimulation fluid used.
Stimulation source water characterisation	Source water used for stimulation	Testing for analytes listed in Appendix C.	Prior to stimulation
Stimulation volume	Each well stage	Total volume of stimulation fluid pumped	Each hydraulic fracture stage.
Flowback storage tanks	Each storage tank	Testing samples of flowback for analytes listed in Appendix C.	6-monthly.
	Each storage tank	Level — estimated evaporation rates.	Daily - through either visual inspections or telemetered meter.
Wastewater gathering system (including SPCF wastewater line connecting Shenandoah S2 wastewater tanks)	Each operational gathering line (surface/ subsurface	Hydrostatic testing.	Prior to operation.
		Flow meters checked.	Continuous. During operation.
		Monthly inspections or buried pipelines and weekly for surface pipelines when in use.	Monthly for buried services Weekly for surface transfers.
Drilling material	Determined by suitably qualified person	Testing samples of drilling cuttings for analytes listed in Table 10 of the Code, Naturally Occurring Radiation Material (NORMs) and volume.	Prior to disposal.
SPCF process wastewater (drip trays and bunds)	SPCF bunds and drip trays	Monitoring of oily water tank level	Continuous

Monitoring Program	Location	Monitoring Requirements	Frequency
Fauna interactions	Open flowback wastewater tanks and surrounding lease area	• Ad hoc bird and fauna observations and photos to be taken around open flowback wastewater tanks. • Open flowback wastewater tank inspection for bird carcasses. • Carcasses present during open flowback tank emptying.	Continuous- all records of fauna interactions will be continuously logged as they occur.

6.1 Sampling methodology

- Water samples will be collected in accordance with the methodology outlined in Table 4.
- All samples will be collected by appropriately qualified personnel, with all meters calibrated in accordance with the manufacturer's instructions .A suitably qualified person is defined as:
    - A person who has at least 2 years' experience relevant to the collection of samples and can conduct tasks in accordance with the relevant sampling procedural requirements.
- Samples will be collected in laboratory supplied sampling containers and placed in chilled eskies and transported under chain of custody (COC) procedures.
- Analysis will be performed by laboratories with National Association of Testing Authorities (NATA) accredited analysis methodology.
- Each sample will have a unique identifier that would be cross referenced to the monitoring location and time of sampling. Due to the remote location, samples will be couriered to the laboratory to minimise sample holding time violations.
- In accordance with of C.5.1 (d) in the Code, where there are no NATA accredited laboratories for a specific analyte or substance, then duplicate samples must be sent to at least two separate laboratories for independent testing or evaluation.

Table 4: Monitoring program methodologies

Program	Sampling methodology
Drilling sump characterisation	National Environment Protection (Assessment of Site Contamination) Measure AS4482.1-2005 guide to the investigation and sampling of sites with potentially contaminated soil
Flowback and drilling fluid monitoring	Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC Guidelines) AS/NZ5667.1: 1998. Water Quality Sampling Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

7. Wastewater storage management response criteria

To minimise the risk of overtopping a tank or sump, the criteria outlined in Table 5 will be implemented when hydraulic fracturing and drilling wastewater is stored on-site.

Table 5: Wastewater storage management response criteria

Monitoring program	Criteria description	Criteria	Criteria response
Significant rainfall event	Significant rainfall event predicted	The predicted 4-day total rainfall exceeds 300mm within the 8-day forecast	All flowback fluid must be transferred to enclosed storage at least 8-hours prior to the predicted commencement of the significant rainfall event. A minimum volume of flowback may be left in an open tank to maintain liner integrity.
Flowback wastewater tank level monitoring	Enclosed flowback storage level exceedance	The total volume of hydraulic fracturing wastewater stored on-site exceeds the available enclosed tank storage capacity	• Flowback activities to cease • Tamboran to provide written notification to DEPWS within 48-hours of exceedance, along with the proposed plan to return to compliance. • Actions agreed to with DEPWS are to be implemented.
	Open flowback storage tank level exceedance	The volume of flowback stored in an open tank exceeds the required tank freeboard level.	• Flowback transfer into the enclosed tank must be undertaken soon as possible to return the tank under the freeboard level. • The tank must not have any additional wastewater added until it returns back to compliance. • Tamboran to provide written notification to DEPWS within 48-hours of exceedance and corrective actions to ensure the breach of freeboard does not re-occur.
Drilling sump level monitoring	Drilling sump freeboard level exceedance	The total volume of drilling wastewater exceeds the freeboard	• Drilling wastewater disposal into the sump/tank to cease

Monitoring program	Criteria description	Criteria	Criteria response
		capacity of the drilling sump	until fluid levels return to below freeboard • Tamboran to provide written notification to DEPWS within 48hours along with a proposed monitoring, reporting and action plan to prevent the sump from overflowing (which will be case specific)Actions must be implemented where the sump freeboard is insufficient to manage a 1:1000 ARI 7 day total rainfall event of 580mm to prevent an overtopping event • Actions are to be agreed to with DEPWS and are to be implemented.
Gathering line pressure and flow monitoring (including SPCF wastewater pipeline)	Gathering line leak detection	The gathering line pressure drops unexpectedly indicating a potential leak Flow meter reconciliation between supply and receiving meter indicates potential leak	• Wastewater transfers to stop immediately • Pipeline to be inspected for potential leaks • Meters to be inspected if suspected error • Physical reconciliation completed where no leak completed. • Transfer only to recommence once confirmation that leak has not occurred.

7.1 Significant rainfall events

The 8-day Bureau of Meteorology 4-day total rain forecast[2] shall be reviewed daily to identify periods of significant rainfall. Significant rainfall is defined in this WWMP as an event where greater than 326mm of total rainfall is predicted over a 4-day period (correlating to a 1:50 ARI 96 hours rainfall

[2] Refer http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp

event). This is a type of rainfall level is consistent with that from a significant rainfall event, such as a monsoonal trough, tropical low or cyclone.

Commencement time to transfer the flowback fluid will be selected to ensure that it is completed at least 8-hours prior to the predicted commencement of the significant rainfall event.

8. Waste transportation and disposal

Where transportation of residual wastewater for disposal is required, all wastewater transport providers will be licenced under the NT *Waste Management and Pollution Control Act 1998.*

All residual wastewater will be transported interstate to a licenced waste storage and treatment facility. Westrex, at Jackson, Queensland is the current default option for wastewater disposal, with other interstate disposal locations available. The transportation of wastewater between states/territories, will require an Interstate waste transport consignment authority as per the NEPM as implemented under the NT *Waste Management and Pollution Control Act 1998* and relevant accepting state/territory (such as the Queensland *Environmental Protection Act 1994*).

All wastewater storage and treatment facilities will be licenced as per the relevant accepting state/territory (such as the Queensland *Environmental Protection Act 1994*).

8.1 Wastewater gathering network

Tamboran may install a gathering network to help transfer water between locations. It is proposed that a using low-pressure (less than 1,500 kPag) polyethylene pipeline will be located between sites, either on the surface or buried. If gathering lines are used, these will be constructed as required to provide the safe and efficient transfer of high volumes of fluids between well pads and other facilities as described in the relevant EMP.

Waste fluids transferred in the gathering network may include:

- Drilling fluids
- Flowback fluids/produced water
- Other wastewater

The gathering lines will be constructed, operated, maintained and abandoned in accordance with the "Code of Practice for Upstream Polyethylene Gathering Networks – CSG Industry, Version 5", August 2019 (APGA 2019).[3]

Details of the construction and operation of the wastewater gathering system can is described in the individual EMP.

[3] Australian Pipelines and Gas Association Ltd (APGA), 2019. *Code of Practice for Upstream Polyethylene Gathering Networks – CSG Industry, Version 5*, August 2019. https://39713956.fs1.hubspotusercontent-na1.net/hubfs/39713956/CoP%20for%20Upstream%20PE%20Gathering%20Lines%20in%20the%20CSG%20Industry%20050919.pdf.

9. Wastewater tank decommissioning

Each wastewater tank will be decommissioned when no longer required to support current or future wastewater storage requirements. Decommissioning typically takes approximately 4 – 6 days and involves a 6 tonne telehandler, spreader bar , vac tank, prime mover and multiple 30 m skips. The process for decommissioning can be typically summarised as:

1. Tanks will be decommissioned when there is low forecasted chance of rainfall during the duration of the decommissioning activity.
2. The tank is first drained to another wastewater tank/ truck to a level that is as low as possible
3. For enclosed tanks, the lids are rolled up and removed- these will be stored on a bund/sealed skip awaiting disposal
4. Fluid transfer equipment is utilised to remove the residual fluids with ongoing fluid removal during deconstruction
5. A temporary bund (earthen or equivalent material) is constructed within the tank to prevent fluid from entering the cleaned section. The bund is sized to allow a section of the liner to be rolled up, cut and safely handled
6. Solids are removed from the section (as much as practicable).
7. The tank liners (primary and secondary) are detached from the tank wall in a section of the tank and several panels are removed to allow equipment and people access to the liner.
8. The primary liner is removed. The secondary liner is left in situ if possible (noting it may become damaged with equipment use).
9. The folded primary liner is cut off before the internal bund and transferred via telehandler to be stored within a bund to contain any potential residual fluids
10. The next area has any residual fluid removed and a new bund is constructed within the tank in preparation for the next section of liner to be removed.
11. Steps 6-9 are repeated until all liner is removed.
12. Once the primary liner is removed, the secondary liner and underlying geofab is removed to waste skips (sealed if contains wet material)
13. The tanks panels are all deconstructed and removed from site/ stockpiled for re-use
14. All waste liners are removed to a licenced disposal facility in a sealed skip (where wet and likely to spill) by a licences waste provider
15. Tank decommissioning will typically occur during the night, with a bund in place to prevent any overflow from rainfall during the evenings
16. Any spilled material/ contamination will be cleaned up immediately, with the spill management processes outlined in the EMP. If a long term suspected leak is identified, this shall be investigated with the affected material removed, stored in a bunded area/ sealed skip and trucked offsite to a licensed waste facility.
17. Any spills/ leaks will be reported as per section 11.2.

10. Waste tracking and reporting

The movement of wastewater will be tracked onsite in accordance with the following:

i. Volumes of wastewater produced from the well into a tank (Well head flow meter)
ii. Volumes of wastewater transferred into/between each tank manually (pump records, operator logs, level sensor and data platform)

iii. Volumes of wastewater stored into each tank (Level sensors and data platform)
iv. Estimates for evaporation rates from each tank updated weekly (level sensors and data platform)
v. Volumes of wastewater reused (operator logs, level sensors and data platform)
vi. Volumes of water removed from site (whether by vehicle or pipeline). (Waste transfer certificates, level sensors and data platforms)
vii. Volumes of spilled material stored onsite and disposed of offsite (Incident logs, waste transport certificates, level sensor and data platform)

Wastewater tracking will be documented, with records available upon request.

Off-site wastewater tracking must be in accordance with tracking requirements of listed wastes as per the *Waste Management and Pollution Control Act*, National Environment Protection Measures (NEPM) and (where relevant) the *Radiation Protection Act.*

Wastewater tracking documentation must be reported to the Minister at least annually in the annual environment performance report for the relevant EMP.

The following measurement criteria have been developed to demonstrate the risks associated with wastewater storage are reduced as low as reasonably practicable:

- Zero wastewater tank overtopping events
- No off-site releases of wastewater
- No reportable spills of wastewater

11. Reporting

11.1 Human health risk assessment

A report regarding flowback and produced water must be given to the Minister for Environment within 6 months of the flowback commencing, in accordance with Regulation 37A and 37B of the Regulations. Reporting must include a full human health risk assessment relating to any chemical found in flowback fluid and produced water (refer Reg 37A(2A) and Regulation 37B(2A), respectively).

11.2 Incident reporting

The reporting of incidents shall comply with the Petroleum (Environment) Regulations 2016 (the Regulations) and the *Waste Management and Pollution Control Act 1998.*

11.2.1 Reportable environmental incident reporting

The Regulations define a reportable incident as an incident arising from a regulated activity that has caused, or has the potential to cause, material environmental harm or serious environmental harm as defined under the *Petroleum Act 1984*.

An interest holder must notify DEPWS of a reportable incident as soon as practicable but no later than two-hours after the first occurrence of the incident or after the time the interest holder becomes aware of the incident. The preferred method of notifying DEPWS is email: [4]

1. Email: Onshoregas.depws@nt.gov.au
2. Phone: 2. Phone: 1800 064 567 NT Environment Protection Authority (NT EPA) Pollution Hotline (caller to state it is a petroleum matter)

Any verbal report to DEPWS must be followed up by a written report from the Project Manager within three days in accordance with the Regulations.

11.2.2 Recordable incidents

The Regulations define a recordable incident as an incident arising from a regulated activity that:

I. Has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or

II. Has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or

III. Is inconsistent with an environmental outcome specified in the current plan for the activity; and

IV. Is not a reportable incident.

An interest holder must notify DEPWS of a recordable incident as soon as practicable but no later than 15-days after the reporting period (agreed period or each 90-day period after the day on which the EMP is approved). The preferred method of notifying DEPWS is email: Onshoregas.depws@nt.gov.au.

11.3 Waste Management and Pollution Control Act 1998 incident reporting

In accordance with the Waste Management Pollution Control Act, where contaminants or waste are not confined within the land on which the petroleum activities are undertaken (i.e. the approved disturbance areas where the petroleum activity is occurring), Tamboran will notify the regulator of incidents causing or threatening to cause pollution as soon as practicable, but no later than 24-hours after becoming aware of the incident.

A notifiable incident is defined as an incident that causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm.

A notification must include:

a) the incident causing or threatening to cause pollution
b) the place where the incident occurred
c) the date and time of the incident
d) how the pollution has occurred, is occurring or may occur
e) the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident
f) the identity of the person notifying.

[4] Effective 20 September 2023, the preferred method of DEPWS notification is email. However for reportable incident notifications the mobile number for the Director Petroleum Operations is also provided, if required.

The notification shall be made to the NT EPA Pollution Hotline 1800 064 567 (caller to state it is a petroleum matter) and the DEPWS email: Onshoregas.depws@nt.gov.au.

12. Emergency response

An Emergency Response Plan has been developed covering the proposed activities within the EMP. The Emergency Response Plan provides a broad framework for managing potential emergency incidents to minimise the potential risk to human safety and the environment. The Emergency Response Plan should be referenced for any emergency response activities.

Spills must be reported to the Minister in accordance with the requirements of Spill Management Plan, and reportable and recordable incidents of the Regulations.

13. Acronyms and Abbreviations

Acronym / abbreviation	Meaning
kPag	kilopascal gauge
m	metre(s)
Mm	millimetre(s)
ML	megalitre(s)
µg	micrograms
µs/cm	micro Siemens per centimetre
pH	a measure of how acidic/basic (alkaline) water is
ANZECC	Australian and New Zealand Environment and Conservation Council
APGA	Australian Pipelines and Gas Association Ltd
ARI	Average Recurrence Interval
BTEX	benzene, toluene, ethylbenzene and xylene
COC	chain of custody
DEPWS	Department of Environment, Parks and Water Security
EMP	Environment management plan(s)
EP	Exploration Permit
KCl	potassium chloride
MWL	Maximum Water Level
NaCl	sodium chloride
NATA	National Association of Testing Authorities
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Agency
NEPM	National Environment Protection Measures
NORM	Naturally Occurring Radiation Material

Acronym / abbreviation	Meaning
NT EPA	Northern Territory Environment Protection Authority
PAH	polycyclic aromatic hydrocarbons
QA/QC	Quality assurance and quality control
QLD	Queensland
RO	Reverse osmosis
SILO	Scientific Information for Land Owners
SPCF	Sturt Plateau Compression Facility
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WWMP	Wastewater Management Plan

Appendix A 1:1000 ARI Calculation

Monthly rainfall totals were analysed from the Scientific Information for Land Owners (SILO) data for to interpolate rainfall data from 1900 to the present day. Consistent with industry accepted methodology associated with practices (such as dam risk assessments which calculate the wet season based on your geographical location) a 3-month period was determined applicable.

The highest 3-month rainfall period during the wet and dry seasons was predicted for every year from 1900 till 2018. These values were then used to fit a Log Pearson III distribution to the data to allow us to extrapolate to the 1000-year, 3-month duration wet season (Figure 1) and 3-month dry season (Figure 2). This method is consistent with the *Australian Rainfall & Runoff* methodologies. The median 1 in 1000-year 3-month wet season is 1,289 mm and 3-month dry season is 300 mm. These figure does not include any evaporation and are therefore considered extremely conservative.

Based on the assessment, a 1,300 mm wet season and 300 mm dry season freeboard will be applied to all open sumps and tanks.

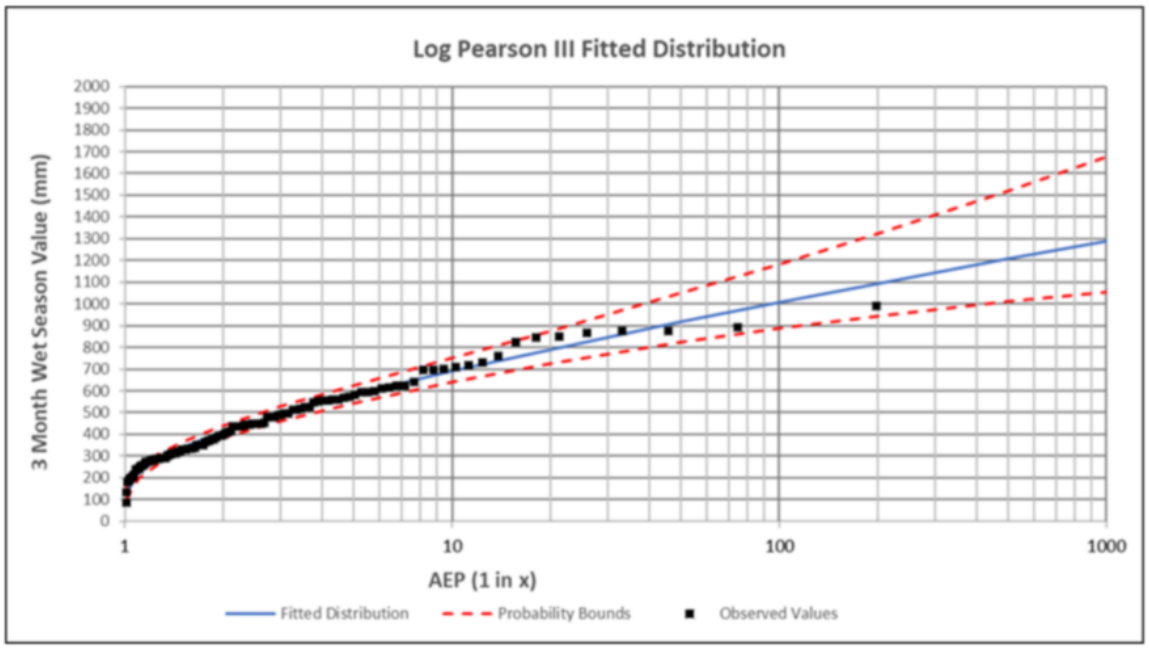

Figure 1: Log Pearson determination of 1:1000 wet season ARI

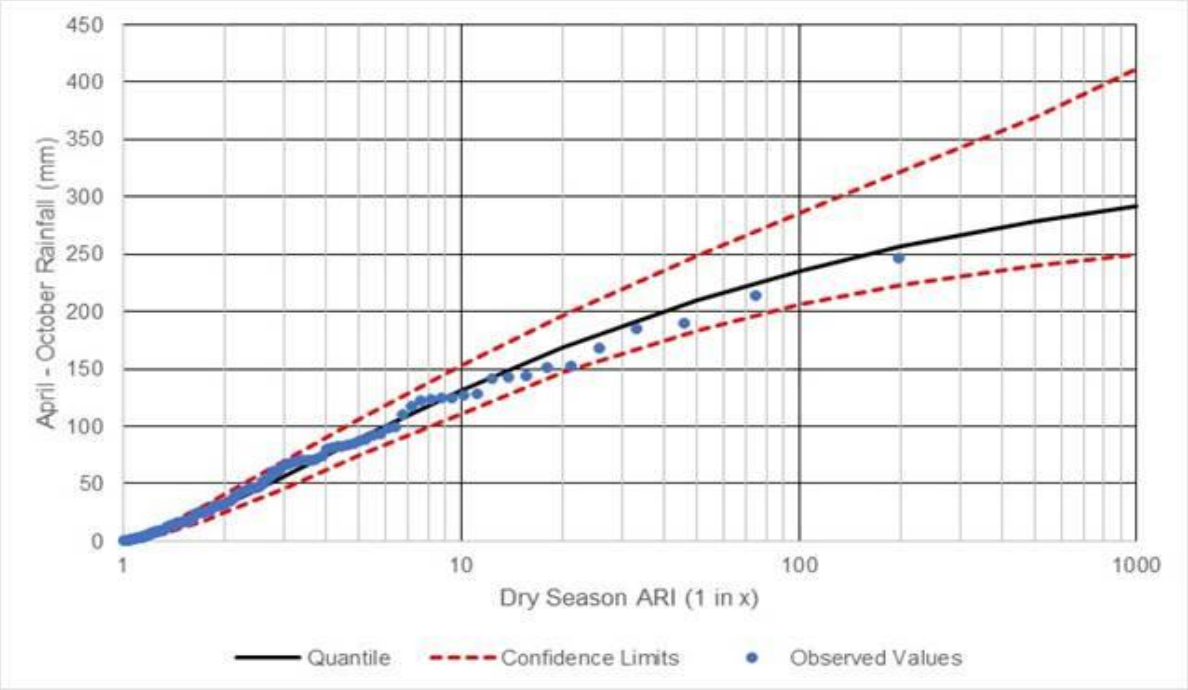

Figure 2: Log Pearson determination of 1:1000 dry season ARI

Appendix B Flowback characteristic summary

Anticipated flowback quality of the Velkerri formation based on Amungee NW-1H flowback results

Parameter	Flow back levels
BTEX compounds	BTEX levels are anticipated to be low ranging between 2 and 15 µg/L.
Total nitrogen (as N)	Maximum value of 62.1 mg/L observed within flowback.
Salinity (TDS)	Saline with total dissolved solids level exceeding 49,000 mg/L.
pH	Slightly acidic with a median value of 6.74.
Major ions	Predominantly Na and Cl dominated. Bicarbonate present at levels consistent with stimulation fluid.
Dissolved metals	Barium and boron are the main metal elements anticipated to be present at elevated levels. Maximum levels of 80.1 mg/L for barium and 54.5 mg/L for boron were recorded during the Amungee NW 1H flowback. Lower level of other metals such ash Arsenic and Manganese were observed, with maximum concentration of 0.084 mg/L and 3.09 mg/L, respectively.
Polycyclic aromatic hydrocarbons	Expected to be below detection level.
Petroleum hydrocarbons	All fractions of TPH are anticipated to be elevated.
Phenolic compounds	Low level of phenolic compounds expected, with only Phenol (max 4 µg/L) and 3-&4- methylphenol (max 11.3 µg/L).
Radionuclides	Maximum Gross Alpha Activity and Gross Beta Activity of 12.4 Bq/L and 18.3 Bq/L were recorded in the flowback of offset wells. The primary component being radium-226.

Flowback quality based on Kyalla 117 N2-1 flowback results

Parameter	Flow back levels
BTEX compounds	Total BTEX levels in the flowback ranged between 63 and 190 µg/L.
Total nitrogen (as N)	Maximum value of 180mg/L observed within flowback.
Salinity (TDS)	Saline with total dissolved solids level from 120,000–290,000 mg/L.
pH	Slightly acidic with a median value of 6.54.
Major ions	Flowback predominantly Na and Cl dominated, with elevated levels of calcium and magnesium.
Dissolved metals	All detected dissolved metal concentrations within the flowback were low, except for barium (1029 mg/L), gallium (290 mg/L) and strontium (279 mg/L).
Polycyclic aromatic hydrocarbons	All values in the flowback below laboratory Limit of Reporting (LOR).
Petroleum hydrocarbons	All fractions of TPH are anticipated to be elevated, with Total Petroleum Hydrocarbon levels likely to range from 25 mg/L–150 mg/L.

Parameter	Flow back levels
Phenolic compounds	Low levels of phenolic compounds detected in flowback with phenol and phenol compounds <3 µg/L.
Radionuclides	Maximum Gross Alpha Activity and Gross Beta Activity of 36.2 Bq/L and 97Bq/L encountered in the flowback, the anticipated source is likely to be radium-226.

Appendix C Wastewater monitoring analyte list

Parameter	Reporting units	Limit of reporting	Method
Physical Parameters			
Dissolved oxygen	mg/L	0.1	Field
Electrical Conductivity (EC)	µs/cm	1	Field
Total Dissolved Solids (TDS)	mg/L	10	APHA 2540C
Total Suspended Solids (TSS)	mg/L	5	APHA 2540C
pH	pH units	0.01	Field
Sodium Adsorption Ratio	ratio	0.01	APHA 4500 Ca, Mg, Ca, NA
Temperature	°C	0.1	Field
Nutrients			
Nitrate	mg/L	0.01	APHA VC13
Nitrite	% saturation and mg/L	0.01	APHA 4500 NO2
Total Nitrogen	mg/L	0.1	APHA 4500 NORG
Total Kjeldahl Nitrogen	mg/L	0.1	APHA NORG/TKN
Ammonia	mg/L	0.01	APHA NH4
Reactive Phosphorous	mg/L	0.01	APHA 4500P
Total Phosphorous	mg/L	0.01	APHA 4500P
Anions			
Sulfate	mg/L	1	APHA 4500-SO4-C
Chlorine/chloride	mg/L	1	APHA 4500-Cl-C
Carbonate	mg/L	1	APHA 2320 B
Bicarbonate (as $CaCO_3$ equivalent)	mg/L	1	APHA 2310 B
Bicarbonate Alkalinity (as $CaCO_3$ equivalent)	mg/L	1	APHA 2320 B
Hydroxide Alkalinity (as $CaCO_3$ equivalent)	mg/L	1	APHA 2320 B
Total Alkalinity (as $CaCO_3$ equivalent)	mg/L	1	APHA 2320 B
Nitrite (NO_2 -)	mg/L	0.01	
Nitrate (NO_3-)	mg/L	0.01	
Fluoride	mg/L	0.1	APHA 4500 F-C
Bromide	mg/L	0.01	APHA 4110B
Total Cyanide	Mg/L	0.004	AWWA/APHA Method 4500
Major Cations			
Sodium	mg/L	1	APHA 4500 Na
Magnesium	mg/L	1	APHA 4500 Mg
Potassium	mg/L	1	APHA 4500 K

Parameter	Reporting units	Limit of reporting	Method
Calcium	mg/L	1	APHA 4500 Ca
Metals and Metalloids (total and dissolved)			
Aluminium	mg/L	0.01	USEPA 6010 ICP/AES
Antimony	mg/L	0.001	USEPA 6010 ICP/AES
Arsenic	mg/L	0.001	USEPA 6010 ICP/AES
Barium	mg/L	0.001	USEPA 6010 ICP/AES
Beryllium	mg/L	0.001	USEPA 6010 ICP/AES
Boron	mg/L	0.001	USEPA 6010 ICP/AES
Bromide	mg/L	0.01	USEPA 6010 ICP/AES
Cadmium	mg/L	0.0001	USEPA 6010 ICP/AES
Chromium	mg/L	0.001	USEPA 6010 ICP/AES
Cobalt	mg/L	0.001	
Copper	mg/L	0.001	USEPA 6010 ICP/AES
Iron	mg/L	0.05	USEPA 6010 ICP/AES
Lead	mg/L	0.001	USEPA 6010 ICP/AES
Manganese	mg/L	0.001	USEPA 6010 ICP/AES
Mercury	mg/L	0.0001	USEPA 6010 ICP/AES
Molybdenum	mg/L	0.001	USEPA 6010 ICP/AES
Nickel	mg/L	0.001	USEPA 6010 ICP/AES
Selenium	mg/L	0.001	USEPA 6010 ICP/AES
Silica	mg/L	0.1	USEPA 6010 ICP/AES
Silver	mg/L	0.001	USEPA 6010 ICP/AES
Strontium	mg/L	0.001	USEPA 6010 ICP/AES
Thorium	mg/L	0.001	USEPA 6010 ICP/AES
Tin	mg/L	0.001	USEPA 6010 ICP/AES
Uranium	mg/L	0.001	USEPA 6010 ICP/AES
Vanadium	mg/L	0.05	USEPA 6010 ICP/AES
Zinc	mg/L	0.001	USEPA 6010 ICP/AES
Naturally Occurring Radioactive Material (NORM)			
alpha radiation	Bq/L	0.05 – 0.1	ASTM D7283-06
beta radiation	Bq/L	0.05 – 0.1	ASTM D7283-06
Gamma	Bq/L	0.05 – 0.1	ASTM D7283-06
BTEX			
Benzene	µg/L	1	USEPA 5030/8260 HS or P&T/GC/MS
Toluene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
Ethylbenzene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
M and P Xylene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
O Xylene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS

Parameter	Reporting units	Limit of reporting	Method
Total Xylene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
Hydrocarbons			
TRH C6 - C10	µg/L	20	USEPA 5030/8260 HS or P&T/GC/MS
TRH C6 - C10 less BTEX	µg/L	20	USEPA 5030/8260 HS or P&T/GC/MS
TRH >C10 - C16	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
TRH >C10 - C16 less Naphthalene	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
TRH >C16 - C34	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
TRH >C34 - C40	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
Total TRH C6 - C40	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
Polycyclic Aromatic Hydrocarbons			
3-Methylcholanthrene	µg/L	1	USEPA 3510/8270 GC/MS
7, 12- Dimethylbenz(a)anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Acenaphthene	µg/L	1	USEPA 3510/8270 GC/MS
Acenaphthylene	µg/L	1	USEPA 3510/8270 GC/MS
Anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (a) pyrene	µg/L	0.5	USEPA 3510/8270 GC/MS
Benzo (b) fluoranthene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (ghi) perylene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (k) fluoranthene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (a) anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Chrysene	µg/L	1	USEPA 3510/8270 GC/MS
Dibenz (ah) anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Fluoranthene	µg/L	1	USEPA 3510/8270 GC/MS
Fluorene	µg/L	1	USEPA 3510/8270 GC/MS
Indeno (1,2,3-cd) pyrene	µg/L	1	USEPA 3510/8270 GC/MS
Napthalene	µg/L	1	USEPA 3510/8270 GC/MS
Phenanthrene	µg/L	1	USEPA 3510/8270 GC/MS
Pyrene	µg/L	1	USEPA 3510/8270 GC/MS
Carcinogenic PAHs (benzo[a}pyrene equivalents	µg/L	0.5	USEPA 3510/8270 GC/MS
Total PAH	µg/L	0.5	USEPA 3510/8270 GC/MS
Volatile Organic Compounds			
2,3,4,6-Tetrachlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4,5-Trichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4,6-Trichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4-Dichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4-Dimethylphenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4-Dinitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,6-Dichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS

Parameter	Reporting units	Limit of reporting	Method
2-Chlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2-Methyl-4,6-dinitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
2-Nitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
4-Chloro-3-methylphenol	µg/L	1	USEPA 3510/8270 GC/MS
4-Nitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
Dinoseb	µg/L	1	USEPA 3510/8270 GC/MS
Formaldehyde	mg/L	1	USEPA 3510/8270 GC/MS
Hexachlorophene	µg/L	1	USEPA 3510/8270 GC/MS
m- and p-Cresol	µg/L	1	USEPA 3510/8270 GC/MS
Pentachlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
Phenol	µg/L	1	USEPA 3510/8270 GC/MS
Organic Carbon			
Dissolved Organic Carbon	mg/L	1	APHA 5310 B
Total Organic Carbon	mg/L	1	APHA 5310 B

APPENDIX E

Erosion and Sediment Control Plan

APPENDIX H

Erosion and Sediment Control Plan

BEETALOO BASIN EXPLORATION PROJECT

Erosion and Sediment Control Plan

EP 76, EP 98 and EP 117

This document outlines the basic principles for contractors to develop site specific erosion and sediment control plans for Beetaloo Basin Exploration Program.

REV	DATE	REASON FOR ISSUE	AUTHOR	APPROVER
0	29/03/2019	Issued for use	A.Court	M.Hanson
1	28/06/2019	Revised based on comments received by DEPWS	A.Court/J.Jentz	M.Hanson
2	16/07/2019	Updated Primary ESCP	A.Court/J.Jentz	M.Hanson
3	19/11/2021	Update overarching ESCP	P.Szamosi/J.Jentz	M.Kernke
4	23/02/2022	Update overarching ESCP	P.Szamosi/J.Jentz	M.Kernke
5	08/07/2022	Update for Amungee delineation area	A.Court	M.Kernke
6	13/09/2022	Update overarching ESCP	J.Jentz	L. Pugh
7	23/06/2023	Revised to include update Amungee NW3, Shenandoah North and South	A Court	L Pugh
8	20/10/2023	Revised to include updated for all sites	A Court	L Pugh
9	27/03/2024	Updated on Reg 10/11 Comments	A Court	L Pugh
10	23/04/2024	Updated on Reg 10/11 Comments	L Pugh	M Kernke
11	06/06/2024	Inclusion of the SPCF	A Court	M Kernke
12	26/09/2024	Minor figure edits for the SPCF	L Pugh	M Kernke
13	15/10/2024	Inclusion of 3D Seismic Program activities	A Court	M Kernke
14	06/03/2025	Minor edit for 3D Seismic EMP	A Court	M Kernke

CPESC Review

Date	CPESC Name / Position	Signature
19/07/2025	Tim Anderson MAgrSc, BAgrSc (Hons), CPESC (#2723), CEnvP (#002).	

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Appendix N Other IECA standard specifications (as required)

Appendix O Table 4.4.7 IECA best practice land clearing and rehabilitation requirements

Appendix P Erosion and sediment control treatment – seismic lines

1 Introduction

This Erosion and Sediment Control Plan (ESCP) has been developed to ensure best practice erosion and sediment controls are implemented during Tamboran's[1] exploration activities within EP 76, EP 98 and EP 117, to avoid or minimise and control erosion and offsite impacts, such as sedimentation of waterways.

This ESCP has been developed to provide direction for Tamboran and contractors to implement erosion and sediment control (ESC) during construction of the well pads and associated infrastructure, the Sturt Plateau Compression Facility (SPCF), worker camps and access tracks, seismic lines as well as during ongoing maintenance and monitoring once sites are established. This ESCP has been updated to include proposed Shenandoah South 3D Seismic Program (SS 3D Seismic Program) which is in the Shenandoah South E&A area on EP98 and EP117.

The design of the exploration well pads, SPCF, seismic lines and access tracks comply with Northern Territory (NT) and local government statutory laws and regulations and are to be designed to meet all relevant and applicable codes and standards. This ESCP has been developed in accordance with the following guidelines:

- Code of Practice for Petroleum Activities in the Northern Territory (DEPWS & DITT, 2019)
- Best Practice Erosion and Sediment Control (IECA, 2008)
- Land Clearing Guidelines (DEPWS, 2024)
- Erosion and Sediment Control Guidelines for Rural Development Environment Fact Sheet (DLRM, 2018).

The location of the proposed exploration activities are shown on Figure 1.

Please note the following Northern Territory Government (NTG) Department name changes for the regulation of Onshore Petroleum activities in the NT:

- The Department of Environment, Parks and Water Security (DEPWS) is now referred to as Department of Lands, Planning and Environment (DLPE).
- The Department of Industry, Tourism and Trade (DITT) is now referred to as Department of Mining and Energy (DME).

[1] Including its subsidiaries.

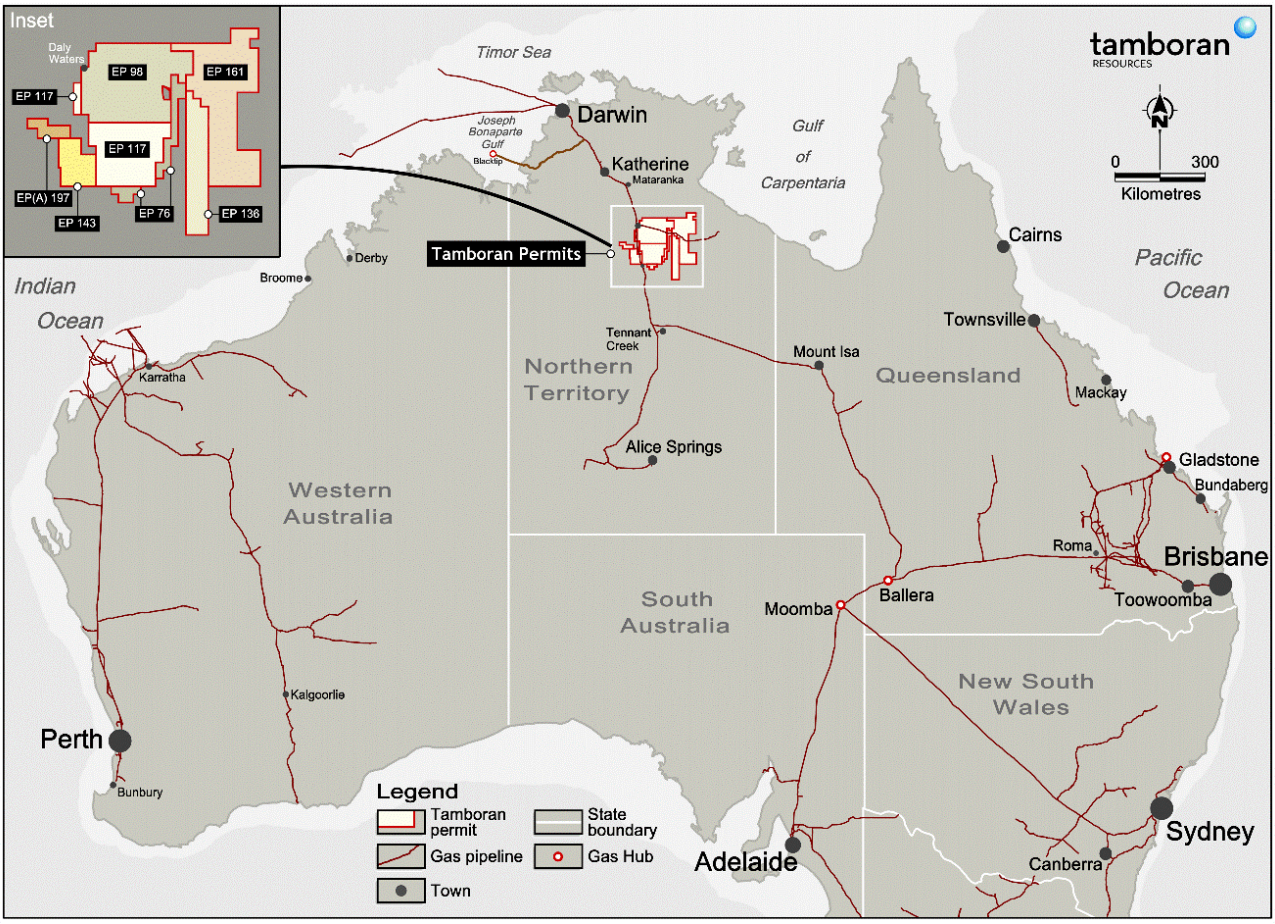


Figure 1: Location of Tamboran exploration permit areas (EPs)

2 Project Context

This plan covers all civil, seismic acquisition, well drilling, stimulating, rehabilitation and routine maintenance/monitoring activities undertaken by Tamboran, its subsidiaries and their contractors within permit EP76, EP98 and EP117 as detailed in Table 1, Table 2 and shown in Figure 2– Figure 5.

Table 1: ESCP infrastructure per Beetaloo Exploration EMP

EMP	EP	Well pad(s)	Camp(s)	Helipad	Seismic line(s)	Access track(s)	Gravel pit(s)	Gathering lines	Other
Velkerri 76 S2 EMP (ORI5-4) Doc #: NT-2050-15-MP-032	76	X	X	X	–	X	X	–	–
Amungee NW-1H (ORI7-2) Doc #: CDN/ID NT-2050-35-PH-0018	98	X	X	–	–	X	–	–	–
Beetaloo W-1 EP 117 EMP (ORI8-2) Doc #: NT-2050-15-MP-039	117	X	X	–	–	X	X	–	–
Kalala S1 EMP (ORI9-2) Doc #: NT-2050-MP-040	98	X	X	X	–	X	X	–	–
Beetaloo Sub-basin Multiwell Drilling, Stimulation & Well Testing Program EMP (ORI10-3) Doc #: NT-2050-15-MP-041	76 & 98	X	X	X	–	X	X	–	–
Amungee NW Delineation Program EMP (ORI11-3) Doc #: NT-2050-15-MP-0088	98	X	X	X	X	X	X	–	–
Shenandoah South E&A program EMP (TAM1-3) Doc #: B2-HSE-MP-08	98 & 117	X	X	X	X	X	X	X	–
Sturt Plateau Compression Facility - Appraisal Gas EMP (TAM2-3) Doc #: TB2-HSE-MP-13	98 & 117	–	X	–	–	–	–	X (between SS2 wells and SPCF)	X SPCF pad Fence line
Shenandoah South 3D Seismic EMP (TAM3-2) Doc #: TB2-HSE-MP-14	98 & 117	–	–	–	X	–	–	–	–

Table 2: Coordinates of centroid 2D seismic and exploration well sites

INFRASTRUCTURE	COORDINATES (Zone 53)			
	Start of line		End of line	
	Lat	Long	Lat	Long
Amungee delineation area seismic lines (EP 98) - EMP ORI11-3				
001-SR	-16.32434	133.82875	-16.39386	133.89996
002-SR	-16.32112	133.85894	-16.35325	133.89186
003-SR	-16.34104	133.87802	-16.39438	133.93218
004-SR	-16.36162	133.93763	-16.41430	133.99165
005-SR	-16.34667	133.95114	-16.39806	134.00384
006-SR	-16.37223	133.86042	-16.37795	134.00306
007-SR	-16.34267	133.88364	-16.34584	133.88032
008-SR	-16.34459	133.88562	-16.34777	133.88229
009-SR	-16.34652	133.88759	-16.34970	133.88427
010-SR	-16.34845	133.88957	-16.35163	133.88624
Shenandoah South E&A 2D Seismic Lines (EP 117 and EP 98) – EMP TAM1-3				
Shenandoah South Line A	-16.83863	133.47175	-16.92103	133.55480
Shenandoah South Line B	-16.83284	133.48508	-16.91394	133.56735
Shenandoah South Line C	-16.81729	133.50872	-16.89536	133.58758
Shenandoah South E&A Gathering Lines (EP 117 and EP 98) – EMP TAM1-3				
***Shenandoah South B to Shenandoah South C (~4.11 km)* – EMP TAM1-3**				
Start – Shenandoah South B pad	345035	8135461	–	
Intersection to existing track	345046	8134499		
Intersection to Shenandoah South C	343442	8134573		
End – Shenandoah South C pad	–		343471	8133331

Kyalla 117 N2 to Shenandoah South 2 (~4.5 km) – EMP TAM1-3 and EMP TAM2-3				
Start – Kyalla 117 N2 pad	356274	8137505	–	
Intersection to existing track	356189	8137509		
Intersection to Shenandoah South 2	356205	8140071		
End – Shenandoah South 2 pad	–		355060	8141514
Shenandoah South 3D Seismic Program (EP 98 and EP 117) – EMP TAM3-2				
1	343278	8146979	354493	8153454
2	343528	8146546	354743	8153021
3	343778	8146113	354993	8152588
4	344028	8145680	355243	8152155
5	344278	8145247	355493	8151722
6	344528	8144814	355743	8151289
7	344778	8144381	355993	8150856
8	345028	8143948	356243	8150423
9	345300	8143527	356493	8149990
10	345550	8143094	356743	8149557
11	337573	8137911	356993	8149124
12	337823	8137478	357243	8148691
13	338073	8137045	357493	8148258
14	338323	8136612	357743	8147825
15	338573	8136179	357993	8147392
16	338823	8135746	358243	8146959
17	339073	8135313	358493	8146526
18	339323	8134880	358743	8146093
19	339573	8134447	358993	8145660
20	339823	8134014	359243	8145227
21	340073	8133581	359493	8144794
22	340323	8133148	359743	8144361
23	340594	8132728	359993	8143928
24	340844	8132295	360243	8143495
25	341094	8131862	360493	8143062
26	341344	8131429	360743	8142629
27	341594	8130996	360993	8142196
28	341844	8130563	361243	8141763
29	350408	8134930	361493	8141330

30	351416	8134934	361743	8140897
31	352424	8134938	361993	8140463
32	353431	8134943	362243	8140030
33	354439	8134947	362493	8139597
34	355447	8134952	362743	8139164
35	356455	8134956	362993	8138731
36	357484	8134973	363243	8138298
37	358492	8134978	363493	8137865
38	359500	8134982	363743	8137432
39	360507	8134987	363993	8136999
40	361515	8134991	364243	8136566
41	362523	8134996	364493	8136133
42	363531	8135000	364743	8135700

Well sites, SPCF, access track and gravel pit reference	**Coordinates (approximate)**		
	Zone	**Easting**	**Northing**
Amungee NW	53	415515	8180683
Amungee NW-2	53	381039	8192324
Amungee NW-3	53	375512	8195308
Amungee NW-4	53	376611	8193100
Amungee NW-5	53	390313.6	8187337
Kalala S1	53	351740	8198030
Velkerri 76 S2	53	435488	8136321
Kyalla 117 N2	53	356175	8137500
Beetaloo W (Kyalla 117 W1)	53	368312	8106695
Shenandoah S2	53	355291	8140676
Shenandoah S B	53	345035	8135464
Shenandoah S C	53	343471	8133330
Shenandoah N A	53	356687	8163762
Sturt Plateau Compression Facility	53	355195	8141324

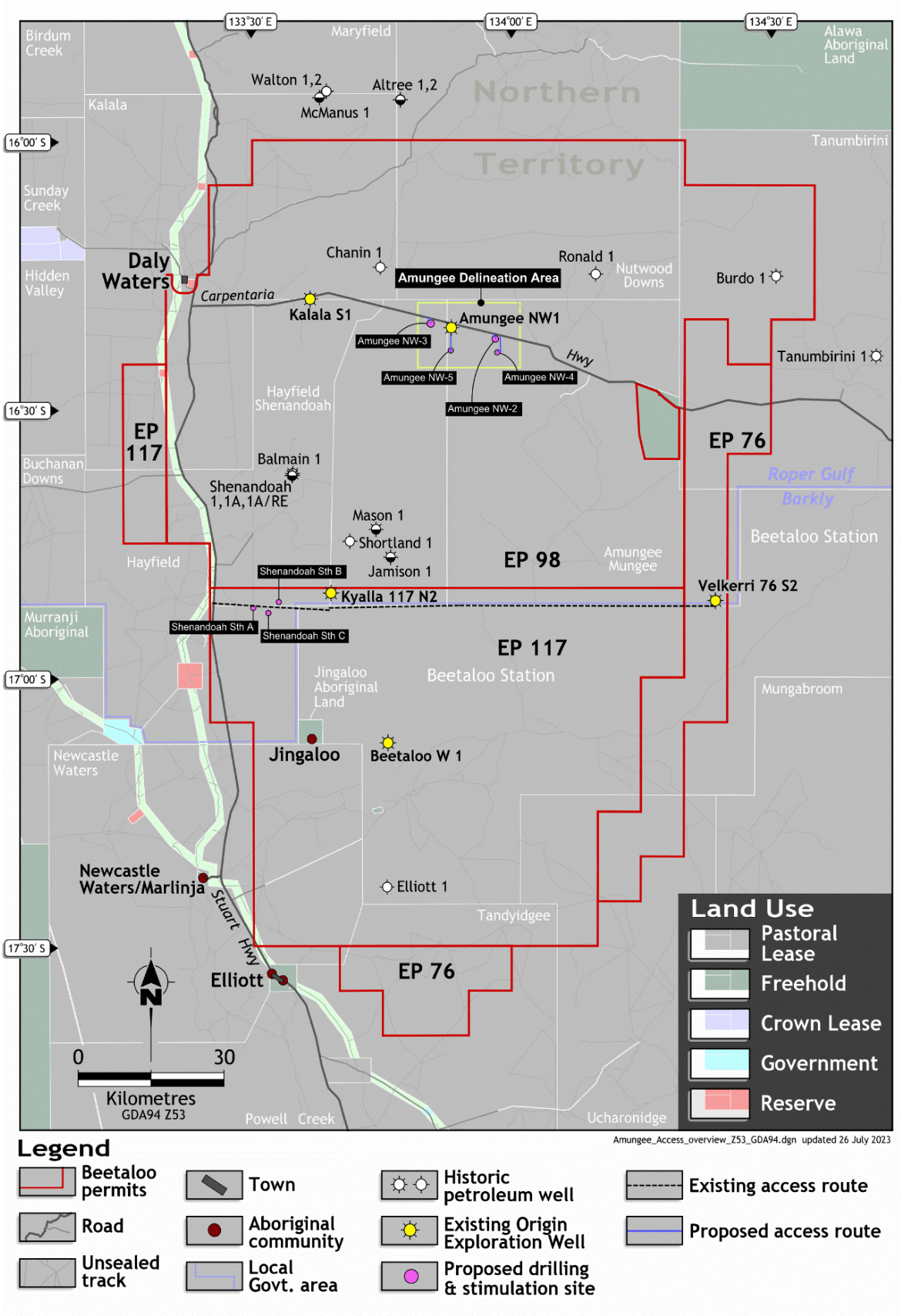


Figure 2: Location of Tamboran's exploration well sites and existing infrastructure

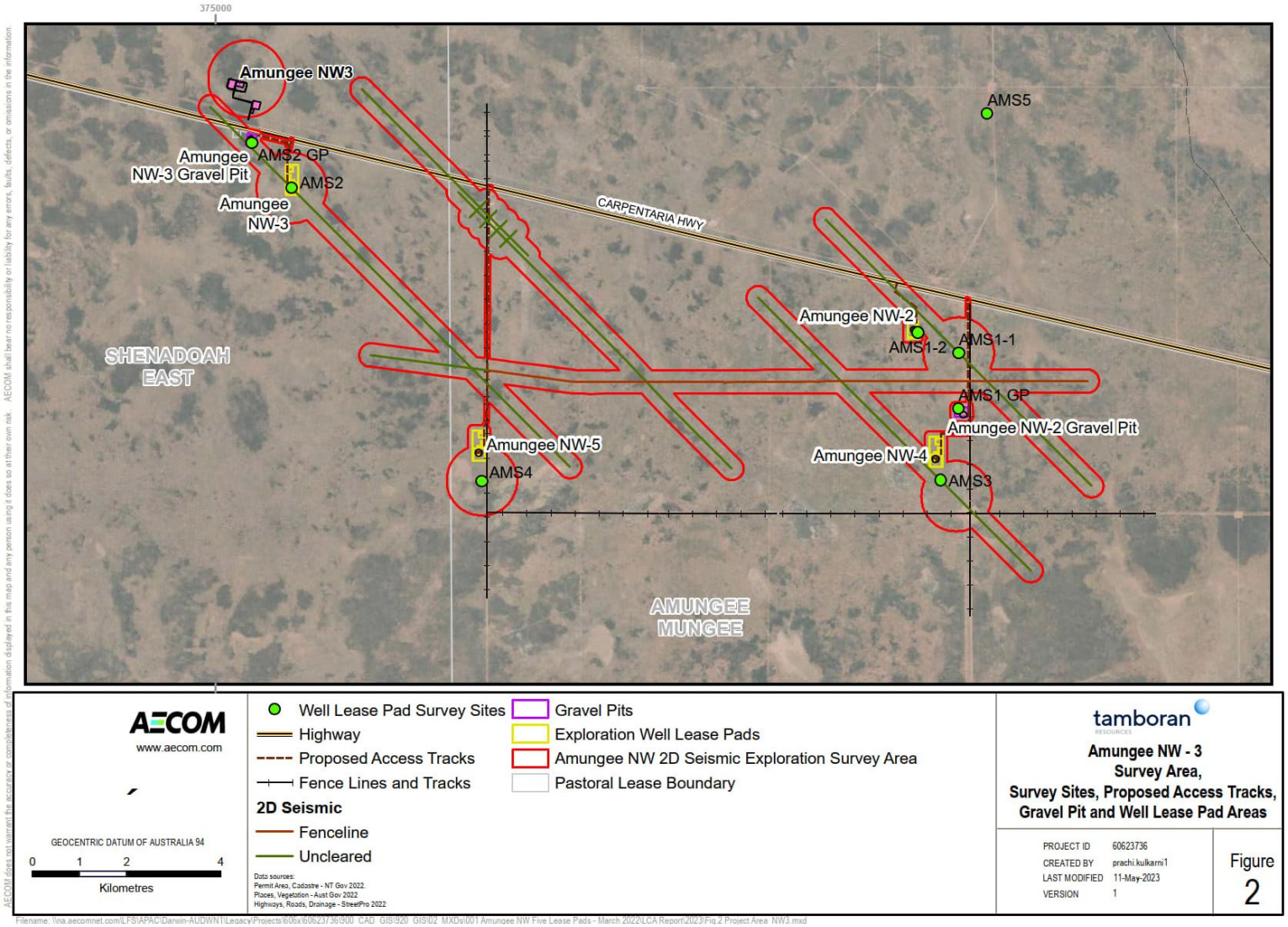


Figure 3: Location of Amungee seismic survey areas

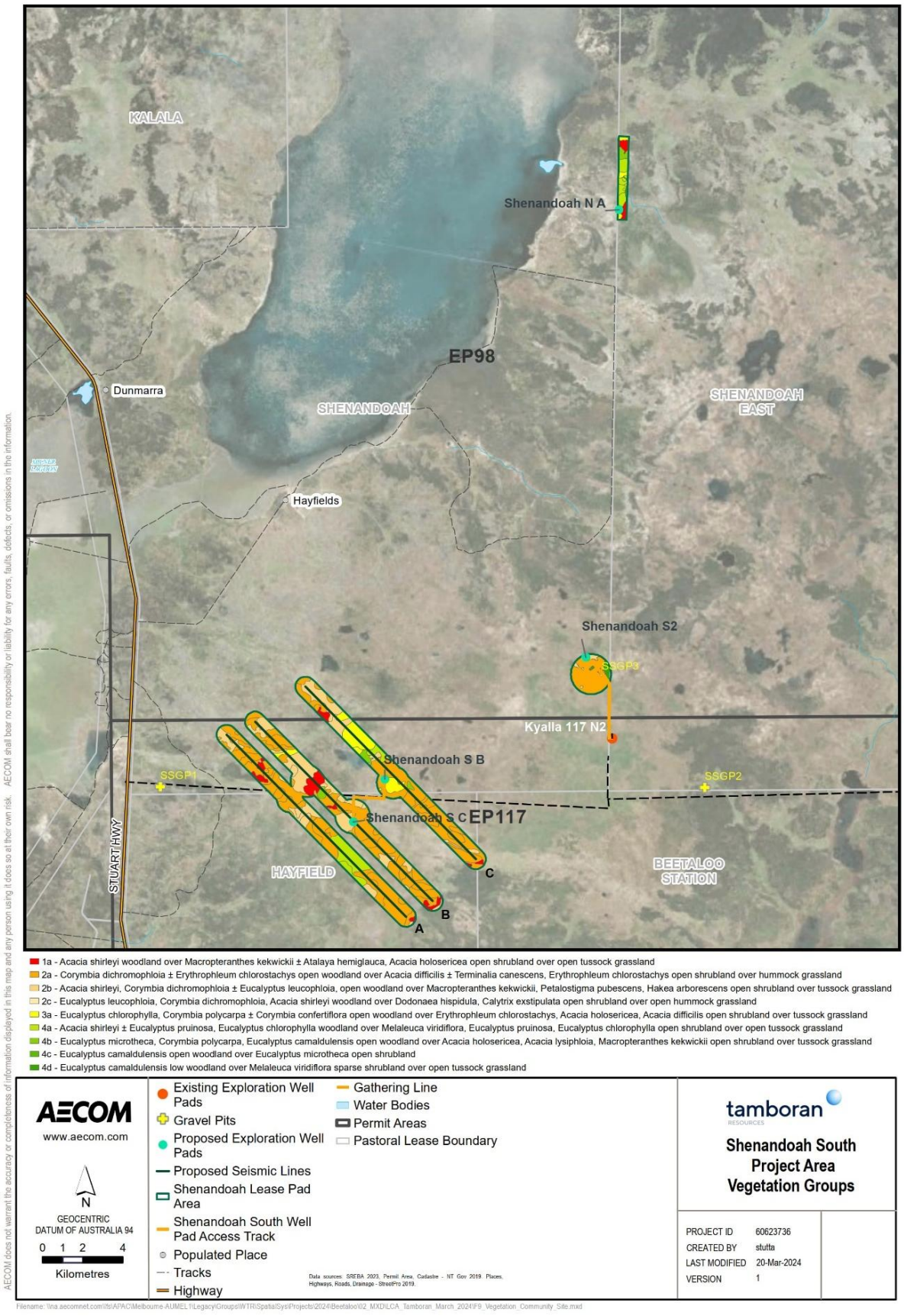


Figure 4: Location of Shenandoah South E&A (includes vegetation communities)

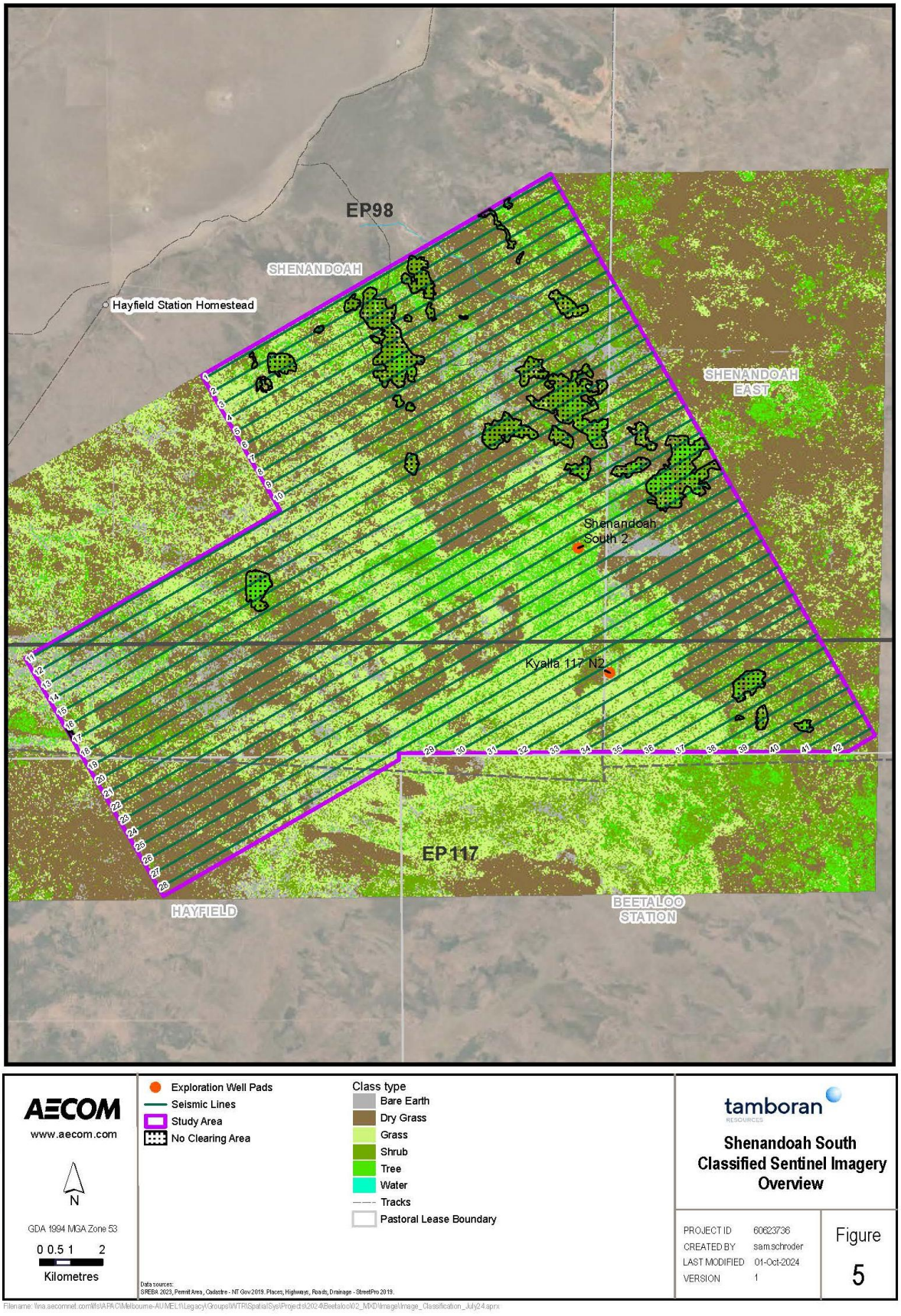


Figure 5: Location of Shenandoah South 3D seismic program

The primary activities subject to this ESCP are:

- Construction and or ongoing maintenance of exploration well pads, SPCF pad, camp pads, stockpile areas, helipad and wet weather storage area.
- Minor intersection upgrade works at the intersection with the Stuart Highway and Carpentaria Highway in accordance with Road Agency approval and Permit to Work within NT Government road reserves.
- 2D and 3D seismic line preparation, data collection and rehabilitation.
- Installation of gathering lines between well pads
- Construction and ongoing maintenance of access tracks.
- Gravel extraction, as required, for construction and maintenance of drill pads and sections of the access tracks.
- All other activities ancillary to the seismic survey and drilling, stimulation and well testing of an exploration well.

2.1 Legislation

The activities outlined within the EMP, which this management sub-plan is a component of, aim to comply with relevant guidelines associated with exploration activities, such as International Erosion Control Association (IECA) *Best Practice for Erosion and Sediment Control* (2008), IECA *Appendix P: Land Based Pipeline Construction December 2015* (Addendum to IECA 2008), the *Australian Pipeline Industry Association Code of Environmental Practice for Onshore Pipelines 2017* and the *Code of Practice for Onshore Petroleum Activities in the Northern Territory 2019* (the Code).

2.1.1 Code of Practice for Onshore Petroleum Activities in the Northern Territory 2019

The Code is a mandatory code of practice for the petroleum industry to ensure that petroleum activities in the Northern Territory are managed according to minimum acceptable standards to ensure that risks to the environment can be managed to a level that is as low as reasonably practical (ALARP) and acceptable.

Under these regulations, Tamboran is required to submit an EMP prior to any petroleum exploration or production activity. The EMP for a petroleum activity must include a primary ESCP outlining all activities. This should be developed by a suitably qualified person in accordance with relevant guidelines including specific environmental outcomes and environmental performance standards to be included in the implementation strategy in the EMP. The ESCP must include:

- A risk assessment in relation to the potential impact to the environment from erosion and sedimentation associated with the proposed activities. Including an assessment of site-specific conditions and the nature and timing of works with the NT Land Clearing Guidelines (DEPWS, 2024) website and any amendments.
- Where the Primary ESCP requires it, a further ESCP must be developed by a suitably qualified person in relation to the relevant matters identified in the Primary ESCP and implemented by the interest holder.
- Road and pipeline designs must:
    - minimise erosion of exposed road surfaces and drains
    - ensure that roads and pipeline surface water flow paths minimise erosion of all exposed surfaces and drains

- comply with legislative requirements.

- The requirements of the Land Clearing Guidelines 2024 as published on the DLPE website and amended from time to time must be complied with in relation to protection of natural waterways as a result of land disturbance and ensure the following:
  - appropriate buffers are implemented around natural waterways
  - disturbance in the wet season is minimised
  - the number of crossing points is minimised
  - crossings are established as close as practicable to right angles to the waterway
  - material changes in the shape of the waterway are avoided
  - material changes in the volume, speed or direction of flow or likely flow of water in the waterway are avoided
  - alteration to the stability of the bed or banks of the waterway (including by removal of vegetation) is avoided
  - erosion risk, sedimentation and pollution of waterways is minimised through the appropriate design and implementation of best practice erosion and sediment control measures.

3 Aims and Objectives

The ESCP aims to:

- Address key soil and water management issues, including legislative and client requirements.
- Determine the "Type" of ESC to be implemented during construction, post construction and until exploration activities are completed.
- Where practical identify, eliminate and reduce hazards and associated risks inherent in specific work activities, which if untreated could lead to a diminished product or create the potential for an accident, dangerous occurrence or environmental incident.

The objective of this ESCP is to manage Tamboran's activities within the EP in a manner that minimises the impacts upon soil, vegetation and surface water which may result from soil disturbance activities including seismic line preparation, land clearing associated with well pad establishment.

This ESCP may be amended as required, in response to the monitoring and maintenance programs described herein to avoid significant and/or sustained deterioration in downstream water quality. Standard drawings are provided as a guide, with the construction supervisor and Tamboran engineers making final determination on site.

Strategies shall be developed, implemented and reviewed on a regular basis, so that risks are identified, measured and recorded throughout the course of the project.

Due to potential chance for activities to lead up to the wet season, wet weather contingencies have been identified in this plan and the overarching EMP (BOM, 2012). It is anticipated that due to the known ground conditions across the region, ground conditions following rainfall events can make access impossible. The primary mitigation will be to monitor weather forecasts daily during the program and where rainfall is likely to result in an event that has potential to limit access, the subcontractor will stabilise the current work areas and go into standby mode until such time can assess the track conditions to recommence activities.

Further strategies will be developed, implemented and reviewed on a regular basis so that risks are identified, measured and recorded throughout the course of exploration activities. Any significant changes to the ESCP will be subject to review and approval by the Department of Lands, Planning and Environment (DLPE) Land Management Team.

3.1 Compliance with IECA Guideline

The ESCP has been prepared by suitably qualified and experienced personnel that understand the intent and minimum standards of IECA. The team that prepared the plan consist of the following:

- [redacted] – BEnvSci, PGDipEnvMgt. Senior Environmental Manager with over 24 years' experience. [redacted] completed the IECA erosion and sediment control training (2013) and is experienced in providing advice to managing environmental requirements in the Beetaloo Sub-Basin including erosion and sediment control for the past 20 years.
- [redacted] – BEng, RPEQ, CPEng. Civil Engineer with over 30 years' experience in the design and documentation of civil engineering projects. [redacted] has signed off all civil drawings under his qualification.

4 Civil Construction Schedule

The exploration schedule for Tamboran's activities will primarily occur from May each year extending into September while rainfall risk rating is considered very low (0 to 30 mm).

Implementation of the ESCP will commence as soon as access is granted and continue throughout the exploration activities until such time that the site is stabilised.

If exploration activities continue through to the wet season, Tamboran will implement the wet weather contingency planning. Planning will occur during August – September and will be implemented between 1 October to 30 April, based on the rainfall erosion risk rating identified in Section 5.1.

Wet weather contingency planning includes the following actions:

- Tamboran to review program schedule to determine what activities will extend into the wet season.
- Undertake inspections of all assets to ensure appropriate ESC in place and are functional before 1 October each year.
- Conduct maintenance on all ESC established onsite before 1 October each year.
- Complete a stocktake on available ESC equipment on site, and where required purchase new equipment before the 1 October each year.

5 Permit Area Erosion Susceptibility

Erosion susceptibility varies throughout the Tamboran permit area, dependent upon the soil types, slope and extent of ground disturbance. Apart from the erosive impact of climatic conditions, soil erosion is influenced mainly by the inherent properties of the soils and the processes which occurred during the formation of the landscapes.

Erosion will occur in the permit area if the land is used beyond its capacity, as is seen if land is overstocked or vehicle movements not controlled, for example. The locations of the exploration well sites for Tamboran have been examined in the field to determine the risk of erosion occurring from exploration activities.

Factors considered include the following:

- Season (R Factor) – the timing of the project works will occur mostly within the dry season of the NT, which has low amounts of rainfall and is considered a low-risk factor. Risk levels of rainfall data of Daly Waters and Newcastle waters can be seen in Table 2 and Table 3 which present the erosion risk rating based on average monthly rainfall using the rating system provided in the IECA (2008) Table 4.4.2 for Daly Waters (northern sites) and Newcastle Waters (southern sites).

Table 3: Erosion risk rating based on average monthly rainfall at Daly Waters (Bureau of Meteorology 2023)

Item	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	165.4	165.4	120.1	23.6	5.0	5.6	1.5	1.7	4.9	22.5	59.4	110
Erosion Risk*	H	H	H	VL	VL	VL	VL	VL	VL	VL	M	H

* E = Extreme (>225 mm); H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm)

Table 4: Erosion risk rating based on average monthly rainfall at Newcastle Waters (Bureau of Meteorology 2023)

Item	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	125.5	130.9	93.7	24.6	9.3	5.3	3.4	1.0	5.4	20.9	35.7	77.3
Erosion Risk*	H	H	M	VL	VL	VL	VL	VL	VL	VL	L	M

* E = Extreme (>225 mm); H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm)

- Soil type (K Factor) – soils with higher clay content are prone to generation of bulldust and are easily eroded by wind and water. Gravelly soils tend to be more robust to disturbance on the scale expected for Tamboran exploration activities. The primary soil type encountered across the permit can generally be described as silty SAND, SM with some gravel. These soils are considered to have a low to medium erodibility potential when the soils are disturbed.
- Slope length – the slope of the exploration area is one of the characteristics that will help to determine the risk of erosion during rainfall events, with steeply inclined areas a higher risk than small undulations in the landform. The Tamboran exploration areas subject to this ESCP are generally flat with a slope of <1%. There are some slight undulations that occur throughout the area, generally being less than 2% gradient, however some areas are known to be greater 2%. Treatments are defined for sections less than 2% and greater than 2% in this plan. The relevant treatment will be considered on a case-by-case basis.
- Aspect – the position of the seismic lines, access tracks and pads in relation to the direction of the contour should be considered and creation of tracks and the well pads across (as opposed to parallel with) the contour should be avoided.
- Groundcover – clearing will be conducted to construct access tracks, establish gravel pits and earthworks relating to construction of the exploration well pad and associated camps, as well as line preparation for seismic exploration. The method that will be used for seismic line preparation will consist of dozer and grader, ensuring that topsoil and root stock is retained.

The clearing method used for gravel pits and construction of well pads, SPCF pad and camp pads will consist of a dozer to initially clear vegetation and then dozer or grader to strip topsoil, ensuring that rootstock is retained in the stockpiled topsoil. Expected machinery includes grader, 4W loader, tip truck, water truck, water tanks, excavators and compactors.

- Drainage line crossings – potential for minor drainage lines to occur across the exploration area. Generally, these can be trafficable with minimal modification of the creek bed required.

5.1 Erosion Hazard Assessment for EP 76, EP 98 and EP 117

5.1.1 Erosion Hazard Assessment for EP76, EP98 and EP117 – Well Pads, Access Tracks

An Erosion Hazard Assessment for all sites subject to this ESCP has been completed to inform the specific issues and actions that will be required for conducting activities within the permit areas. Table 5 (Amungee, Kalala, Kyalla, Velkerri and Beetaloo) and (Shenandoah South 2, South B, South C and North A) present the results of the assessment for exploration well pads and the SPCF adjacent to the Shenandoah South 2 well pad. The IECA (2008) Explanatory Notes for the assessment are presented Appendix A.

Table 5: Erosion hazard assessment for EP 76, EP 98 and EP 117 – well pads and access tracks

Condition (as described by IECA, 2008)	Points	Erosion Hazard Score					Trigger value
		Amungee Delineation Area*	Kalala S1	Kyalla 117 N2	Velkerri 76 S2	Beetaloo W	
AVERAGE SLOPE OF DISTURBANCE AREA [1]							
• not more than 3% [3% =33H:1V]	0	0	0	0	0	0	4
• more than 3% but not more than 5% [5% =20H:1V]	1	Comment - Topographical survey of well sites indicated (low relief) with a slope <3% (refer Appendix B)					
• more than 5% but not more than 10% [10% =10H:1V]	2						
• more than 10% but not • more than 15% [15%= 6.7H:1V]	4						
• more than 15%	6						
SOIL CLASSIFICATION GROUP (AS1726) [2]							
• GW, GP, GM, GC	0	2	2	2	2	2	-
• SW, SP, OL, OH	1	Comment – Geotechnical testing indicated SM - Silty sands, poorly graded sand-silt mixtures (refer Appendix C[2]).					
• SM, SC, MH, CH	2						
• ML, CL, or if imported fill is used, or if soils are untested	3						

[2] Note, Amungee NW, Beetaloo W and Kalala S well sites were constructed prior to 2018.

Condition (as described by IECA, 2008)	Points	Erosion Hazard Score					Trigger value
		Amungee Delineation Area*	Kalala S1	Kyalla 117 N2	Velkerri 76 S2	Beetaloo W	
EMERSON (DISPERSION) CLASS NUMBER [3]							
• Class 4, 6, 7, or 8	0	4	4	4	4	4	6
• Class 5	2	Comment – Class 3 or default- Amungee Delineation Area Class 3 or default - soils disturbed by cut and fill operations or construction traffic are likely to discolor stormwater (i.e. cause turbid runoff). Controls to reduce turbidity are required.					
• Class 3, (default value if soils are untested)	4						
• Class 1 or 2	6						
DURATION OF SOIL DISTURBANCE [4]							
• not more than 1 month	0	2	2	2	2	2	6
• more than 1 month but not more than 4 months	2	Comment – Clearing and earthworks are expected to be between 1 and 4 months.					
• more than 4 months but not more than 6 months	4						
• more than 6 months	6						
AREA OF DISTURBANCE [5]							
• not more than 1000 m^2	0	6	6	6	6	6	6
• more than 1000 m^2 but not more than 5000 m^2	1	Comment – All exploration well sites are greater than 4 ha but less than 12 ha of disturbance.					
• more than 5000 m^2 but not more than 1 ha	2						
• more than 1 ha but not • more than 4 ha	4						
• more than 4 ha	6						
WATERWAY DISTURBANCE [6]							
• No disturbance to a watercourse, open drain or channel	0	0	0	0	0	0	2
• Involves disturbance to a constructed open drain or • channel	1	Comment – Not near natural water courses (refer Appendix D).					
• Involves disturbance to a natural watercourse	2						
REHABILITATION METHOD [7] Percentage of area (relative to total disturbance) revegetated by seeding without light mulching (i.e. worst-case revegetation method).							
• not more than 1%	1	1	1	1	1	1	-
• more than 1% but not	2						

Condition (as described by IECA, 2008)	Points	Erosion Hazard Score					Trigger value
		Amungee Delineation Area*	Kalala S1	Kyalla 117 N2	Velkerri 76 S2	Beetaloo W	
• more than 5%		Comment – topsoil replaced along batters to commence assisted natural regeneration.					
• more than 5% but not more than 10%	3						
• more than 10%	4						
RECEIVING WATERS [8]							
• Saline waters only	0	2	2	2	2	2	-
• Freshwater body (e.g. creek or freshwater lake or river)	2	Comment – not located within the major flow pathway (refer to flood assessment in the Amungee Delineation Area Land Condition Assessment).					
SUBSOIL EXPOSURE [9]							
• No subsoil exposure except of service trenches	0	0	0	0	0	0	-
• Subsoils are likely to be exposed	2						
EXTERNAL CATCHMENTS [10]							
• No external catchment	0	1	1	1	1	1	-
• External catchment diverted around the soil disturbance	1	Comment – refer to civil design drawings (Appendix E to Appendix M)					
• External catchment not diverted around the soil disturbance	2						
ROAD CONSTRUCTION [11]							
• No road construction	0	2	2	2	2	2	-
• Involves road construction works	2						
pH OF SOILS TO BE REVEGETATED [12]							
• more than pH 5.5 but less than pH 8	0	0	0	0	0	0	-
• other pH values, or if soils are untested	1	Comment – Soil pH 5.5 to 8.0					
Total Score [13]		**20**	**16**	**20**	**20**	**20**	
For guidance purposes only: [13] A primary ESCP must be submitted to the local government for approval during the planning phase for any development that obtains a total point score of 17 or greater or when any trigger value is scored or exceeded							

Table 6: Erosion hazard assessment for EP 76, EP 98 and EP 117 – Shenandoah E&A Program

Condition (as described by IECA, 2008)	Points	Erosion Hazard Score					Trigger value
		Shenandoah South E&A Program					
		South B	South C	South 2 (inclusive of SPCF pad)	North A		
AVERAGE SLOPE OF DISTURBANCE AREA [1]							
• not more than 3% [3% =33H:1V]	0	0	0	0	0		4
• more than 3% but not more than 5% [5% =20H:1V]	1	Comment - Topographical survey of well sites indicated (low relief) with a slope <2% (refer Appendix B)					
• more than 5% but not more than 10% [10% =10H:1V]	2						
• more than 10% but not more than 15% [15%= 6.7H:1V]	4						
• more than 15%	6						
SOIL CLASSIFICATION GROUP (AS1726) [2]							
• GW, GP, GM, GC	0	2	2	2	2		-
• SW, SP, OL, OH	1	Comment – Geotechnical testing indicated SM - Silty sands, poorly graded sand-silt mixtures (refer Appendix C).					
• SM, SC, MH, CH	2						
• ML, CL, or if imported fill is used, or if soils are untested	3						
EMERSON (DISPERSION) CLASS NUMBER [3]							
• Class 4, 6, 7, or 8	0	6	6	4	6		6
• Class 5	2	Comment – Class 3 or default- Class 3 or default - soils disturbed by cut and fill operations or construction traffic are likely to discolour stormwater (i.e. cause turbid runoff). Controls to reduce turbidity are required.					
• Class 3, (default value if soils are untested)	4						
• Class 1 or 2	6						
DURATION OF SOIL DISTURBANCE [4]							
• not more than 1 month	0	2	2	2	2		6
• more than 1 month but not more than 4 months	2	Comment – Clearing and earthworks are expected to be between 1 and 4 months.					
• more than 4 months but not more than 6 months	4						
• more than 6 months	6						

Condition (as described by IECA, 2008)	Points	Erosion Hazard Score					Trigger value
		Shenandoah South E&A Program					
		South B	South C	South 2 (inclusive of SPCF pad)	North A		
AREA OF DISTURBANCE [5]							
• not more than 1000 m2	0	6	6	6	6		6
• more than 1000 m2 but not more than 5000 m2	1	Comment – All exploration well sites are greater than 4 ha but less than 12 ha of disturbance.					
• more than 5000 m2 but not more than 1 ha	2						
• more than 1 ha but not • more than 4 ha	4						
• more than 4 ha	6						
WATERWAY DISTURBANCE [6]							
• No disturbance to a watercourse, open drain or channel	0	0	0	0	0		2
• Involves disturbance to a constructed open drain or • channel	1	Comment – Not near natural water courses (refer Appendix D).					
• Involves disturbance to a natural watercourse	2						
REHABILITATION METHOD [7] Percentage of area (relative to total disturbance) revegetated by seeding without light mulching (i.e. worst-case revegetation method).							
• not more than 1%	1	1	1	1	1		-
• more than 1% but not • more than 5%	2	Comment – topsoil replaced along batters to commence assisted natural regeneration.					
• more than 5% but not more than 10%	3						
• more than 10%	4						
RECEIVING WATERS [8]							
• Saline waters only	0	2	2	2	2		-
• Freshwater body (e.g. creek or freshwater lake or river)	2	Comment – not located within the major flow pathway (refer to flood assessment for each well pad)					

Condition (as described by IECA, 2008)	Points	Erosion Hazard Score					Trigger value
		Shenandoah South E&A Program					
		South B	South C	South 2 (inclusive of SPCF pad)	North A		
SUBSOIL EXPOSURE [9]							
• No subsoil exposure except of service trenches	0	0	0	0	0		-
• Subsoils are likely to be exposed	2						
EXTERNAL CATCHMENTS [10]							
• No external catchment	0	1	1	1	1		-
• External catchment diverted around the soil disturbance	1	Comment – refer to civil design drawings (Appendix E to Appendix M)					
• External catchment not diverted around the soil disturbance	2						
ROAD CONSTRUCTION [11]							
• No road construction	0	2	2	2	2		-
• Involves road construction works	2						
pH OF SOILS TO BE REVEGETATED [12]							
• more than pH 5.5 but less than pH 8	0	0	0	0	0		-
• other pH values, or if soils are untested	1						
Total Score [13].		**22**	**22**	**20**	**22**		
For guidance purposes only: [13] A primary ESCP must be submitted to the local government for approval during the planning phase for any development that obtains a total point score of 17 or greater or when any trigger value is scored or exceeded							

5.1.2 Erosion Hazard Assessment for Seismic Surveys

Table 7 presents the results of the assessment for the seismic programs.

Table 7: Erosion hazard assessment for EP 76, EP 98 and EP 117 –seismic survey areas

Condition (as described by IECA, 2008)	Points	Score	Trigger value
		Seismic Survey Areas	
AVERAGE SLOPE OF DISTURBANCE AREA [1]			
• not more than 3% [3% = 33H:1V]	0	1	4
• more than 3% but not more than 5% [5% = 20H:1V]	1	Comment - Topographical data of well sites indicated (low relief) with a slope <1-2%. Isolated areas increase to 3% to 5%. Value of 1 adopted as worst case scenario.	
• more than 5% but not more than 10% • [10% = 10H:1V]	2		
• more than 10% but not more than 15% [15% = 6.7H:1V]	4		
• more than 15%	6		
SOIL CLASSIFICATION GROUP (AS1726) [2]			
• GW, GP, GM, GC	0	2	-
• SW, SP, OL, OH	1	Comment – Initial soil testing during the baseline survey indicated SM - Silty sands, poorly graded sand-silt mixtures (refer EMP).	
• SM, SC, MH, CH	2		
• ML, CL, or if imported fill is used, or if soils are untested	3		
EMERSON (DISPERSION) CLASS NUMBER [3]			
• Class 4, 6, 7, or 8	0	4	6
• Class 5	2	Comment – Class 3 – Specific testing for Emerson Class not conducted. Therefore, default value used.	
• Class 3, (default value if soils are untested)	4		
• Class 1 or 2	6		
DURATION OF SOIL DISTURBANCE [4]			
• not more than 1 month	0	2	6
• more than 1 month but not more than 4 months	2	Comment – Line preparation to rehabilitation will be less than 1-month duration, however worst-case allowance used.	
• more than 4 months but not more than 6 months	4		
• more than 6 months	6		
AREA OF DISTURBANCE [5]			
• not more than 1000 m^2	0	1	6
• more than 1,000 m^2 but not more than 5,000 m^2	1	Comment – Due to the tread lightly approach of the line preparation using	

Condition (as described by IECA, 2008)	Points	Score	Trigger value
		Seismic Survey Areas	
• more than 5,000 m^2 but not more than 1 ha	2	existing tracks and minimising tree and shrub clearing and the re-instatement of topsoil and vegetation as soon as possible after acquisition, results in no more than 5,000 m^2 assessed at any one time.	
• more than 1 ha but not more than 4 ha	4		
• more than 4 ha	6		
WATERWAY DISTURBANCE [6]			
• No disturbance to a watercourse, open drain or channel	0	2	2
• Involves disturbance to a constructed open drain or channel	1	Comment – Activities require crossing of some minor drainage lines (i.e intermittent stream 1 and 2). Not considered to be major works and will be re-instated as completion of acquisition. Also noted that majority of drainage crossings would be avoided for seismic program or would use a tread lightly approach such as on foot resulting in no disturbance.	
• Involves disturbance to a natural watercourse	2		
REHABILITATION METHOD [7] Percentage of area (relative to total disturbance) revegetated by seeding without light mulching (i.e. worst-case revegetation method).			
• not more than 1%	1	1	-
• more than 1% but not more than 5%	2	Comment – Topsoil and vegetated material to be replaced over disturbance within 2 weeks post activity for natural regeneration.	
• more than 5% but not more than 10%	3		
• more than 10%	4		
RECEIVING WATERS [8]			
• Saline waters only	0	N/A	-
• Freshwater body (e.g. creek or freshwater lake or river)	2	Comment – not applicable because freshwater bodies are ephemeral drainage lines only, with no flowing water at time of acquisition (dry season acquisition).	
SUBSOIL EXPOSURE [9]			
• No subsoil exposure except of service trenches	0	0	-
• Subsoils are likely to be exposed	2		
EXTERNAL CATCHMENTS [10]			
• No external catchment	0	0	-
• External catchment diverted around the soil disturbance	1	Comment – Not considered applicable based on the activities being completed	

Condition (as described by IECA, 2008)	Points	Score	Trigger value
		Seismic Survey Areas	
• External catchment not diverted around the soil disturbance	2	are temporary seismic lines.	
ROAD CONSTRUCTION [11]			
• No road construction	0	0	-
• Involves road construction works	2	Comment – only temporary seismic lines required. No construction of new tracks is necessary. Existing pastoral tracks to be treated post activity.	
pH OF SOILS TO BE REVEGETATED [12]			
• more than pH 5.5 but less than pH 8	0	0	-
• other pH values, or if soils are untested	1	**Comment –** Majority soils recorded within Soil pH range 5.5-8 across exploration area. Some areas recorded outside range but considered minimal risk to seismic program.	
Total Score [13]		**13**	
For guidance purposes only: [13] A primary ESCP must be submitted to the local government for approval during the planning phase for any development that obtains a total point score of 17 or greater or when any trigger value is scored or exceeded.			

The erosion hazard assessment for the Tamboran permit areas, all report equal to, or just below the point score of 17. Based on the trigger value being met the ESCP is required for majority of Tamboran's activities.

5.2 Soil Loss Estimate

IECA (2008) soil loss estimation has been used to determine the type of controls the project should adopt to limit soil loss during construction when soils are exposed to rainfall. Long term average soil loss resulting from sheet and rill flow can be predicted using the Revised Universal Soil Loss Equation (RUSLE).

Soil loss calculated using RUSLE for the project area was calculated as follows:

$$A = R K LS C P$$

Where A = annual soil loss due to erosion [tonnes/hectare/year (t/ha/yr)]

R = rainfall erosivity factor based on = 6297)

K = soil erodibility factor of 0.055 for silt loam)

LS = topographic factor derived from slope length and slope gradient (0.24)

C = cover and management factor (1)

P = erosion control practice factor (1.3)

It is noted that the annual R-factor of 6297 for the Katherine region has been adopted as per comment received by DLPE Land Management Team. Since preparation of the initial ESCP, additional geotechnical information has been obtained which provides a larger sample size of the proposed permit areas.

The geotechnical sampling completed on the sites is as provided in Table 8. As such, the K-factor has been determined from Table E4 of the IECA Guidelines.

Revision of the LS-factor on more detailed design drawings shows a total slope length of approx. 200 m at a gradient of 0.00120 m/m (0.12%), indicative of the gradients across both sites. A LS factor of 0.24 was adopted, indicating a 200 m slope at 0.01 m/m (1%) for sites on the Amungee delineation, Kalala, Kyalla, Velkerri and Beetaloo. The slopes based on the contour information at hand for the Shenandoah South 2, South B, South C, North A (and option 2) are provided in Table 8.

Based on the reviewed RUSLE soil loss methodology, the Annual Soil Loss estimate using these values is 33 t/ha/yr – 204 t/ha/yr. A combination of Type 3, Type 2 and Type 1 sediment controls will be required based on the RUSLE equation.

All the proposed activities for the exploration program are planned during the dry season (May to September) when the erosion risk rating for rainfall is very low (refer to Table 2 and Table 3). Where activities occur in the wet season, Tamboran's wet weather contingency plan will be implemented (refer Table 12).

Table 8: RUSLE value and factors

Site	R	K Factor	Slope %	LS	C	P	A (t/ha/yr)
Amungee Delineation	6297	0.055	1	0.24	1	1.3	108
Kalala	6297	0.055	1	0.24	1	1.3	108
Kyalla	6297	0.055	1	0.24	1	1.3	108
Velkerri	6297	0.055	1	0.24	1	1.3	108
Beetaloo	6297	0.055	1	0.24	1	1.3	108
Shenandoah S A	6297	0.043	0.5 – 1.0	0.24	1	1.3	84
Shenandoah S B	6297	0.043	0.3 – 0.5	0.24	1	1.3	84
Shenandoah S C	6297	0.017	0.3 – 0.5	0.24	1	1.3	33
Shenandoah S2	6297	0.055	1	0.24	1	1.3	108
Shenandoah N A	6297	0.025	1.5 – 2.0	0.58	1	1.3	204
Shenandoah N A (option 2)	6297	0.025	1.5 – 2.0	0.58	1	1.3	204

5.3 Erosion Risk and Determination of ESC

Erosion risk ratings for the Project area have been determined based on the average monthly erosivity (R-factor of 6297), average monthly rainfall depth (mm) (refer Table 2 and Table 3 above) and soil loss (estimated at between 108t/ha/yr and 204t/ha/yr). As indicated in Table 9, the Project has an erosion risk rating of "very low" to "low".

Table 9: Erosion risk rating (adapted from IECA, 2008, Tables 4.4.1, 4.4.2 and 4.4.3)

Erosion Risk Rating	Average Monthly Erosivity (R-Factor)	Average Monthly Rainfall Depth (mm)	Soil Loss (t/ha/yr)
Very Low	0 to 60	0 to 30*	0 to 150
Low	60+ to 100	30+ to 45	150+ to 225

Erosion Risk Rating	Average Monthly Erosivity (R-Factor)	Average Monthly Rainfall Depth (mm)	Soil Loss (t/ha/yr)
Moderate	100+ to 285	45+ to 100	225+ to 500
High	285+ to 1,500	100+ to 225	500+ to 1,500
Extreme	>1,500*	>225	>1,500

* It is noted that the monthly erosivity factor would only be triggered during rainfall events. The construction period is proposed to occur from July to October and based on assessment of the average monthly rainfall for the region (refer Table 2 and Table 3), the erosion risk rating is considered very low (0 to 30 mm during this time). It is anticipated that at completion of construction the site would be stabilised for normal operation.

Table 10 provides an indication of the "Type" of erosion and sediment controls that should be deployed during construction depending on annual soil loss. Based on the proposed construction schedule during the dry season, the project is determined to trigger the use of Type 3, Type 2and Type 1 erosion and sediment controls, based on the soil loss rate for the site in question. Refer to the results in Table 8 for the soil loss calculations and compare to Table 10, for the type of soil loss controls required.

Table 10: Sediment control standard (adapted from IECA 2008, Table 4.5.1)

Catchment Area (m^2)	Soil Loss Rate Limit (t/ha/yr)		
	Type 1	Type 2	Type 3
250	N/A	N/A	All Cases
1000	N/A	N/A	All Cases
2500	N/A	>75	75
>2500	>150	150	75

Table 11 provides a range of erosion and sediment controls that can be deployed on the project for each 'Erosion and Sediment Control Type'.

Table 11: Classifications of sediment controls

Type 1	Type 2	Type 3
Sheet flow		
Buffer zone capable of infiltrating 100% of stormwater runoff or processed water Infiltration basin or sand filter bed capable of infiltration of 100% of flow	Buffer zone capable of infiltrating 100% of stormwater runoff Compost / mulch berm	Buffer Zone capable of infiltrating 100% of stormwater runoff Filter fence Modular sediment trap Sediment fence
Concentrated flow		
Sediment basin (sized in accordance with design standard)	Sediment basin (smaller than the design standard) Filter tube dam Rock filter dam Sediment trench Sediment weir	Coarse sediment trap Modular sediment trap U-shaped sediment trap
Dewatering sediment control		

Type 1	Type 2	Type 3
Type F/D Sediment Basin Stilling Pond	Filter bag or filter tube filter pond Filter tube dam Portable sediment tank Settling pond Sump pit	Compost berm Filter fence Grass filter bed Hydro cyclone Portable sediment tank Sediment fence
In-stream sediment control		
Pump sediment laden water to an off-stream type F/D sediment basin or high filtration system	Filter tube barrier Modular sediment barrier Rock filter dam Sediment weir	Modular sediment barrier Sediment filter cage

The site specific ESCP drawings are provided in Appendix E to Appendix M.

Standard drawings that may be applicable for the Project, including controls for access tracks and stream crossings are provided in Appendix N. The final design of the ESC controls will be dependent on decisions made in the field by the Supervising Engineer and site conditions. Any significant changes to those identified in this ESCP will be reported through to DLPE Land Management Team for review and approval. Tamboran and its civil contractors will be responsible for notifying of any changes.

Standard drawings for erosion and sediment controls are available at: http://www.austieca.com.au/publications/book-6-standard-drawings.

5.3.1 Modifying the ESC Measures

It is possible that some ESC measures will require modification as the project is constructed and in response to the performance of ESC measures or changes in project circumstances. The modifications may be considered minor, moderate or significant. Moderate and minor changes will occur, and it is expected that significant modifications will be the exception. If significant erosion events occur, significant changes to the measures used will be required and should be approved by a CPESC or suitably qualified consulting engineer.

To accommodate the range of circumstances likely to occur, a change management decision matrix is presented in Table 12. Where changes are required, these will be risked assessed through a change management process and kept in a change management register.

Table 12: Change management decision matrix

Authority required	Minor	Moderate		Significant
	Maintenance of all measures	Removal or relocation of minor temporary controls	Permanent measure relocation	Permanent measure removal/revisions to ESCP
Tamboran onsite company rep	✓	×	×	×
Site supervisor	-	✓	×	×
CPESC	-	-	✓	✓
Consulting engineer	-	-	✓	✓

✓ Authorised to undertake
× Not authorised to undertake
- Denotes that authority level is not required

Examples of different types of sediment controls can be seen in Table 7. Examples of minor temporary controls would fall under Type 3 sediment controls while Type 2 and Type 1 sediment controls provide examples of permanent measures.

It is noted that minor and permanent are not indications of how long the sediment controls are in place. At completion of the activities, the disturbed areas to be restored and/or rehabilitated to pre-disturbed conditions consistent with the surrounding land use.

If ESC measures are observed to be ineffective (e.g. obvious sediment deposition has occurred, or is occurring in a waterway), the source of the sediment must be identified, and corrective ESC measures implemented.

6 Erosion and Sediment Controls

6.1 Well Exploration Areas

Based on the erosion susceptibility of the exploration area, the ESCP measures to be adopted for the exploration programs are summarised in Table 13. These ESCP measures have been considered during the design of the exploration well pads and associated infrastructures, inclusive of the SPCF, and will be implemented by the Tamboran contractors during the construction and maintenance activities.

Table 13: Measures to be implemented for erosion and sediment control – well exploration areas

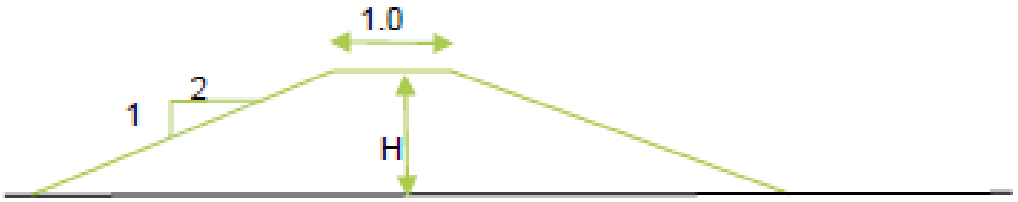
Activity	Management controls
Land clearing	• Undertake selective clearing (only clearing areas that are necessary for construction and ESC activities), using lighter machinery such as graders or smaller bulldozers, taking care not to overwork the site. Overworking the site can lead to the loss of topsoil, compaction, formation of windrows and wheel rutting. • Minimise tree clearing activities only during the dry season (May to September) to allow the ground surface to stabilise before the onset of the wet season (October to April). • Retain vegetation buffers surrounding streams and creeks, as outlined in the *NTG Land Clearing Guidelines 2021*. • Undertake clearing for each stage in small units over time, keeping the disturbed areas small and time of exposure short, in conjunction with progressive re-vegetation (assisted natural regeneration using available topsoil). • Take all reasonable and practicable measures to minimise the removal of, or disturbance to, trees, shrubs and ground covers (organic or inorganic) that are to be retained. • If bulk tree clearing is required, it must occur in a manner that minimises disturbance to existing ground cover (organic or inorganic). • Bulk tree clearing and grubbing of the site must be immediately followed by specified temporary stabilisation measures (e.g. gravel, soil berm) prior to commencement of each stage of construction works. • Land clearing should not occur unless preceded by the installation of appropriate drainage and sediment control measures. The exception would be any land clearing necessary to allow installation of these control measures. Prior to land clearing, establish tree protection zones around vegetation to be retained e.g. identify with high-visibility tape, or light fencing. • All land clearing must be in accordance with the Federal, Territory and local government vegetation clearing requirements and IECA Table 4.4.7 Best practice land clearing and rehabilitation requirements. • All reasonable and practicable steps to be taken to apply best practice Erosion control measures following earthworks and site stabilised prior to anticipated rainfall. Disturbed areas will be stabilised with a minimum 60% cover within 30 days of completion.

Activity	Management controls

Access tracks	• Where possible, use existing roads and tracks to access the well sites, and where new tracks are required, they should be located along the most direct and practicable route to the well site (noting Velkerri 76 S1 access track has been diverted around the sensitive Bullwaddy/Lancewood vegetation type).
	• Trucks entering and exiting the site will be constrained in such a manner to prevent dropping or tracking material on the Highway in accordance with the Road Agency Approval (ref 2018-0186-D2).
	• Monitor Stuart Highway during construction and operation. Where tracked material on the road pavement becomes a potential safety issue, Tamboran and its contractors will sweep and clean material off the road. If Stuart Highway turn-in results in dust, dirt creating hazard to road users, additional ESC will be considered including installation of shaker grid or rock pad.
	• Minimise track width and surface disturbance (e.g. topsoil, seed and root stock) as far as practicable to allow safe passage of required equipment.
	• Disturbed areas will be stabilised with a minimum 60% cover 30 days of completion if rainfall possible.
	• Where gravelling is warranted (Stuart Highway and Carpentaria Turn-in), the formation process can remove undesirable material and/or box the imported material where it is required. Track formation will be required for the following reasons:
	  • Drainage control, especially in areas where erosion or sediment influences are evident, any vegetation, topography, wheel rutting or
	  • compaction is likely to intercept, concentrate and channel water.
	  • Where the topography of the track location or the drainage characteristics of the soil are likely to hinder access for a protracted time period following rain (e.g. 1 to 2 weeks).
	  • Where natural side-slope poses a safety hazard to potential users of the track (e.g. contractors, landowners).
	• Place scrub and vegetation cleared from the route adjacent to the route where practical to facilitate its return to the disturbed area. Where this occurs, spread the material out rather than form windrows. Allow disturbed areas to be stabilised and natural regeneration of the native grasses to occur.
	• Construct access tracks with table drains that are free draining.
	• Avoid road crowning to allow water to naturally cross the road.
	• Form tracks to allow off-road drainage. Where track intercepts the direction of overland flow and re-directs this flow to a non-natural drainage line, install erosion control works to minimise potential erosion.
	• The design and position of erosion control measures to be determined in the field by experienced operator and site engineer, based on the site characteristics of the access track location.
	• Where construction of table drains are deemed necessary, they should have a broad flat base at least 1 m wide and should not be graded to produce a ‘V’ shape. To minimise erosion, the slope should be no greater than 0.5% on erodible soils or 1% on stable soils.

Activity	Management controls
	• Where encounter dispersive / erosive soils they should be stabilised with gypsum or other stabiliser, as determined by laboratory analysis of soils. • Where cut-out drains are required, they should be spaced based on the slope of the area i.e. 0.5% slope, allow for cut-out draining every 170-180 m or 1 % slope, allow for cut-out drainage every 120-130 m etc. (refer to NT Road Drainage Fact Sheet). It is noted that the recommended distance between turn-out drains is a guide and may not apply to all locations along the access track. • Monitor road conditions to ensure deterioration does not occur. Assist in the maintenance and repair work on roads and tracks used. • Following completion of activities and within 2 years after the surrender of a lease, the land surrounding or affected by the installation of access tracks shall be restored in accordance with the site-specific rehabilitation plan and final determination of asset (i.e. if transferring asset ownership to landholder).
Placement of gathering lines along access tracks	• Placement and installation of gathering lines in accordance with the Upstream Polyethylene Gathering Networks – CSG Industry Code of Practice (Version 5.0 August 2019) and Appendix P - Land-based pipeline construction (IECA, December 2015). • Route selection of gathering lines should consider the location of start and end points, well locations and access requirements, hydraulic requirements based on topography, existing services and infrastructure, and current and future land use. • Gathering line route to be selected such that the pipe can be installed, tested, and operated safely and practically. • Gathering line to be placed above ground within the access track corridor (but not within the trafficable area), minimising the need for additional vegetation clearing where possible. Topsoil to be removed to allow gathering line to be placed directly on the subsoil layer to minimise soil disbursement. • Extra protection of gathering line to be provided where necessary, particularly to prevent damage from conditions such as traffic and cattle movement and at stream and river crossings (where applicable). • Allow for trafficable cross banks where gathering line crosses the access tracks. No other area of the gathering line to be trafficable. • Where gathering line intersects an overland flow path, allow for sheet flow to pass to avoid concentrated flow resulting in scouring. • Install sediment controls such as fibre rolls or mulch berms along line to control velocity and capture minor sediment. • Avoid rocky areas and steep slopes and side slopes if possible. • Align gathering line straight up and down slopes. • Contents of pipes to be clearly labelled based on Table 3.3.1 Colour Specification (i.e. yellow for gas, produced formation water purple, etc.). • Fire protection measures to be employed by reducing fuel loads by up to 5 m either side of the gathering line. • Regularly inspect, monitor and maintain ESC measures.

Activity	Management controls

Pad construction / maintenance	• Pad construction to be in accordance with the typical ESCP (refer **Appendix E**). The topsoil berm dimension to be in accordance with the IECA Figure 1 Standard Drawing MB-01 presented in **Appendix N**.
	  • Use topsoil berms to divert upstream runoff from undisturbed areas ('clean' water) around and away from disturbed areas, and back to the environment.
	  • Topsoil bunds are to be formed to the profile provided in the sketch below. Bund height (H) is specified on the drawings.
	  • Where topsoil bunds are to be utilised for wastewater storage spill containment, topsoil bunds are to be formed to the profile provided in the sketch below. Bund height shall consider the well pad slope and volume of wastewater stored onsite. The typical, low point bund height is specified on the drawings, assuming a 0.2% storage area fall.
	 
	
	  • Topsoil to be compacted to 95% mmdd.
	  • Use topsoil berms to contain / manage runoff from disturbed construction areas ('dirty' water) and prevent release to environment without treatment.
	  • Treat runoff from construction areas through suitable sediment controls (e.g. sediment traps).
	  • Configure berms so that upstream runoff does not mix with construction area runoff prior to treatment of construction area runoff.
	• Where topsoil stripping is required, the stripping depth would be in accordance with Technical Instruction (NT-2050-15-TI-0001) and amelioration rates agreed with the Construction Supervisor, Tamboran engineers and by a suitably qualified ESC practitioner. It is noted that the expected nominal depth of topsoil across the well pads at locations ranges from <100 mm to 150 mm. Final strip depth will be confirmed in the field. Any changes to the adopted ESCs will be reflected in the ESCP and to satisfaction of DLPE.
	• Stockpiled felled trees nearby for future use in rehabilitation.
	• Inspect on a regular basis in accordance with Section 5 Maintenance.
	• Damage or maintenance is undertaken by an appropriately qualified person i.e. contractor / Tamboran.
	• Following completion of activities and within 2 years after the surrender of a lease, the land surrounding or affected by the exploration wells

Activity	Management controls
	shall be restored in accordance with the site-specific rehabilitation plan and final determination of asset (i.e. if transferring asset ownership to landholder).
Stream and creek crossings	Where a crossing is required to be upgraded, a bed level crossing as detailed in **Appendix L**, will be installed in accordance with the following: • Crossings will be aligned perpendicular to the water flow. • Crossing will be constructed from clean rocks (minimal fine material) that are an equivalent or larger size than the natural bed material at the crossing. • The surface is to be left rough and not to be over compacted (e.g. track-rolled finish or rougher). • The lowest point of the bed level crossing will be installed at the level of the lowest point of the natural stream bed (preconstruction), within the footprint of the proposed crossing. • There must be a height difference of at least 100 mm up to ≤ 300 mm from the lowest point of the crossing to the edges of the low flow section of the crossing. Where scour protection is required: • Scour protection must abut the surface edge of the crossing at the same level (this is to ensure that there is no drop in elevation at the join). • If the crossing is set below bed level then the surface of the scour protection must also be below bed level. • The stream bed must abut the scour protection at the same level (this is to ensure that there is no drop in elevation at the join). • The scour protection is installed at a gradient no steeper than 1 in 20 or the natural channel gradient, whichever is steeper. • Scour protection must incorporate a low flow channel. Use clean rocks (minimal fine material), at least 100 mm diameter. • Ensure the rock armouring is not over compacted but left at the same level and uneven (track-rolled finish or rougher). • Use clean rocks (minimal fine material), at least 100 mm diameter. • The retention of vegetation buffers, as outlined in the NTG Land Clearing Guidelines 2019, as they relate to stream order has been considered for the siting of proposed access tracks and pads. • Site specific progressive ECPs should be approved by DLPE prior to any disturbance. • Should activities pushout to the wet season, the DLPE to be reviewed and updated for wet season conditions. The revision to be reviewed and approved by DLPE during September to allow implementation of the plan prior to the onset of the wet season. Wet season ESCP to be implemented between 1 October to 30 April.
Soil and stockpile management	• Stockpile existing topsoil, where available, so that it can be reused on the site for ESC and future rehabilitation at completion of project. • Stockpiles of erodible material that has the potential to cause environmental harm if displaced, must be:

Activity	Management controls
	• Appropriately protected from wind, rain, concentrated surface flow and excessive up-slope stormwater surface flows. • Located at least 2m from any hazardous area or retained vegetation. • Located up-slope of an appropriate sediment control system. • Provided with an appropriate protective cover (synthetic or vegetative) if the materials are likely to be stockpiled for more than 28 days. • Provided with an appropriate protective cover (synthetic or vegetative) if the materials are likely to be stockpiled for more than 10 days during those months that have an erosion risk rating higher than medium. • A suitable flow diversion system must be established immediately up-slope of a stockpile of erodible material that has the potential to cause. • environmental harm if displaced, if the up-slope catchment area draining to the stockpile exceeds 1,500m^2. • Avoid creating windrows. Do not create windrows across creeks, use rollers when putting in tracks in preference to dozers, or walk the dozer with the blade raised off the ground.
Site management	• All disturbed areas identified as very low, low, medium or high erosion risk must be suitably stabilised prior to anticipated rainfall, from the day that soil disturbances on the area have been finalised- IECA Table 4.4.7. • Tracks to be regularly inspected for early signs of compaction, erosion and soil degradation (generation of bulldust). Ongoing maintenance and repair work should be implemented as required on tracks. • No off-lease or off-road driving. • The construction schedule must aim to minimise the duration that any and all areas of soil are exposed to the erosive effects of wind, rain and surface water flow. • Land-disturbing activities must: • allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities. • minimise soil erosion resulting from rain, water flow and/or wind. • minimise adverse effects of sediment runoff, including safety issues. • prevent, or at least minimise, environmental harm resulting from work-related soil erosion and sediment runoff. • ensure that the value and use of land/properties adjacent to the site (including access roads) are not diminished as a result of the adopted ESC measures. • Additional and/or alternative ESC measures must be implemented in the event that unacceptable off-site sedimentation is occurring as a result of the work activities. • Sediment deposited off the site as a direct result of an on-site activity, must be collected and the area appropriately rehabilitated as soon as reasonable and practicable, and in a manner that gives appropriate consideration to the safety and environmental risks associated with the

Activity	Management controls
	sediment deposition.
Drainage control	• Where reasonable and practicable, stormwater runoff entering the site, must be diverted around or through the area in a manner that minimises soil erosion and the contamination of water for all discharges. • All reasonable and practicable measures must be implemented to control flow velocities a manner that prevents soil erosion along drainage paths and at the entrance and exit of all drains and drainage pipes during storms up to the relevant design storm discharge.

Erosion control	• If synthetic reinforced erosion control mats or blankets are required, they must not be placed in, or adjacent to, riparian zones and watercourses if such materials are likely to cause environmental harm to wildlife or wildlife habitats.
	• A minimum 60% ground cover must be achieved on all non-completed earthworks exposed to accelerated soil erosion. If further construction activities or soil disturbances are likely to be suspended for more than 30 days during months when the expected rainfall erosivity is less than 60;
	  • minimum 70% cover within 30 days if between 60 and 100;
	  • minimum 70% cover within 20 days if between 100 and 285;
	  • minimum 80% cover within 10 days if between 285 and 1,500; and
	  • minimum 95% cover within 5 days if greater than 1,500.

Sediment control	• Optimum benefit must be made of every opportunity to trap sediment within the work site, and as close as practicable to its source. • Sediment pond to be installed and operated to both collect and retain sediment (refer to Drawing NT-2050-15-MP-0021 and NT-2050-15-MP-022 in Appendix E). Design details of the sediment pond is provided in NT-2050-20-DD-0030. • All reasonable and practicable measures must be taken to prevent, or at least minimise, the release of sediment from the site (section 7.5). • Sediment control devices must be de-silted and made fully operational as soon as reasonable and practicable after a sediment-producing event if the device's sediment retention capacity falls below 75% of its design retention capacity. • Materials removed from sediment control devices must be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.
Wet weather contingency	• 7-day forecast from the Bureau of Meteorology (BOM) to be monitored and the civil and water bore construction activities planned around the forecasts. • Where forecasts indicate rainfall is likely to result in an event that has potential to limit access to the work area, the civil and water bore contractor will stabilise the current work areas and go into standby mode until such time they can assess the track condition after an event to recommence activities. • Emergency response – a post-rainfall/flood damage reconnaissance and assessment will be undertaken as soon as the area becomes

Activity	Management controls
	accessible. Any damage observed would be repaired as soon as practicable after the event and ensure the controls and measures are in place prior to the next rainfall event.
Site rehabilitation	• Following completion of works, disturbed areas are to be restored and/or rehabilitated. • Gravel pits to have topsoil returned and re-profiled. • All compacted areas will be ripped and scarified to promote regeneration of vegetation; this may require assistance through spread of native seed stock. • All disturbed areas will be allowed to naturally regenerate or be revegetated on completion of use. • Compacted areas will be contour ripped to 0.5m depth where practicable. • At completion of activities, establish vegetation similar to adjacent vegetation, unless agreement with landowner for alternative use. • Remove and appropriately dispose of all synthetic erosion and sediment control materials. • All disturbed areas identified as very low, low, medium or high erosion risk must be suitably stabilised prior to anticipated rainfall, from the day that soil disturbances on the area have been finalised- IECA Table 4.4.7. • Stabilise disturbed areas quickly to reduce the potential for erosion. Methods of stabilisation will be site specific and based, in part, on laboratory analysis of soils for erosive and dispersive characteristics. • Previously removed vegetation and topsoil will be uniformly re-spread over disturbed area to assist with rehabilitation process through agencies of increased infiltration and return of seed-bearing topsoil. If required, additional native seed mix from the area could be respread to speed up rehabilitation process. • Windrows of debris that cannot be removed should be aligned down the contour or in a manner appropriate to avoid channeling and concentrating runoff. All other windrows are to be removed as soon as practicable. • The type of ground cover applied to completed earthworks is compatible with the anticipated long-term land use, environmental risk, and site rehabilitation measures.

6.2 2D and 3D Seismic Activities

Based on the erosion susceptibility of the exploration areas, the ESCP measures to be adopted for the 2D and 3D seismic exploration programs are summarised in Table 14 below. These ESCP measures have been considered during the design of the seismic program and will be implemented by the Tamboran contractors during the construction and maintenance activities.

Table 14: Measures to be implemented for erosion and sediment control – seismic survey areas

Activity	Management controls
Vegetation clearing	• Undertake selective clearing (only clearing areas that are necessary for surveying lines), using lighter machinery such as graders or smaller bulldozers, taking care not to overwork tracks. Overworking the site can lead to the loss of topsoil, compaction, formation of windrows and wheel rutting. Refer to the first dot point in the seismic line preparation and access track and camp establishment/maintenance section below. • Ground surface to be stabilised before the onset of the wet season (November to March). • Undertake clearing for each stage in small units over time, keeping the disturbed areas small and exposure time short, in conjunction with progressive re- vegetation (assisted natural regeneration using available topsoil and removed vegetation). • Take all reasonable and practicable measures to minimise the removal of, or disturbance to, trees, shrubs and ground covers (organic or inorganic) that are to be retained. • All vegetation clearing must be in accordance with the Federal, Territory and local government vegetation clearing requirements and IECA Table 4.4.7 Best practice land clearing and rehabilitation requirements detailed Appendix O. • Best practice erosion control measures will be implemented in accordance with the ESCP following earthworks and site stabilised prior to anticipated rainfall. • Disturbed areas will be stabilised in accordance with the Rehabilitation Management Plan, as per Section 7.4.

<table>
<tr><th>Activity</th><th>Management controls</th></tr>
<tr><td>Creek and Drainage Line Crossings</td><td>Minimise disturbance in the buffers in accordance with the stream order of the encountered drainage line in accordance with the buffers provided below:
<table>
<tr><th>Class</th><th>Stream order</th><th>Minimum buffer width (m)</th><th>Measured from</th></tr>
<tr><td>Drainage depression</td><td>Not applicable</td><td>25</td><td>The outer edge of the drainage depression, which is the extent of the associated poorly drained soils and associated vegetation.</td></tr>
<tr><td>Intermittent streams</td><td>First</td><td>25</td><td>The outer edge of the riparian vegetation or levee (whichever is greater).
If braided channels are present, the edge of the outer most stream channel</td></tr>
<tr><td>Intermittent streams</td><td>Second</td><td>50</td><td>As above</td></tr>
<tr><td>Creeks</td><td>Third and fourth</td><td>100</td><td>As above</td></tr>
<tr><td>Rivers</td><td>Fifth and higher</td><td>250</td><td>As above</td></tr>
</table>

No additional material will be used for the seismic acquisition to cross over the creek crossing. Existing crossings will not be altered.
The activities shall be completed in a manner that does not cause a:

material change to the shape of a waterway,
material change to the volume, speed or direction of flow or likely flow of water in or into a waterway, or
alteration to the stability of the bed or banks of a waterway, including by removal of vegetation.

Ongoing monitoring of creek and drainage crossing condition prior to, during and at completion of rehabilitation.
Reinstate the original topography of the creek or drainage bed following seismic acquisition.
</td></tr>
<tr><td>Seismic line preparation</td><td>
The method for line preparation described in the EMP is to use existing pastoral station tracks wherever practicable, or minimise the complete removal of the vegetation, with vehicles to traverse over or around the vegetation instead, leaving as much intact as possible. Assessment of the survey area indicates that in the order of 80 to 90% of the undisturbed areas will be traversed as a blade up exercise.
Minimising vegetation and soil disturbance is the default position for the seismic program. Wherever possible vegetation and soil shall not
</td></tr>
</table>

Activity	Management controls
	be disturbed when establishing survey lines (i.e. blade up). If disturbance is required, establishment of survey lines which will form a runoff channel is to be avoided. • Seismic vehicles that enter and exit the site will be constrained in such a manner to prevent dropping or tracking material on the Highway in accordance with the Road Agency Approval. • Place scrub and vegetation cleared from the route adjacent to the route where practical to facilitate its return to the disturbed area. Where this occurs, spread the material out rather than form windrows. Allow disturbed areas to be stabilised and natural regeneration of the native grasses to occur.

Site management	• All plant and equipment brought to site is to be certified a "free" of weeds, soil pathogens and pests.
	• All disturbed areas identified as very low, low, medium or high erosion risk must be suitably stabilised prior to anticipated rainfall, from the day that soil disturbances on the area have been finalised - IECA Table 4.4.7 in Appendix O.
	• Land-disturbing activities must:
	  • Allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities. Where this cannot be achieved, reference should be made to installing controls as detailed in the following section.
	  • Minimise soil erosion resulting from rain, water flow and/or wind.
	  • Minimise adverse effects of sediment runoff, including safety issues.
	  • Prevent, or at least minimise, environmental harm resulting from work-related soil erosion and sediment runoff.
	  • Ensure that the value and use of land/properties adjacent to the site (including access roads) are not diminished as a result of the adopted ESC measures.
	• Additional and/or alternative ESC measures must be implemented in the event that unacceptable off-site sedimentation is occurring as a result of the work activities.
	• Sediment deposited off the site as a direct result of an on-site activity, must be collected and the area appropriately rehabilitated as soon as reasonable and practicable, and in a manner that considers the safety and environmental risks associated with the sediment deposition.

Wet weather contingency	• Wet season contingency planning to be conducted where activities extend into the wet season. • 7-day forecast from the Bureau of Meteorology (BOM) to be monitored and the seismic exploration activities planned around the forecasts. • Where forecasts indicate rainfall is likely to result in an event that has potential to limit access to the work area, the seismic contractor will stabilise the current work areas and go into standby mode until such time they can assess the track condition after an event to recommence activities. • Emergency response - a post-rainfall/flood damage reconnaissance and assessment will be undertaken as soon as area becomes accessible.

Activity	Management controls
	• Any damage observed would be repaired as soon as practicable after the event.
Site rehabilitation	• Within 2 weeks of the activities being completed, disturbed areas are to be restored and/or rehabilitated. Reference should be made to Tamboran's Rehabilitation Management Plans. • All compacted areas will be ripped and scarified to promote regeneration of vegetation. • All disturbed areas will be allowed to naturally regenerate or be revegetated on completion of use. • At completion of activities, establish vegetation to the standard of that registered in the pre-assessment, or better. • All disturbed areas identified as very low, low, medium or high erosion risk must be suitably stabilised prior to anticipated rainfall, from the day that soil disturbances on the area have been finalized as per the requirements of IECA Table 4.4.7 (Appendix O). • Stabilise disturbed areas quickly to reduce the potential for erosion. • Previously removed vegetation and topsoil will be uniformly re-spread over disturbed area to assist with rehabilitation process through agencies of increased infiltration and return of seed-bearing topsoil. If required, additional native seed mix from the area could be respread to speed up rehabilitation process. This will be confirmed during rehabilitation monitoring activities. • This will be confirmed during rehabilitation monitoring activities. • Windrows to be removed as soon as practicable. • The type of ground cover applied to completed earthworks is compatible with the anticipated long-term land use, environmental risk, and site rehabilitation measures. • At completion, the disturbed areas are to be restored and/or rehabilitated to original pre-disturbed condition consistent with surrounding land use. • Remove and appropriately dispose of all synthetic erosion and sediment control materials.

6.3 ESC Treatment Options for Specific Situations

Appendix N to Appendix P contain typical erosion and sediment control measures that are to be applied throughout the project when required. Treatments are identified for specific situations and should be applied appropriately. Five different seismic line treatments are identified below.

- Blade up areas where only wheel tracks will develop – no treatments required.
- Surface bladed by grader to smooth out ground surface to allow vehicle movements. No tree removal. Topsoil will be bladed off by grader and windrowed for later respreading at completion of data recording, to preserve the soil structure. Whoa boys or roll over banks to be provided as per details in Appendix P.
    - At the conclusion of activities, or as part of progressive rehabilitation, or the anticipated onset of a significant rainfall event which will require the site to be abandoned, topsoil would be respread and ripped into the soil surface.
    - Works on grade (>2%)– Surface bladed by grader to smooth out ground surface to allow vehicle movements. No tree removal. Topsoil will be bladed off by grader and windrowed for later respreading at completion of data recording, to preserve the soil structure. Whoa boys or roll over banks to be provided as per details in Appendix P.
    - At the conclusion of activities, or as part of progressive rehabilitation, or the anticipated onset of a significant rainfall event which will require the site to be abandoned, topsoil would be respread and ripped into the soil surface.
- Wooded communities e.g. Lancewood/Bullwaddy – For most of the program wherever practical, activities should be planned to avoid impacts to Lancewood and Bullwaddy vegetation communities. Where this is not possible, the vegetation community would require measures as follows:
    - A survey line of 3.5 to 5 m maximum cleared by the dozer avoiding trees where possible, but selective clearing if required. Felled trees to be pushed to the nearby bushland to enable vehicle access through the site, but reinstated post survey.
    - Following clearing the topsoil bladed off by grader and windrowed for later respreading with the vegetated material at completion of data recording.
    - The line preparation will require blading to a sufficient depth, no greater than 150 mm, to enable the safe access of the vehicles where required. The purpose of the blading is to reduce the risk of tyre puncture from the Lancewood which is known to snap off at ground level leaving a spike protruding.
    - Whoa boys or roll over banks to be provided as per detail in Appendix P.
    - At the conclusion of activities, or as part of progressive rehabilitation, or the anticipated onset of a significant rainfall event which will require the site to be abandoned, topsoil would be respread at a thickness of 150 mm and ripped into the soil surface.
    - Felled vegetation will be evenly spread over the top soiled area to provide additional protection against erosion.
- Seasonally inundated areas - Similar to the wooded communities described above, high clay content soils (vertosols) are also found in seasonally inundated areas (i.e. wetlands/floodplains). Unlike the wooded areas these clays continue at depth, making the scraping back of topsoil less effective in keeping bulldust down and preserving soil structure.

The recommendation in these include:

- line preparation with vehicles traversing directly of the annual grasses, flattening or slashing for data acquisition i.e. blade up (noting bushfire precautions recommended).
- Where soils have been compacted in the seasonally inundated areas, a light ripping to break up the surface is recommended to promote growth of stratum 3 grasses.

7 Monitoring

7.1 Construction

Monitoring for soil erosion and related issues is best undertaken at critical stages, such as:

- At the time of the baseline land condition assessment.
- During siting of access tracks and exploration areas, this is when there is the greatest opportunity to avoid erosion problems.
- After completion of a specific phase of activity, all disturbed areas will be monitored before and after the wet season.
- When accessing the site after the wet season, all disturbed areas should be inspected for signs of erosion. If significant impacts are identified remediation works may need to be conducted prior to continued vehicular access.
- In the unlikely event that water is required to be released from the sediment pond, the stored water will be visually assessed (no sheen, or turbidity) and physical parameters (pH, EC) taken to ensure release water will not impact on any downgradient sensitive receiving environments (refer Section 7.3). It is noted that well sites do not have any sensitive receiving water bodies located in proximity to the sites.

When accessing the site after the wet season, all disturbed areas should be inspected for signs of erosion. If significant impacts are identified remediation works may need to be conducted.

7.2 Operations

Visual inspections will be undertaken throughout the seismic survey activities to assess the impact risk level of the regulated activities being undertaken and the likelihood of accelerated erosion occurring. A review of mitigation measures that are implemented throughout the project phase will be conducted regularly to assess the efficacy and that the standard is maintained.

All other areas to be inspected before and after the wet season to identify the occurrence of erosion and sedimentation. Where erosion is observed, maintenance activities shall be undertaken. Ongoing monitoring and maintenance shall occur throughout the life of the infrastructure until the land is handed back.

7.3 ESC Trigger Action Response Plan

The following Trigger Action Response Plan (TARP) is to be implemented during construction:

- Monitoring requirements:
  - 7-day forecast from Bureau of Meteorology (BOM) to be monitored and construction and ground disturbance activities to planned around the forecast.
  - Daily visual inspection of access track, lease pads and campsite conditions for duration of civil construction activities.

- Routine visual inspections of the creek and drainage line access track crossings and the wastewater containment system at the camp weekly or following a rainfall event (i.e. greater than 20 mm in 24 hours).
- Review ESC across the site and where required implement maintenance prior to 1 October each year.

- Action:
  - On establishment of each exploration well pad, undertake jar testing work to determine anticipated settling rate of sediments on site. This will inform flocculent dosing requirements as required.
  - Where monitoring has indicated weather condition have impacted the integrity of the erosion and sediment controls, operators must adopt one of the treatment plans from section 6.0 to mitigate the impacts of rainfall and ensure that the ESC devices are reinstated as soon as physically practicable after the event.
  - Inspection of all ESC devices across the worksite and physical water quality testing (physical parameters only) at the well pad sediment basin should be conducted prior to discharge of water offsite. Water quality discharge indicators include:
  - No visible oil, grease or other hydrocarbons. No visible foams caused by surfactants and detergents. No visible abnormal discoloration.
    - pH: Between 5.2 – 9.0[1]
    - EC: 1,300 µS/cm.[2]

[1] *The proposed minimum pH is reflective of observed regional rainfall pH levels, with pH levels of 5.24 observed at Daly Waters on March 20, 2024. Tamboran has observed pH levels on its enclosed tank lids and sediment basins around the pH of 5 level. Given the large volume of rainwater that falls on a site in a very short period, the pH in the sediment basin is anticipated to be low, before increasing as they interact with the receiving soils. This has been observed in sediment basins onsite, with pH increasing from 5.2 to 6.5 over several hours after a rainfall event due to the low buffer capacity of rainwater. Given the existing pH of rainwater is approximately 5.2, we believe this to be an appropriate release limit for stormwater.*

[2] *The proposed limit of 1,300 µs/cm was chosen as it aligns with the EC of the Gum Ridge formation (the main source of water used on proposed sites) and the ANZECC short term irrigation guideline value for moderately sensitive crops (Table 9.2.5 of the ANZEC Guidelines (2000) Volume 3, Chapter 9, Primary industries).*

The proposed EC limit is underpinned by modelling designed to assess the changing soil salinities and the potential for impact on the receiving vegetation types, including Eucalyptus, Acacia, Melaleuca species and native grasses which are common to the area. Many of these species have been shown to have a moderate to high tolerance to salinity.

The results of the modelling indicate the maximum root zone salinity will be in the order of 1.6 dS/m (for a sandy loam) to 1.7 dS/m (for a clay). This is below the likely vegetation root zone salinity of the vegetation types in the area. Also, the sodium adsorption ratio (SAR) for the Gum Ridge Formation was calculated at 2, which when combined with the EC values, indicates that the release of stormwater based on the revised release criteria is unlikely to cause soil structural issues.

The adopted discharge criteria are widely used by Tamboran at its other operational sites on EP 117, EP 98 and EP 76, with no negative effects on soil properties or native vegetation.

- **Response:**
  - Post-rainfall/flood damage reconnaissance and assessment to be undertaken as soon as the area becomes accessible. Any damage observed would be repaired as soon as practicable after the event and ensure the controls and measures are in place prior to the next rainfall event.
  - If water quality conditions meet discharge indicators, beneficial reuse of water may be considered for construction activities.
  - Maintain dewatering records for any sediment basins including pH, EC, visual description and volume of water dewatered.
  - External NATA accredited laboratory testing of soil/sediment or surface water would only be required for the following triggers:
    - Work area has a known existing contaminating event in the preceding 3 months that could influence stormwater discharge quality (refer to Tamboran's Spill Management Plan appended to the EMP).
    - The visual inspection and physical water quality testing indicated potential contamination.
    - Where there is a sensitive receiving water body within 200 m of the discharge point.

7.4 Rehabilitation

7.4.1 Well Sites including, SPCF, Access Tracks, Gathering Lines, Gravel Pits and Camps

Where rehabilitation of a site is required, rehabilitation monitoring will be undertaken annually to assess the rehabilitation success and determine whether additional remedial works are required. Success criteria are defined in the relevant EMP and include:

- Safe for humans and wildlife
- Non-polluting
- Stable, with appropriate vegetation cover
- Land condition suitable for existing pastoral land use.

7.4.2 Seismic Line Acquisition

Rehabilitation will be undertaken along all newly cleared survey lines concurrently with the completion of the survey process. Reference should be made to the relevant Rehabilitation Management Plan prepared in support of each EMP. Rehabilitation of all areas must be undertaken in accordance with the methodologies described in the Rehabilitation Management Plan and treatments in Appendix P of this document.

Rehabilitation monitoring will be undertaken before and after the initial wet season and then annually for 5 years to assess the rehabilitation success and determine whether additional remedial works are required. Success criteria are defined in the relevant EMP and include:

- safe for humans and wildlife
- non-polluting
- stable, with appropriate vegetation cover
- waterways are not materially changed.
- land condition suitable for existing pastoral land use.

7.5 Incident Reporting

The constructor must follow incident reporting requirements covered in the Tamboran incident management directive.

Sediment release and turbidity increase incidents can require some assessment to determine if they are reportable, as controls are only designed to cope with certain rain events (refer to IECA, 2008).

The constructor must:

- Report sediment release and turbidity increase incidents.
- Include justification in each case of why the incident is, or is not, reportable to the regulator based on:
    - The state of the controls prior to the rainfall
    - The design standard applied (IECA, 2008)
    - The actual rainfall received, based on the nearest data source available
    - Whether the design storm event was exceeded or not; and
    - Whether environmental harm was caused or not.

7.6 Records

Records shall be retained demonstrating areas have been inspected. Photographic records will be maintained over the duration of the activities for documenting soil disturbance.

All environmentally relevant incidents are to be recorded in a field log that must remain accessible to all relevant regulatory authorities.

Minimum records to be retained for each site include:

Location of disturbance	Area of disturbance	Date	Close out

7.7 ESCP Revisions

Where major changes are required to the proposed controls in the ESCP through Tamboran's change management processes, DLPE would be advised and a revised ESCP provided. Should any civils be required during the wet season, the wet weather contingency plan outlined in Table 13 will be implement.

7.8 Maintenance

All temporary erosion and sediment control measures, including drainage control measures, must be fully operational and maintained in proper working order at all times during the project.

When undertaking construction work, erosion and sediment control measures must be inspected:

- at least daily (when work is occurring on-site during the wet season)
- within 24 hours of expected rainfall
- within 18 hours of a rainfall event of sufficient intensity and duration to cause runoff on-site or greater than 20 mm in 24 hours.

Once operational, inspections of the site will continue daily while onsite, and before and after the wet season. Where erosion is observed, maintenance activities shall be undertaken.

Sediment removed from sediment traps and places of sediment deposition must be disposed of in a lawful manner that does not cause ongoing soil erosion or environmental harm. Laboratory testing will be required to determine contamination status, however if consistent with surrounding natural environment and can be returned to site.

Prior to the completion of activities on the ground, the construction areas will be stabilised to the satisfaction of the construction supervisor.

8 References

APGA. 2019. *Upstream Polyethylene Gathering Networks – CSG Industry Code of Practice* (Version 5.0 August 2019). Australian Pipelines and Gas Association, QLD.

Catchment and Creeks Pty Ltd. 2012. *Erosion & Sediment Control – A Field Guide for Construction Site Managers V5*. Catchment and Creeks. Brisbane. QLD.

Department of Agriculture, Fisheries and Forestry. 2013. *Code for Self-Assessable Development Minor Waterway Barrier Works Part 4: Bed Level Crossings Code Number WWBW01 April 2013*. State of Queensland, Qld.

Department of Environment, Parks and Water Security (DEPWS) 2024. *Land Clearing Guidelines*. Version 2. Northern Territory Government.

IECA. 2008. *Best Practice Erosion and Sediment Control – for building and construction sites*. Picton, NSW: International Erosion Control Association (Australasia).

IECA & Australian Pipelines and Gas Association Ltd (APGA). 2015. *Appendix P: Land-Based Pipeline Construction* (addendum to IECA 2008). Picton, NSW: International Erosion Control Association (Australasia).

Scientific Inquiry into Hydraulic Fracturing in the Northern Territory. 2018. *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory – Final Report*.

APPENDIX A Erosion hazard assessment explanatory notes

reference: IECA, 2008, *Best Practice Erosion and Sediment Control Hazard Assessment Form)*

Requirements: Specific issues or actions required by the proponent.

Warnings: Issues that should be considered by the proponent.

Comments: General information relating to the topic.

[1] **REQUIREMENTS:**

For sites with an average slope of proposed land disturbance greater than 10%, a preliminary ESCP must be submitted to the regulatory authority for approval during planning negotiations.

Proponents must demonstrate that adequate erosion and sediment control measures can be implemented on-site to effectively protect downstream environmental values.

If site or financial constraints suggest that it is not reasonable or practicable for the prescribed water quality objectives to be achieved for the proposal, then the proponent must demonstrate that alternative designs or construction techniques (e.g. pole homes, suspended slab) cannot reasonably be implemented on the site.

WARNINGS:

Steep sites usually require more stringent drainage and erosion controls than flatter grade sites.

COMMENTS:

The steeper the land, the greater the need for adequate drainage controls to prevent soil and mulch from being washed from the site.

[2] **REQUIREMENTS:**

If the actual soil K-factor is known from soil testing, then the Score shall be determined from Table 1.

If a preliminary ESCP is required during planning negotiations, then it must be demonstrated that adequate space is available for the construction and operation of any major sediment traps, including the provision for any sediment basins and their associated embankments and spillways. It must also be demonstrated that all reasonable and practicable measures can be taken to divert the maximum quantity of sediment-laden runoff (up to the specified design storm) to these sediment traps throughout the construction phase and until the contributing catchment is adequately stabilised against erosion.

WARNINGS: -

The higher the point score, the greater the need to protect the soil from raindrop impact and thus the greater the need for effective erosion control measures. A point score of 2 or greater will require a greater emphasis to be placed on revegetation techniques that do not expose the soil to direct rainfall contact during vegetation establishment, e.g. turfing and *Hydro mulching*.

COMMENTS:

Table 2 provides an *indication* of soil conditions likely to be associated with a particular Soil group based on a statistical analysis of soil testing across NSW. This table provides only an initial estimate of the likely soil conditions.

The left-hand-side of the table provides an indication of the type of sediment basin that will be required (Type C, F or D). The right-hand-side of the table provides an indication of the likely erodibility of the soil based on the Revised Universal Soil Loss Equation (RUSLE) K-factor.

Table 3 provides some general comments on the erosion potential of the various soil groups.

Table 1 – Score if soil K-factor is known

	RUSLE soil erodibility K-factor			
	K < 0.02	0.02<K<0.04	0.04<K<0.06	K > 0.06
Score	0	1	2	3

Table 2 – Statistical analysis of NSW soil data [1]

Unified Soil Class System	Likely sediment basin classification (%)			Probable soil erodibility K-factor (%) [2]			
	Dry	Wet		Low	Moderate	High	Very High
	Type C	Type F	Type D	K < 0.02	0.02<K<0.04	0.04<K<0.06	K > 0.06
GM	30	58	12	12	51	26	12
GC	42	33	25	13	71	17	0
SW	40	48	12	49	39	12	0
SP	53	32	15	76	18	5	1
SM	21	67	12	26	48	25	1
SC	26	50	24	16	64	18	2
ML	5	63	32	4	35	45	16
CL	9	51	39	12	56	19	13
OL	2	80	18	34	61	5	1
MH	12	41	48	15	19	41	25
CH	5	44	51	39	43	11	7

Notes: [1] Analysis of soil data presented in Landcom (2004).

[2] Soil erodibility based on Revised Universal Soil Loss Equation (RUSLE) K-factor.

Unified Soil Classification System (USCS)

GW Well graded gravels, gravel-sand mixtures, little or no fines
GP Poorly graded gravels, gravel-sand mixture, little or no fines
GM Silty gravels, poorly graded gravel-sand-silt mixtures
GC Clayey gravels, poorly graded gravel-sand-clay mixtures SW Well graded sands, gravelly sands, little or no fines
SP Poorly graded sands, gravelly sands, little or no fines
SM Silty sands, poorly graded sand-silt mixtures
SC Clayey sands, poorly graded sand-clay mixtures
ML Inorganic silts & very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL Inorganic clays, low–medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL Organic silts and organic silt-clays of low plasticity
MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH Inorganic clays of high plasticity, fat clays
OH Organic clays of medium to high plasticity

Table 3 – Typical properties of various soil groups [1]

Soil Groups	Typical properties [2]
GW, GP	Low erodibility potential.
GM, GC	Low to medium erodibility potential. May create turbid runoff if disturbed as a result of the release of silt and clay particles.
SW, SP	Low to medium erodibility potential.
SM, SC	Medium erodibility potential. May create turbid runoff if disturbed as a result of the release of silt and clay particles.
MH, CH	Highly variable (low to high) erodibility potential. Will generally create turbid runoff if disturbed.
ML, CL	High erodibility potential. Tendency to be dispersive. May create some turbidity in runoff if disturbed.

Note: [1] After Soil Services & NSW DLWC (1998).
[2] Any soil can represent a high erosion risk if the binding clays or silts are unstable.

Table 4 provides **general** guidelines on the suitability of various soil groups to various engineering applications.

Table 4 – Engineering suitability based on Unified Soil Classification [1]

Unified Soil Class	USC Group	Embankments		Fill	Slope stability	Untreated roads
		Water retaining	Non- water retaining			
Well graded gravels	GW	Unsuitable	Excellent	Excellent	Excellent	Average
Poorly graded gravel	GP	Unsuitable	Average	Excellent	Average	Unsuitable
Silty gravels	GM	Unsuitable	Average	Good	Average	Average
Clayey gravels	GC	Suitable	Average	Good	Average	Excellent
Well graded sands	SW	Unsuitable	Excellent	Excellent	Excellent	Average
Poorly graded sands	SP	Unsuitable	Average	Good	Average	Unsuitable
Silty sands	SM	Suitable [2]	Average	Average	Average	Poor
Clayey sands	SC	Suitable	Average	Average	Average	Good
Inorganic silts	ML	Unsuitable	Poor	Average	Poor	Unsuitable
Inorganic clays	CL	Suitable [2]	Good	Average	Good	Poor
Organic silts	OL	Unsuitable	Unsuitable	Poor	Unsuitable	Unsuitable
Inorganic silts	MH	Unsuitable	Poor	Poor	Poor	Unsuitable
Inorganic clays	CH	Suitable [2]	Average	Unsuitable	Average	Unsuitable
Organic clays	OH	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable
Highly organic soils	Pt	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable

Unified Soil Class	USC Group	Embankments		Fill	Slope stability	Untreated roads
		Water retaining	Non- water retaining			
Notes: [1] Modified from Hazelton & Murphy (1992) [2] Suitable only after modifications to soil such as compaction and/or erosion protection						

[3] If the soils have not been tested for Emerson Class, then adopt a score of 4.

REQUIREMENTS:

Works proposed on sites containing Emerson Class 1 or 2 soils have a very high pollution potential and must submit a conceptual ESCP to the regulatory authority for review and/or approval (as required by the authority) during planning negotiations.

WARNINGS:

Class 3 and 5 soils disturbed by cut and fill operations or construction traffic are highly likely to discolour stormwater (i.e. cause turbid runoff). Chemical stabilisation will likely be required if these soils are placed immediately adjacent to a retaining wall. Any disturbed Class 1, 2, 3 and 5 soils that are to be revegetated must be covered with a non-dispersive topsoil as soon as possible (unless otherwise agreed by the regulatory authority).

Class 1 and 2 soils are highly likely to discolour (pollute) stormwater if exposed to rainfall or flowing water. Treatment of these soils with gypsum (or other suitable substance) will most likely be required. These soils should not be placed directly behind a retaining wall unless it has been adequately treated (stabilised) or covered with a non-dispersible soil.

[4] The duration of disturbance refers to the total duration of soil exposure to rainfall up until a time when there is at least 70% coverage of all areas of soil.

REQUIREMENTS:

All land developments with an expected soil disturbance period greater than 6 months must submit a conceptual ESCP to the regulatory authority for review and/or approval (as required by the authority) during planning negotiations.

COMMENTS:

Construction periods greater than 3 months will generally experience at least some significant storm events, independent of the time of year that the construction (soil disturbance) occurs.

[5] **REQUIREMENTS:**

Development proposals with an expected soil disturbance in excess of 1ha must submit a conceptual ESCP to the regulatory authority for review and/or approval (as required by the regulatory authority) during planning negotiations.

The area of disturbance refers to the total area of soil exposed to rainfall or dust-producing winds either as a result of:

(a) the removal of ground cover vegetation, mulch or sealed surfaces;
(b) past land management practices;
(c) natural conditions.

WARNINGS:

A *Sediment Basin* will usually be required if the disturbed area exceeds 0.25ha (2500m^2) within any sub-catchment (i.e. land flowing to one outlet point).

COMMENTS:

For soil disturbances greater than 0.25ha, the revegetation phase should be staged to minimise the duration for which soils are exposed to wind, rain and concentrated runoff.

[6] **REQUIREMENTS:**

All developments that involve earthworks or construction within a natural watercourse (whether that

watercourse is in a natural or modified condition) must submit a conceptual ESCP to the regulatory authority for review and/or approval (as required by the regulatory authority) during planning negotiations.

Permits and/or licences may be required from the State Government, including possible submission of the ESCP to the relevant Government department.

[7] **REQUIREMENTS:**

No areas of soil disturbance shall be left exposed to rainfall or dust-producing winds at the end of a development without an adequate degree of protection and/or an appropriate action plan for the establishment of at least 70% cover.

COMMENTS:

Grass seeding without the application of a light mulch cover is considered the least favourable revegetation technique. A light mulch cover is required to protect the soil from raindrop impact, excessive temperature fluctuations, and the loss of essential soil moisture.

[8] **COMMENTS:**

All receiving waters can be adversely affected by unnatural quantities of sediment-laden runoff. Freshwater ecosystems are generally more susceptible to ecological harm resulting from the inflow of fine or dispersible clays than saline water bodies. The further inland a land disturbance is, the greater the potential for the released sediment to cause environmental harm as this sediment travels towards the coast.

For the purpose of this clause it is assumed that all sediment-laden runoff will eventually flow into saline waters. Thus, sediment-laden discharges that flow first into freshwater are likely to adversely affect both fresh and saline water bodies and are therefore considered potentially more damaging to the environment.

This clause does **not** imply that sediment-laden runoff will not cause harm to saline waters.

[9] **COMMENTS:**

This clause refers to subsoils exposed during the construction phase either as a result of past land practices or proposed construction activities. The exposure of subsoils resulting from the excavation of minor service trenches should not be considered.

[10] **WARNINGS:**

The greater the extent of external catchment, the greater the need to divert up-slope stormwater runoff around any soil disturbance.

COMMENTS:

The ability to separate “clean” (i.e. external catchment) stormwater runoff from “dirty” site runoff can have a significant effect on the size, efficiency and cost of the temporary drainage, erosion, and sediment control measures.

[11] **REQUIREMENTS:**

Permission must be obtained from the owner of a road reserve before placing any erosion and sediment control measures within the road reserve.

WARNINGS:

Few sediment control techniques work efficiently when placed on a road and/or around roadside stormwater inlets. Great care must be taken if sediment control measures are located on a public roadway, specifically:

- safety issues relating to road users;
- the risk of causing flooding on the road or within private property.

The construction of roads (whether temporary or permanent) will usually modify the flow path of stormwater runoff. This can affect how “dirty” site runoff is directed to the sediment control measures.

COMMENTS:

“On-road” sediment control devices are at best viewed as secondary or supplementary sediment control measures. Only in special cases and/or on very small projects (e.g. kerb and channel replacement) might these controls be considered as the “primary” sediment control measure.

[12] **WARNINGS:**

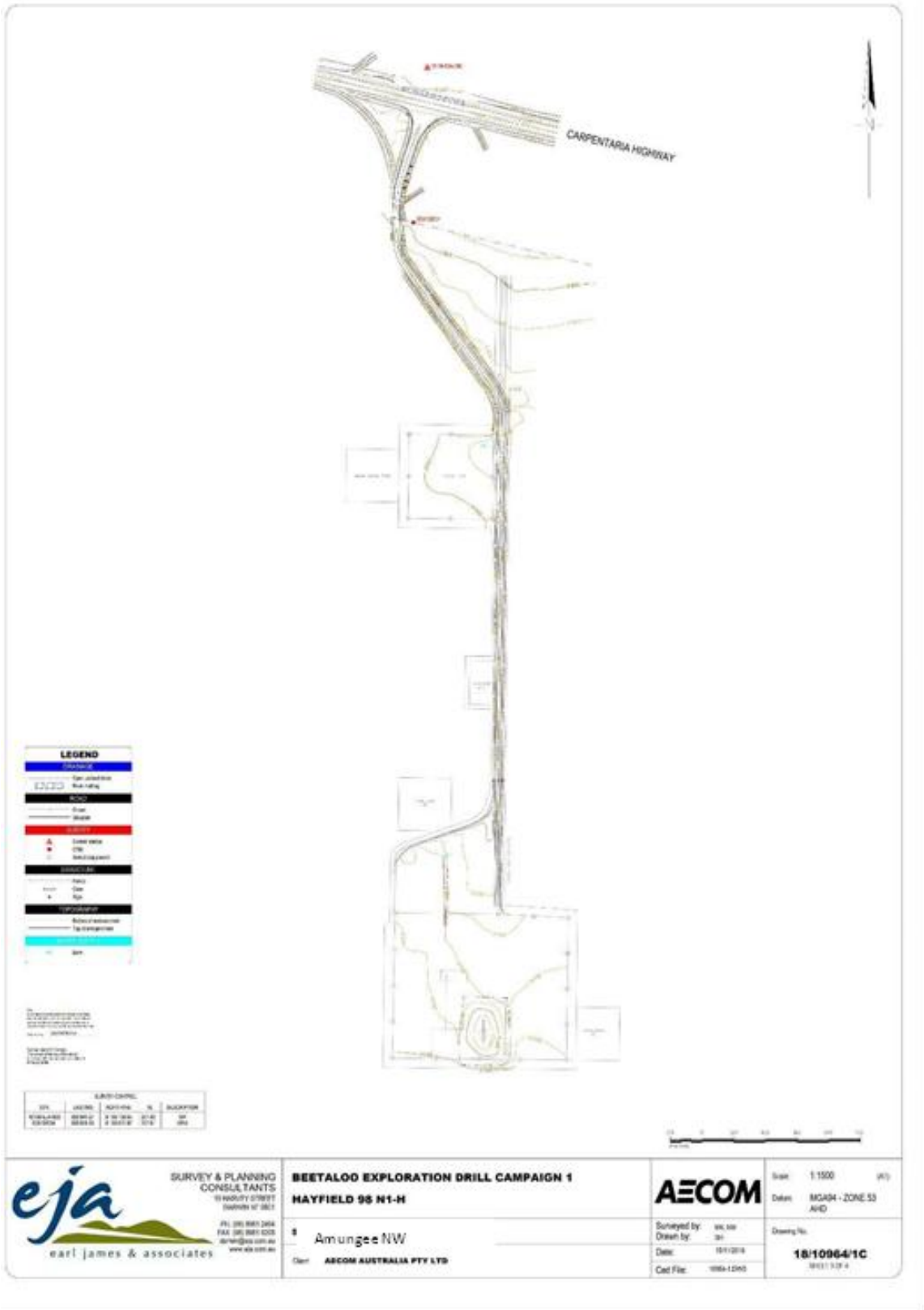
Soils with a pH less than 5.5 or greater than 8 will usually require treatment in order to achieve satisfactory revegetation. Soils with a pH of less than 5 (whether naturally acidic or in acid sulfate soil areas) may also

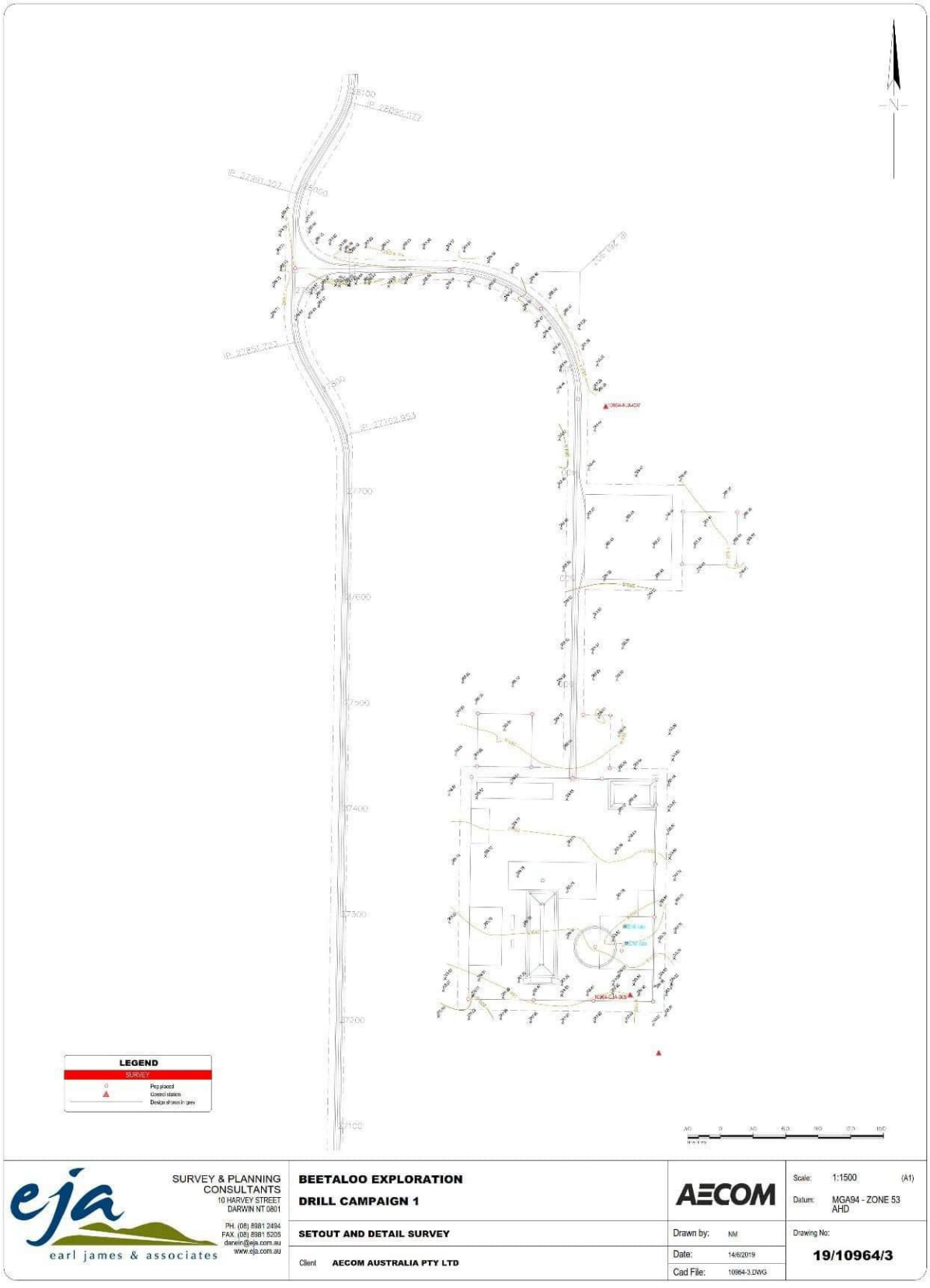
limit the choice of chemical flocculants (e.g. Alum) for use in the flocculation of *Sediment Basins*.

[13] **REQUIREMENTS:**

A preliminary ESCP must be submitted to the local government for approval during the planning phase for any development that obtains a total point score of 17 or greater or when any trigger value is scored or exceeded.

APPENDIX B Well pad and highway topographical survey

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SURVEY
Pegs placed
Control station
Design details in grey
SURVEY & PLANNING CONSULTANTS
10 HARVEY STREET
DARWIN NT 0801
PH. (08) 8981 2494
FAX. (08) 8981 5205
darwin@eja.com.au
www.eja.com.au
earl james & associates
BEETALOO EXPLORATION
DRILL CAMPAIGN 1
SETOUT AND DETAIL SURVEY
Client AECOM AUSTRALIA PTY LTD
AECOM
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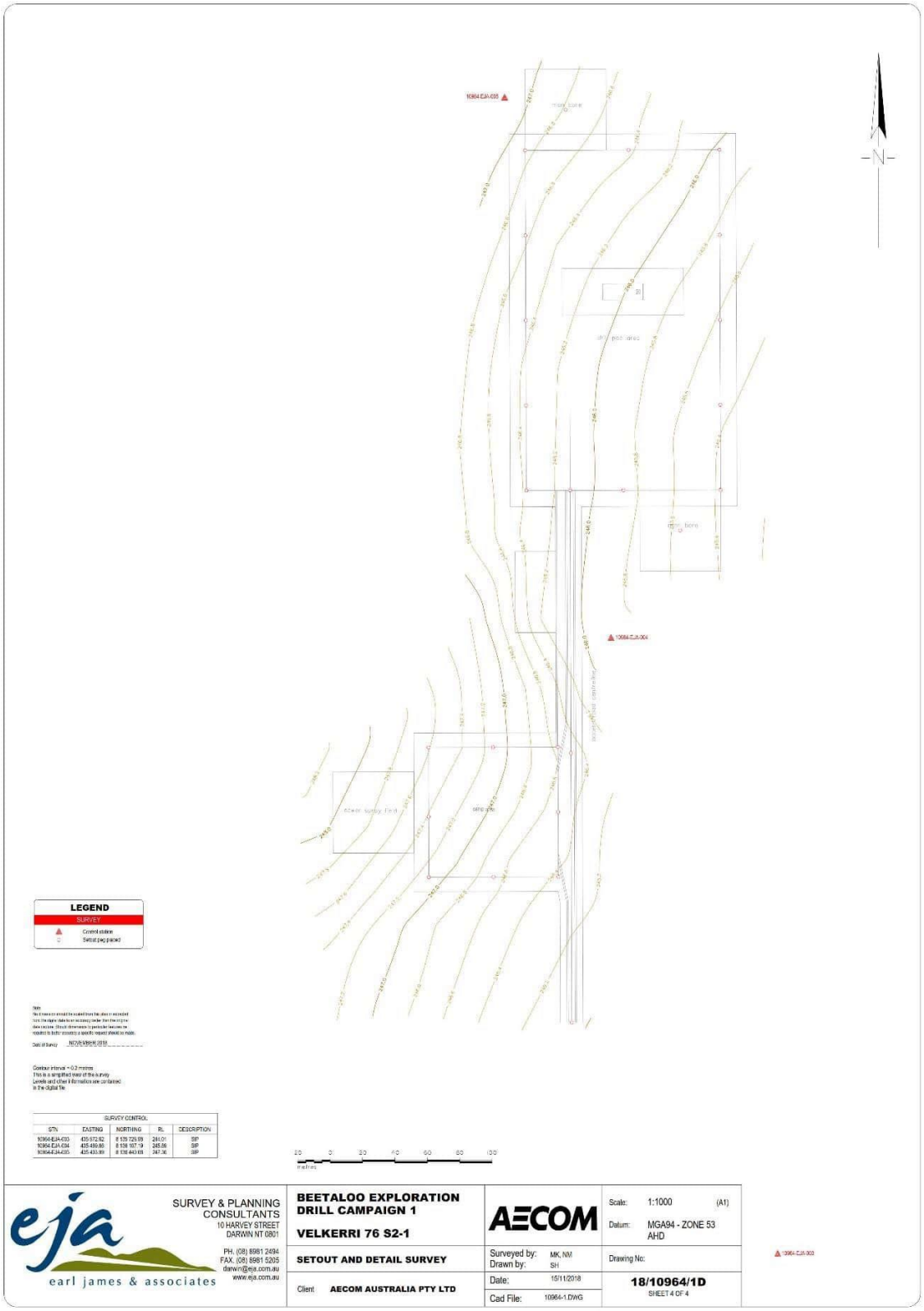
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8 135 167.19
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SP
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8 136 440.68
247.36
SP
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metres
SURVEY & PLANNING CONSULTANTS
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darwin@eja.com.au
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earl james & associates
BEETALOO EXPLORATION DRILL CAMPAIGN 1
VELKERRI 76 S2-1
SETOUT AND DETAIL SURVEY
Client AECOM AUSTRALIA PTY LTD
AECOM
Surveyed by: MK, NM
Drawn by: SH
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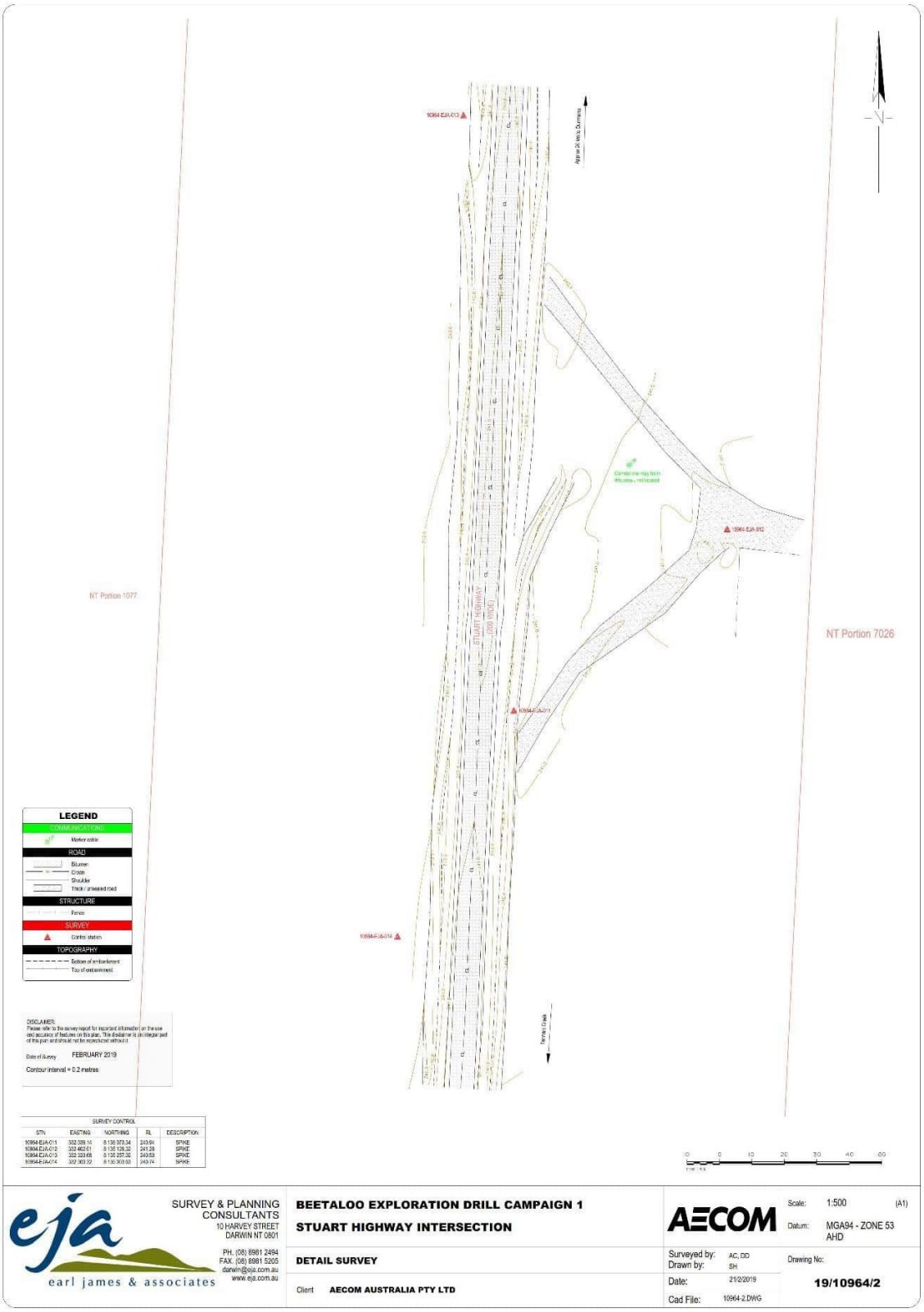
SHEET 4 OF 4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NT Portion 7026
STUART HIGHWAY (1000 WIDE)
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COMMUNICATIONS
Marker cable
ROAD
Bitumen
Cross
Shoulder
Track / unsealed road
STRUCTURE
Fence
SURVEY
Control station
TOPOGRAPHY
Bottom of embankment
Top of embankment
DISCLAIMER:
Please refer to the survey report for important information on the use and accuracy of features on this plan. This disclaimer is an integral part of this plan and should not be reproduced without it.
Date of Survey FEBRUARY 2019
Contour interval = 0.2 metres
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SURVEY & PLANNING CONSULTANTS
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earl james & associates
BEETALOO EXPLORATION DRILL CAMPAIGN 1
STUART HIGHWAY INTERSECTION
DETAIL SURVEY
Client AECOM AUSTRALIA PTY LTD
AECOM
Scale: 1:500 (A1)
Datum: MGA94 - ZONE 53 AHD
Surveyed by: AC, DD
Drawn by: SH
Date: 21/2/2019
Cad File: 10964-2.DWG
Drawing No: 19/10964/2

APPENDIX C Geotechnical laboratory results

Material Test Report

Douglas Partners
Douglas Partners Pty Ltd
Darwin Laboratory
Unit 2/14 Caryota Crt COCONUT GROVE NT 0810
Phone: (08) 8948 6800
Fax: (08) 8948 6899
Email: dave.millard@douglaspartners.com.au
Accredited for compliance with ISO/IEC 17025 - Testing

NATA
Approved Signatory: Dave Millard
Engineering Geologist
NATA Accredited Laboratory Number: 828

Report Number: 677612.00-1
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/01/2019
Client: AECOM Australia Pty Ltd
PO Box 73, Hunter Region NSW 2310
Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466F
Date Sampled: 13/12/2018
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **KYALLA01 (0.0 - 0.4m)**
Material: SAND, with silt

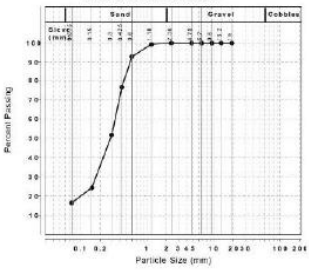
Particle Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	100	
1.18 mm	99	
0.6 mm	93	
0.425 mm	76	
0.3 mm	52	
0.15 mm	24	
0.075 mm	16	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	Not Obtainable		
Plastic Limit (%)	Not Obtainable		
Plasticity Index (%)	**Non Plastic**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	0.0		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	1.9

Particle Size Distribution



Material Test Report

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PO Box 73, Hunter Region NSW 2310
Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466G
Date Sampled: 13/12/2018
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **KYALLA02 (0.0 - 0.4m)**
Material: Silty SAND

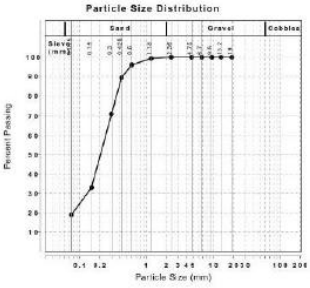
Particle Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	100	
1.18 mm	99	
0.6 mm	96	
0.425 mm	89	
0.3 mm	71	
0.15 mm	33	
0.075 mm	19	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	14		
Plastic Limit (%)	13		
Plasticity Index (%)	**1**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	0.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	2.3

Particle Size Distribution



Material Test Report

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PO Box 73, Hunter Region NSW 2310
Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466H
Date Sampled: 13/12/2018
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **KYALLA03 (0.0 - 0.4m)**
Material: Silty SAND

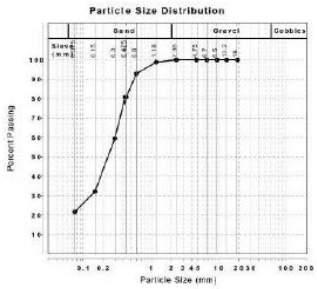
Particle Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	100	
1.18 mm	99	
0.6 mm	93	
0.425 mm	81	
0.3 mm	60	
0.15 mm	32	
0.075 mm	22	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	15		
Plastic Limit (%)	13		
Plasticity Index (%)	**2**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	1.0		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	3.1

Particle Size Distribution



Material Test Report

Douglas Partners
Douglas Partners Pty Ltd
Darwin Laboratory
Unit 2/14 Caryota Crt COCONUT GROVE NT 0810
Phone: (08) 8948 6800
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Accredited for compliance with ISO/IEC 17025 - Testing

NATA
Approved Signatory: Dave Millard
Engineering Geologist
NATA Accredited Laboratory Number: 828

Report Number: 677612.00-1
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/01/2019
Client: AECOM Australia Pty Ltd
PO Box 73, Hunter Region NSW 2310
Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466I
Date Sampled: 13/12/2018
Sampling Method: AS1289 1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **KYALLA04 (0.0 - 0.4m)**
Material: Silty SAND

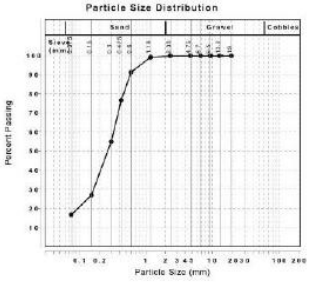
Particle Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	100	
1.18 mm	99	
0.6 mm	91	
0.425 mm	77	
0.3 mm	55	
0.15 mm	27	
0.075 mm	17	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried / Air Dried / Natural		
Preparation Method	Wet Sieve / Dry Sieve / Both Sieves		
Liquid Limit (%)	15		
Plastic Limit (%)	13		
Plasticity Index (%)	**2**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	0.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	2.0

Particle Size Distribution



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Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466A
Date Sampled: 13/12/2018
Sampling Method: AS1289.1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **VELKERR01 (0.0 - 0.4m)**
Material: Silty SAND, trace gravel

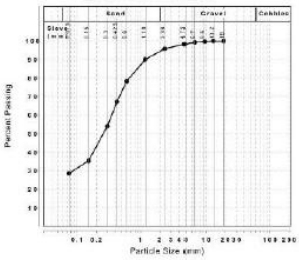
Particle Distribution (AS1289.3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	99	
4.75 mm	98	
2.36 mm	95	
1.18 mm	90	
0.6 mm	78	
0.425 mm	67	
0.3 mm	54	
0.15 mm	35	
0.075 mm	29	

Atterberg Limit (AS1289.3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	25		
Plastic Limit (%)	15		
Plasticity Index (%)	10		

Linear Shrinkage (AS1289.3.4.1)		Min	Max
Linear Shrinkage (%)	4.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289.2.1.1)	
Moisture Content (%)	8.8

Particle Size Distribution



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Client: AECOM Australia Pty Ltd
PO Box 73, Hunter Region NSW 2310
Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466B
Date Sampled: 13/12/2018
Sampling Method: AS1289.1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **VELKERR02 (0.0 - 0.4m)**
Material: Silty SAND

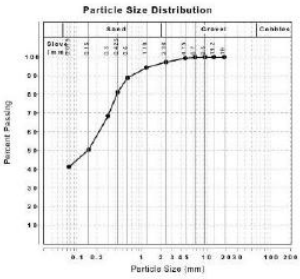
Particle Distribution (AS1289.3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	99	
2.36 mm	97	
1.18 mm	94	
0.6 mm	89	
0.425 mm	81	
0.3 mm	68	
0.15 mm	50	
0.075 mm	41	

Atterberg Limit (AS1289.3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	18		
Plastic Limit (%)	13		
Plasticity Index (%)	5		

Linear Shrinkage (AS1289.3.4.1)		Min	Max
Linear Shrinkage (%)	3.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289.2.1.1)	
Moisture Content (%)	5.6

Particle Size Distribution



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PO Box 73, Hunter Region NSW 2310
Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466C
Date Sampled: 13/12/2018
Sampling Method: AS1289.1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **VELKERR03 (0.0 - 0.4m)**
Material: Silty SAND

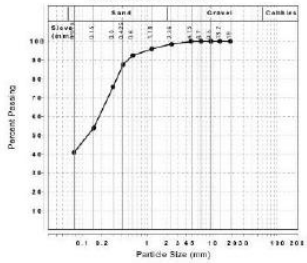
Particle Distribution (AS1289.3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	99	
1.18 mm	96	
0.6 mm	92	
0.425 mm	88	
0.3 mm	76	
0.15 mm	54	
0.075 mm	41	

Atterberg Limit (AS1289.3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	19		
Plastic Limit (%)	12		
Plasticity Index (%)	7		

Linear Shrinkage (AS1289.3.4.1)		Min	Max
Linear Shrinkage (%)	3.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289.2.1.1)	
Moisture Content (%)	4.9

Particle Size Distribution



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Client: AECOM Australia Pty Ltd
PO Box 73, Hunter Region NSW 2310
Contact: Jace Emberg
Project Number: 677612.00
Project Name: 60480548 - Beetaloo soil samples
Project Location: Beetaloo, NT
Work Request: 1466
Sample Number: 19-1466D
Date Sampled: 13/12/2018
Sampling Method: AS1289.1.2.1 6.4 - Sampling from layers in earthworks or pavement - uncompacted/compacted
Sample Location: **VELKERR04 (0.0 - 0.4m)**
Material: Silty SAND

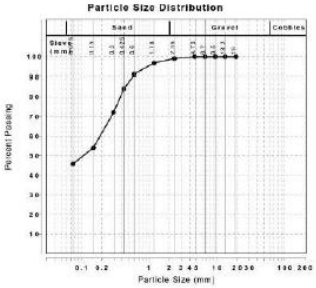
Particle Distribution (AS1289.3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	99	
1.18 mm	97	
0.6 mm	91	
0.425 mm	84	
0.3 mm	72	
0.15 mm	54	
0.075 mm	46	

Atterberg Limit (AS1289.3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	24		
Plastic Limit (%)	13		
Plasticity Index (%)	11		

Linear Shrinkage (AS1289.3.4.1)		Min	Max
Linear Shrinkage (%)	4.5		
Cracking Crumbling Curling	Cracking		

Moisture Content (AS 1289.2.1.1)	
Moisture Content (%)	5.2

Particle Size Distribution



Material Test Report

Report Number: 215285.00-1
Issue Number: 1
Date Issued: 13/05/2022
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: David van de Hoek
Project Number: 215285.00
Project Name: Project 60623736 - February
Project Location: Not Supplied, - NT
Client Reference: Project 60623736
Work Request: 4176
Sample Number: DW-4176B
Date Sampled: 06/05/2022
Dates Tested: 10/05/2022 - 12/05/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **AMS2 - Gravel Pit** Amungee NW3
Material: Silty Sandy Gravel

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	100		
13.2 mm	95		
9.5 mm	88		
6.7 mm	83		
4.75 mm	76		
2.36 mm	54		
1.18 mm	48		
0.6 mm	46		
0.425 mm	46		
0.3 mm	43		
0.15 mm	29		
0.075 mm	19		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	Not Obtainable		
Plastic Limit (%)	Not Obtainable		
Plasticity Index (%)	**Non Plastic**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	0.0		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	8		
Soil Description	Natural Soil		
Nature of Water	Demineralised Water		
Temperature of Water (°C)	26.5		

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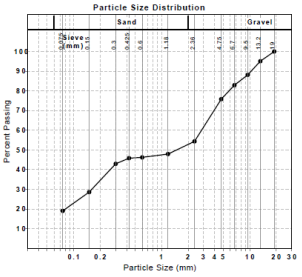
Particle Size Distribution



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Date Issued: 13/05/2022
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: David van de Hoek
Project Number: 215285.00
Project Name: Project 60623736 - February
Project Location: Not Supplied, - NT
Client Reference: Project 60623736
Work Request: 4176
Sample Number: DW-4176C
Date Sampled: 06/05/2022
Dates Tested: 10/05/2022 - 12/05/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **AMS2** Amungee NW3
Material: Silty Gravel

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	100		
13.2 mm	99		
9.5 mm	97		
6.7 mm	92		
4.75 mm	83		
2.36 mm	59		
1.18 mm	52		
0.6 mm	52		
0.425 mm	51		
0.3 mm	50		
0.15 mm	41		
0.075 mm	32		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	16		
Plastic Limit (%)	10		
Plasticity Index (%)	**6**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	2.5		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	2		
Soil Description	Natural Soil		
Nature of Water	Demineralised Water		
Temperature of Water (°C)	25.6		

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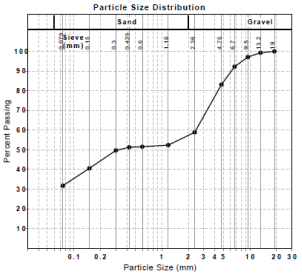
Particle Size Distribution



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Report Number: 215285.00-1
Issue Number: 1
Date Issued: 13/05/2022
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: David van de Hoek
Project Number: 215285.00
Project Name: Project 60623736 - February
Project Location: Not Supplied, - NT
Client Reference: Project 60623736
Work Request: 4176
Sample Number: DW-4176D
Date Sampled: 03/05/2022
Dates Tested: 10/05/2022 - 12/05/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **AMS3** Amungee NW4
Material: Silty Sandy Gravel

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	100		
13.2 mm	99		
9.5 mm	97		
6.7 mm	86		
4.75 mm	76		
2.36 mm	59		
1.18 mm	51		
0.6 mm	50		
0.425 mm	49		
0.3 mm	47		
0.15 mm	36		
0.075 mm	27		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	14		
Plastic Limit (%)	12		
Plasticity Index (%)	**2**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	1.0		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	8		
Soil Description	Natural soil		
Nature of Water	Demineralised Water		
Temperature of Water (°C)	26.6		

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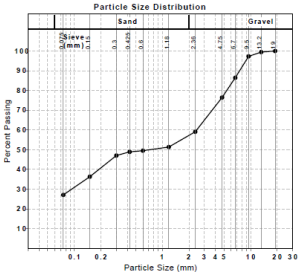
Particle Size Distribution



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Report Number: 215285.00-1
Issue Number: 1
Date Issued: 13/05/2022
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: David van de Hoek
Project Number: 215285.00
Project Name: Project 60623736 - February
Project Location: Not Supplied, - NT
Client Reference: Project 60623736
Work Request: 4176
Sample Number: DW-4176E
Date Sampled: 05/05/2022
Dates Tested: 10/05/2022 - 12/05/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **AMS4** Amungee NW5
Material: Clayey Sandy Gravel

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	100		
13.2 mm	97		
9.5 mm	94		
6.7 mm	90		
4.75 mm	83		
2.36 mm	64		
1.18 mm	54		
0.6 mm	52		
0.425 mm	51		
0.3 mm	49		
0.15 mm	38		
0.075 mm	28		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	21		
Plastic Limit (%)	11		
Plasticity Index (%)	**10**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	4.0		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	2		
Soil Description	Natural Soil		
Nature of Water	Demineralised Water		
Temperature of Water (°C)	25.6		

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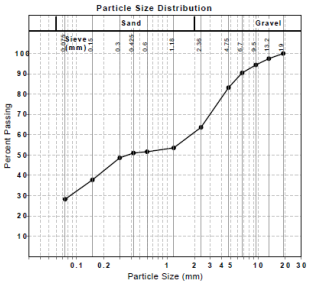
Particle Size Distribution



Material Test Report

Report Number: 220270.00-2
Issue Number: 1
Date Issued: 21/04/2023
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: William Riddell
Project Number: 220270.00
Project Name: Material Testing
Project Location: Beetaloo Basin, Beetaloo NT
Work Request: 4919
Sample Number: DW 4919F
Date Sampled: 01/04/2023
Dates Tested: 13/04/2023 - 19/04/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Shenandoah NA (Option 1)**
Material: Clayey Sand

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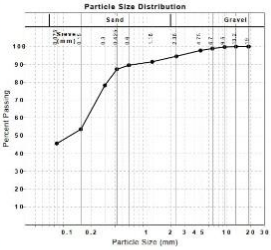
Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	99	
4.75 mm	98	
2.36 mm	95	
1.18 mm	91	
0.6 mm	90	
0.425 mm	87	
0.3 mm	78	
0.15 mm	54	
0.075 mm	46	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)	Min	Max
Sample History	Air Dried	
Preparation Method	Wet Sieve	
Liquid Limit (%)	19	
Plastic Limit (%)	11	
Plasticity Index (%)	**8**	

Linear Shrinkage (AS1289 3.4.1)	Min	Max
Moisture Condition Determined By	AS 1289.3.1.2	
Linear Shrinkage (%)	**4.0**	
Cracking Crumbling Curling	None	

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	**3**	
Soil Description	Natural Soil	
Nature of Water	Distilled Water	
Temperature of Water (°C)	25.5	

Particle Size Distribution



Material Test Report

Report Number: 220270.00-2
Issue Number: 1
Date Issued: 21/04/2023
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: William Riddell
Project Number: 220270.00
Project Name: Material Testing
Project Location: Beetaloo Basin, Beetaloo NT
Work Request: 4919
Sample Number: DW 4919G
Date Sampled: 02/04/2023
Dates Tested: 13/04/2023 - 20/04/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Shenandoah NA (Option 2)**
Material: Sandy Clay

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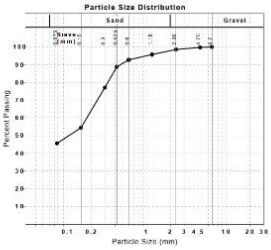
Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
6.7 mm	100	
4.75 mm	100	
2.36 mm	99	
1.18 mm	96	
0.6 mm	93	
0.425 mm	89	
0.3 mm	77	
0.15 mm	54	
0.075 mm	46	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)	Min	Max
Sample History	Air Dried	
Preparation Method	Wet Sieve	
Liquid Limit (%)	25	
Plastic Limit (%)	12	
Plasticity Index (%)	**13**	

Linear Shrinkage (AS1289 3.4.1)	Min	Max
Moisture Condition Determined By	AS 1289.3.1.2	
Linear Shrinkage (%)	**6.5**	
Cracking Crumbling Curling	Cracking	

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	**6**	
Soil Description	Natural Soil	
Nature of Water	Distilled Water	
Temperature of Water (°C)	25.5	

Particle Size Distribution



Material Test Report

Report Number: 220270.00-2
Issue Number: 1
Date Issued: 21/04/2023
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: William Riddell
Project Number: 220270.00
Project Name: Material Testing
Project Location: Beetaloo Basin, Beetaloo NT
Work Request: 4919
Sample Number: DW 4919H
Date Sampled: 03/04/2023
Dates Tested: 13/04/2023 - 20/04/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Shenandoah NB**
Material: Silty Sandy Gravel

Douglas Partners
Geotechnics | Environment | Groundwater
Douglas Partners Pty Ltd
Darwin Laboratory
Unit 2/14 Caryota Circuit Coconut Grove NT 0810
Phone: (08) 8948 6800
Email: Sunil.Sukhdeo@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Sunil Sukhdeo
Laboratory Manager
Laboratory Accreditation Number: 828

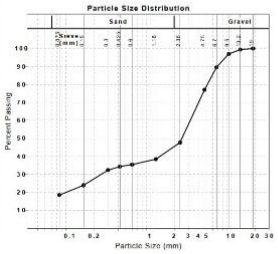
Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	99	
9.5 mm	97	
6.7 mm	90	
4.75 mm	77	
2.36 mm	48	
1.18 mm	38	
0.6 mm	35	
0.425 mm	34	
0.3 mm	32	
0.15 mm	24	
0.075 mm	18	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)	Min	Max
Sample History	Air Dried	
Preparation Method	Wet Sieve	
Liquid Limit (%)	15	
Plastic Limit (%)	11	
Plasticity Index (%)	**4**	

Linear Shrinkage (AS1289 3.4.1)	Min	Max
Moisture Condition Determined By	AS 1289.3.1.2	
Linear Shrinkage (%)	**3.0**	
Cracking Crumbling Curling	Cracking	

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	**3**	
Soil Description	Natural Soil	
Nature of Water	Distilled Water	
Temperature of Water (°C)	25.5	

Particle Size Distribution



Material Test Report

Report Number: 220270.00-2
Issue Number: 1
Date Issued: 21/04/2023
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: William Riddell
Project Number: 220270.00
Project Name: Material Testing
Project Location: Beetaloo Basin, Beetaloo NT
Work Request: 4919
Sample Number: DW 4919A
Date Sampled: 31/03/2023
Dates Tested: 13/04/2023 - 19/04/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Shenandoah SA**
Material: Silty Sand with Gravel

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Darwin Laboratory
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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Sunil Sukhdeo
Laboratory Manager
Laboratory Accreditation Number: 828

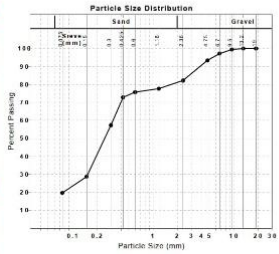
Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	99	
6.7 mm	97	
4.75 mm	93	
2.36 mm	82	
1.18 mm	78	
0.6 mm	76	
0.425 mm	73	
0.3 mm	67	
0.15 mm	29	
0.075 mm	20	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)	Min	Max
Sample History	Air Dried	
Preparation Method	Wet Sieve	
Liquid Limit (%)	13	
Plastic Limit (%)	11	
Plasticity Index (%)	**2**	

Linear Shrinkage (AS1289 3.4.1)	Min	Max
Moisture Condition Determined By	AS 1289.3.1.2	
Linear Shrinkage (%)	**5.0**	
Cracking Crumbling Curling	Cracking	

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	**3**	
Soil Description	Natural Soil	
Nature of Water	Distilled Water	
Temperature of Water (°C)	25.5	

Particle Size Distribution



Material Test Report

Report Number: 220270.00-2
Issue Number: 1
Date Issued: 21/04/2023
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: William Riddell
Project Number: 220270.00
Project Name: Material Testing
Project Location: Beetaloo Basin, Beetaloo N t
Work Request: 4919
Sample Number: DW 4919D
Date Sampled: 01/04/2023
Dates Tested: 13/04/2023 - 19/04/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Shenandoah SB**
Material: Silty Sand

Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
6.7 mm	100	
4.75 mm	100	
2.36 mm	100	
1.18 mm	99	
0.6 mm	95	
0.425 mm	86	
0.3 mm	62	
0.15 mm	34	
0.075 mm	27	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	14		
Plastic Limit (%)	10		
Plasticity Index (%)	4		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	2.0		
Cracking Crumbling Curling	None		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	3		
Soil Description	Natural Soil		
Nature of Water	Distilled Water		
Temperature of Water (°C)	25.5		

Douglas Partners
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Douglas Partners Pty Ltd
Darwin Laboratory
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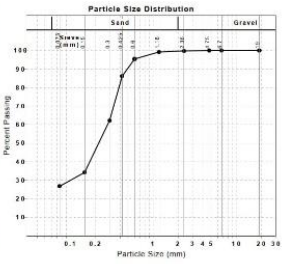
Email: Sunil.Sukhdeo@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Sunil Sukhdeo
Laboratory Manager
Laboratory Accreditation Number: 828



Material Test Report

Report Number: 220270.00-2
Issue Number: 1
Date Issued: 21/04/2023
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: William Riddell
Project Number: 220270.00
Project Name: Material Testing
Project Location: Beetaloo Basin, Beetaloo N t
Work Request: 4919
Sample Number: DW 4919C
Date Sampled: 31/03/2023
Dates Tested: 13/04/2023 - 19/04/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Shenandoah SC**
Material: Sandy Clay With Gravel

Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
19 mm	100	
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	98	
1.18 mm	98	
0.6 mm	95	
0.425 mm	90	
0.3 mm	72	
0.15 mm	49	
0.075 mm	41	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	22		
Plastic Limit (%)	12		
Plasticity Index (%)	10		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	5.0		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	3		
Soil Description	Natural Soil		
Nature of Water	Distilled water		
Temperature of Water (°C)	25.5		

Douglas Partners
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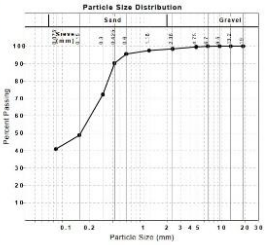
Douglas Partners Pty Ltd
Darwin Laboratory
Unit 2/14 Caryota Circuit Coconut Grove NT 0810
Phone: (08) 8948 6800
Email: Sunil.Sukhdeo@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Sunil Sukhdeo
Laboratory Manager
Laboratory Accreditation Number: 828



Material Test Report

Report Number: 220270.00-1
Issue Number: 1
Date Issued: 20/01/2023
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: William Riddell
Project Number: 220270.00
Project Name: Material Testing
Project Location: Beetaloo Basin, Beetaloo NT
Work Request: 4776
Sample Number: DW-4776F
Date Sampled: 14/12/2022
Dates Tested: 13/01/2023 - 18/01/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Shen South 2**
Material: Silty SAND

Particle Size Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
4.75 mm	100	
2.36 mm	100	
1.18 mm	99	
0.6 mm	94	
0.425 mm	81	
0.3 mm	57	
0.15 mm	28	
0.075 mm	20	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	13		
Plastic Limit (%)	11		
Plasticity Index (%)	2		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	0.5		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	5		
Soil Description	Natural		
Nature of Water	Demineralised Water		
Temperature of Water (°C)	25		

Douglas Partners
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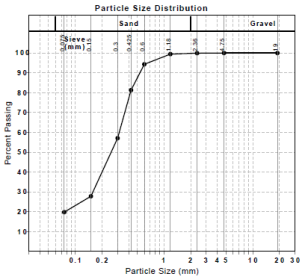
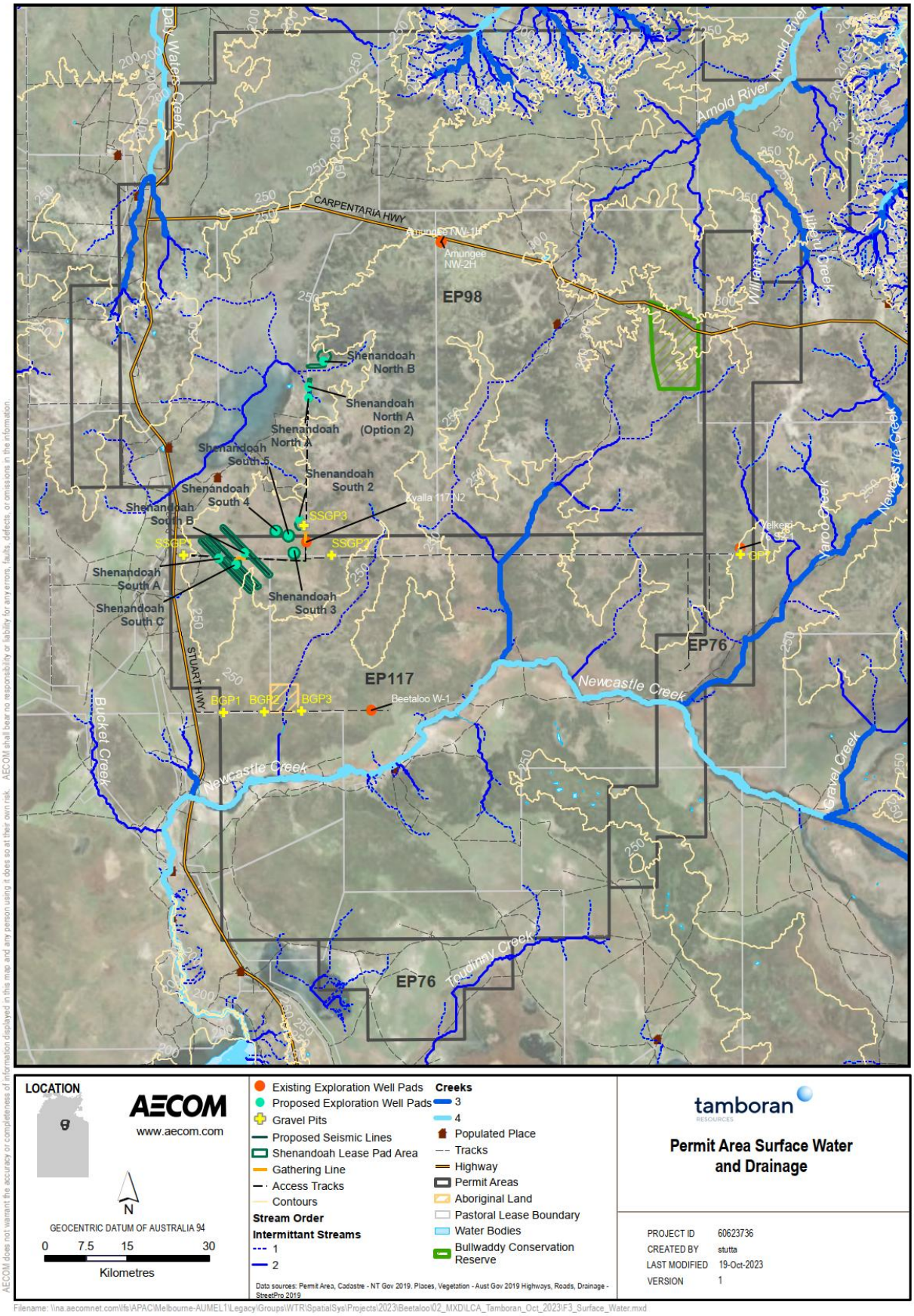
Phone: (08) 8948 6800
Email: Sunil.Sukhdeo@douglaspartners.com.au

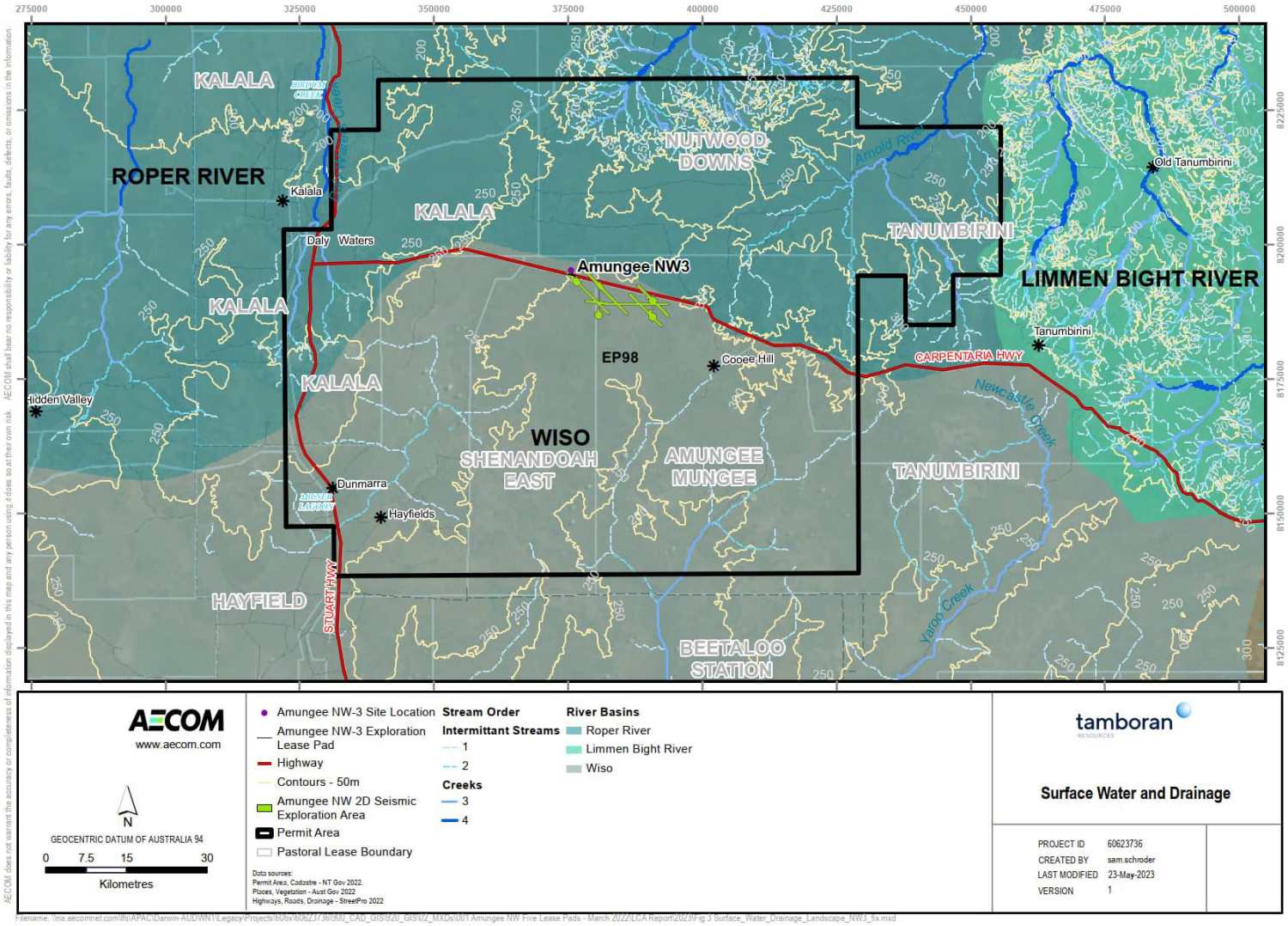
Accredited for compliance with ISO/IEC 17025 - Testing

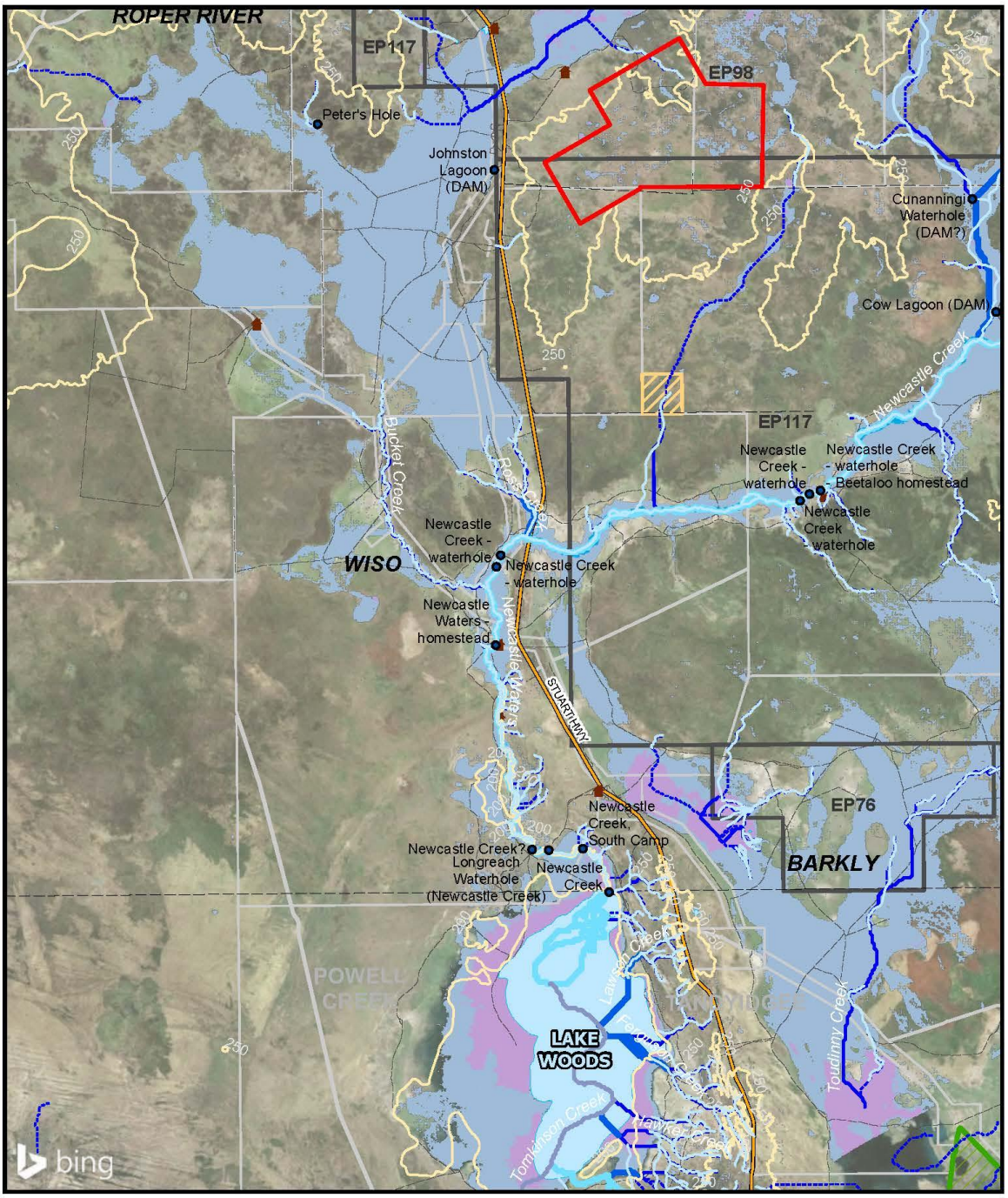
Approved Signatory: Sunil Sukhdeo
Laboratory Manager
Laboratory Accreditation Number: 828



APPENDIX D Permit area surface water



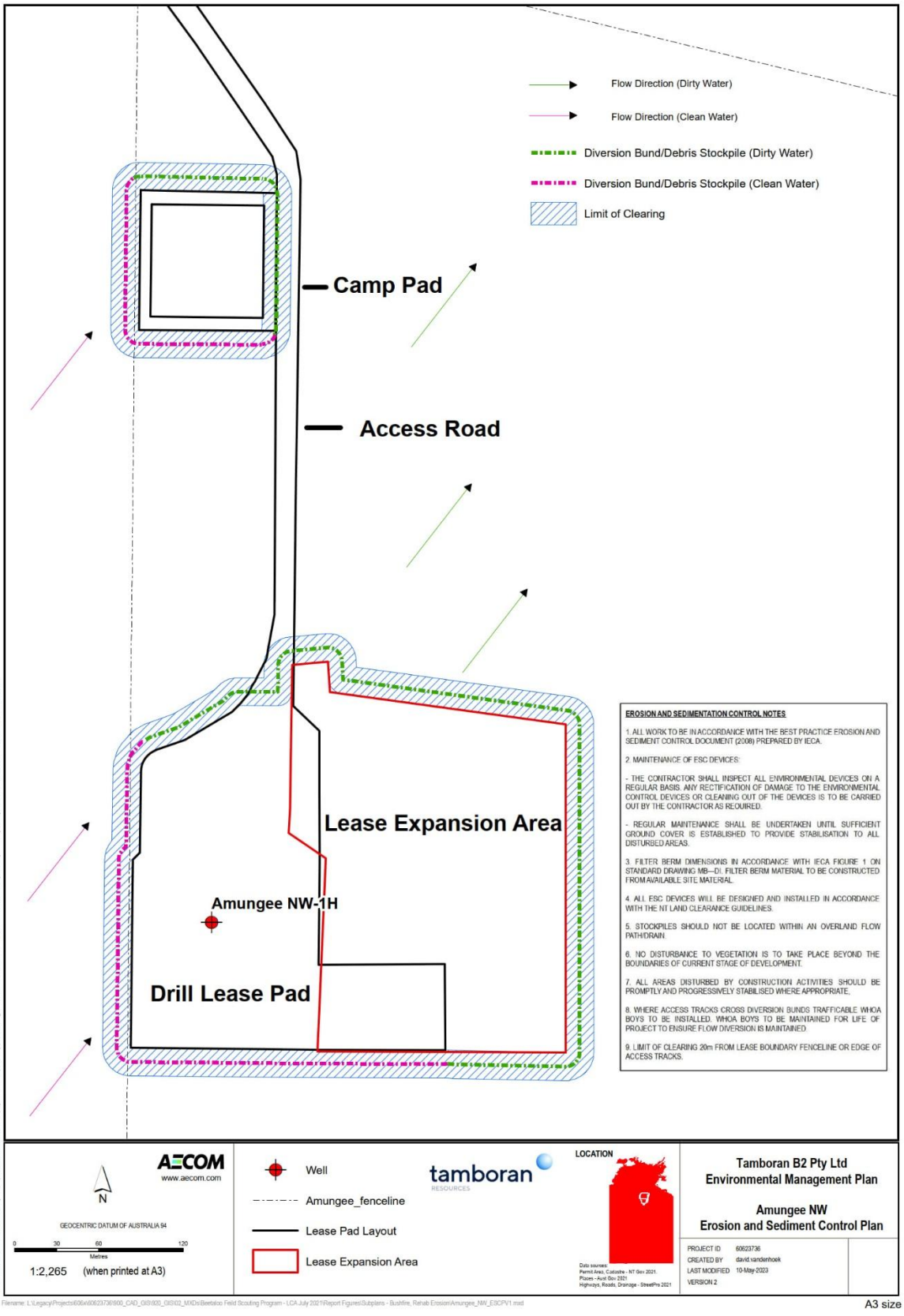

275000
300000
325000
350000
375000
400000
425000
450000
475000
500000
8225000
8200000
8175000
8150000
8125000
KALALA
ROPER RIVER
Kalala
Daly Waters
NUTWOOD DOWNS
Arnold River
Old Tanumbirini
TANUMBIRINI
LIMMEN BIGHT RIVER
Amungee NW3
Tanumbirini
CARPENTARIA HWY
EP98
Cooee Hill
Hidden Valley
Newcastle Creek
WISO
SHENANDOAH EAST
AMUNGEE
MUNGEE
Dunmarra
Hayfields
STUART HWY
HAYFIELD
Yarroa Creek
BEETALOO STATION
AECOM
www.aecom.com
N
GEOCENTRIC DATUM OF AUSTRALIA 94
0 7.5 15 30
Kilometres
Amungee NW-3 Site Location
Amungee NW-3 Exploration Lease Pad
Highway
Contours - 50m
Amungee NW 2D Seismic Exploration Area
Permit Area
Pastoral Lease Boundary
Stream Order
Intermittant Streams
1
2
Creeks
3
4
River Basins
Roper River
Limmen Bight River
Wiso
Data sources:
Permit Area, Cadastre - NT Gov 2022.
Places, Vegetation - Aust Gov 2022
Highways, Roads, Drainage - StreetPro 2022
tamboran RESOURCES
Surface Water and Drainage
PROJECT ID 60623736
CREATED BY sam.schroder
LAST MODIFIED 23-May-2023
VERSION 1

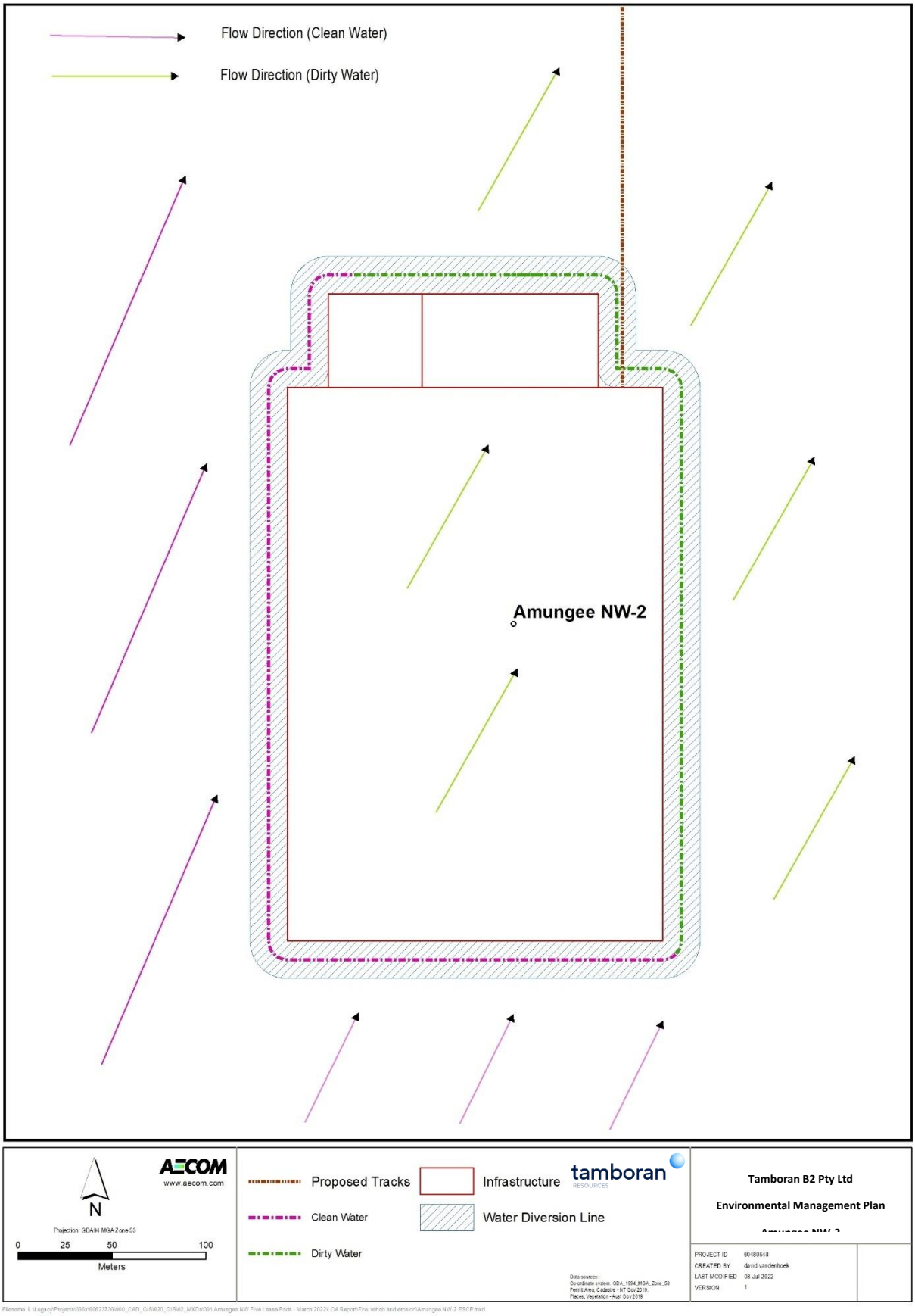


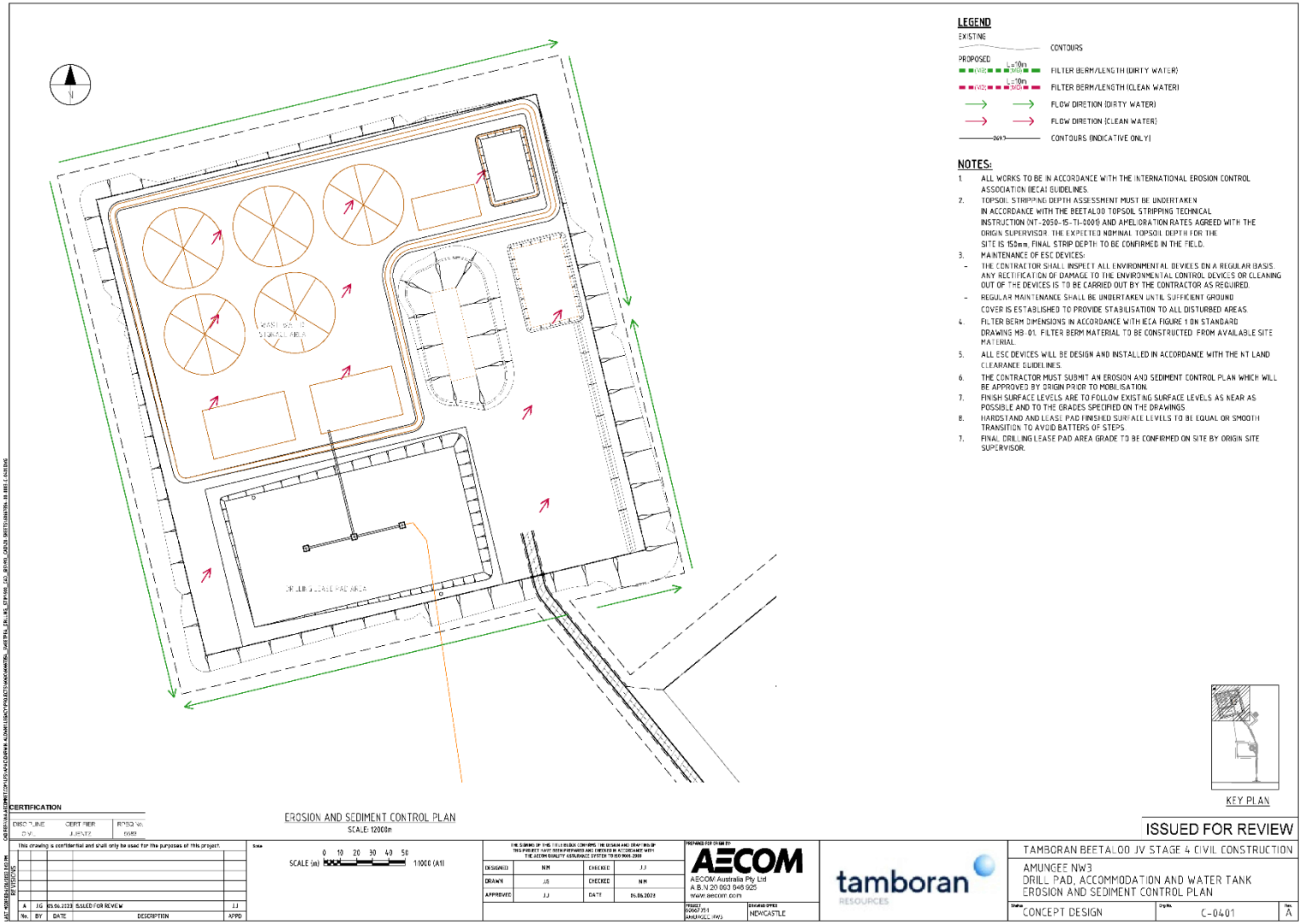
Filename: \\na.aecomnet.com\LFS\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\02_MXD\LCA_Tamboran_July_2024\ArcGIS Pro\60623736_TamboranLCA_FigureRequest_v1\60623736_TamboranLCA_FigureRequest_v1.aprx

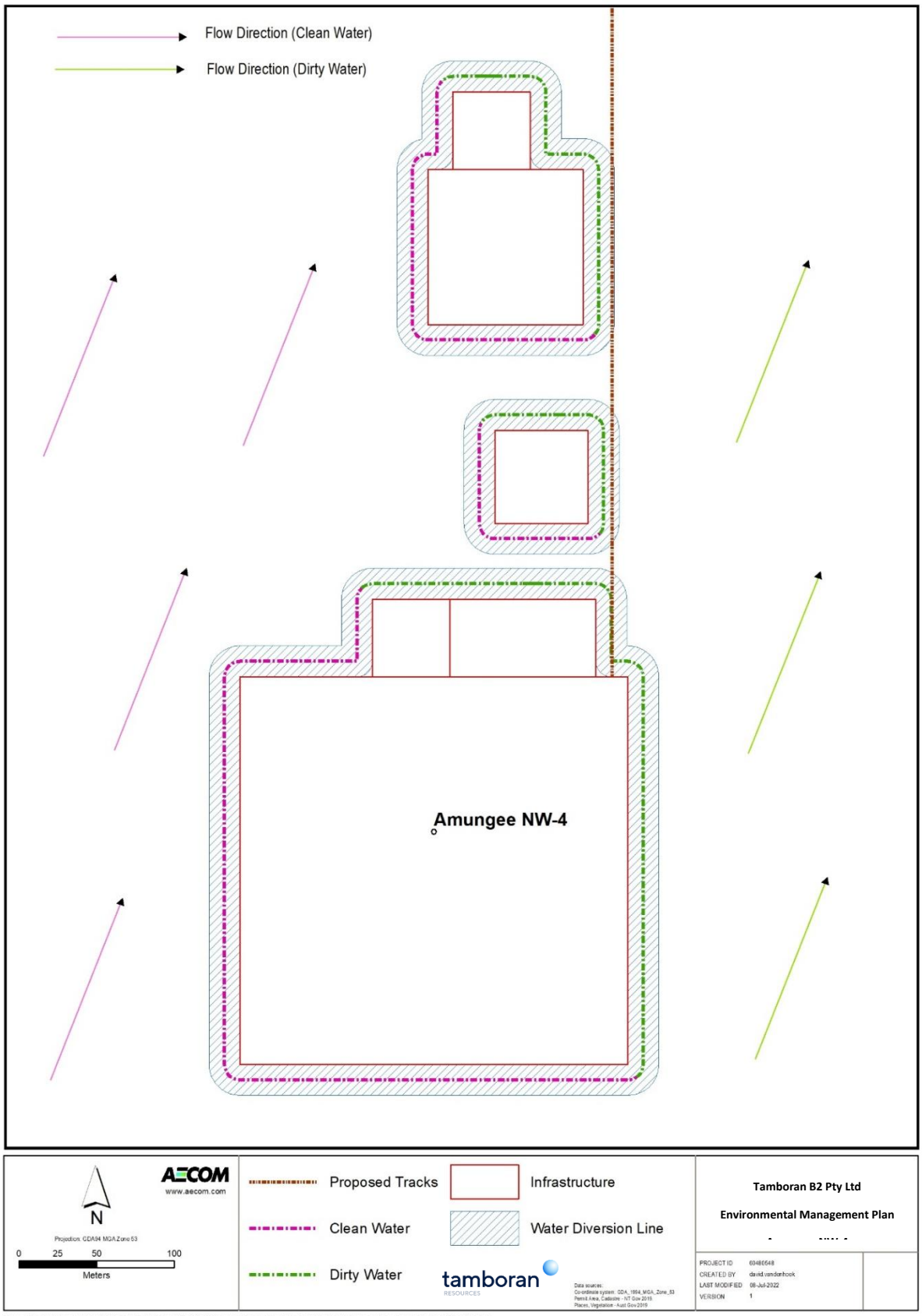
APPENDIX E Erosion and sediment control plans:

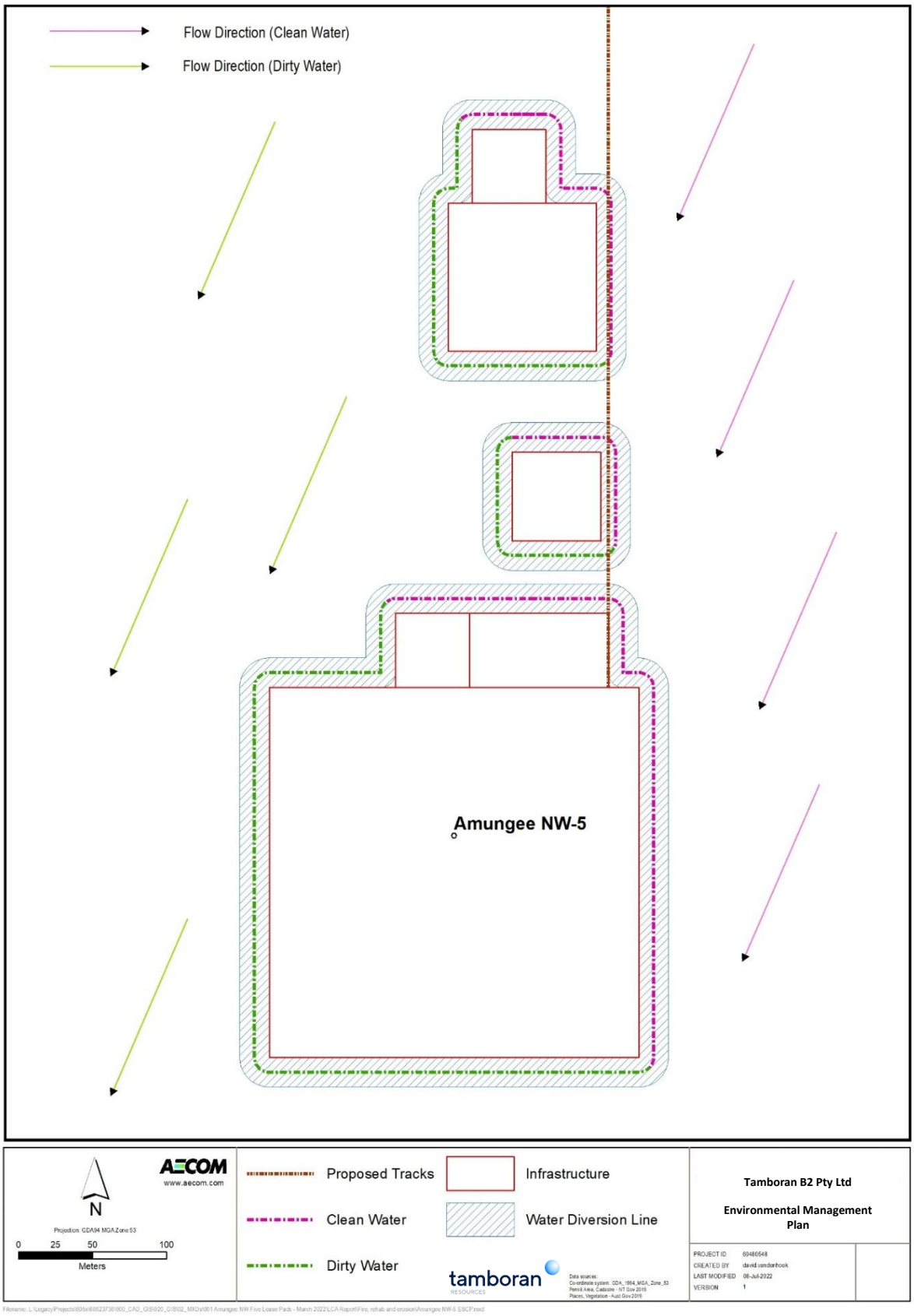
- **Amungee NW**
- **Amungee NW-2**
- **Amungee NW-3**
- **Amungee NW-4**
- **Amungee NW-5**
- **Shenandoah South A**
- **Shenandoah South B**
- **Shenandoah South C**
- **Shenandoah South 2, including SPCF**
- **Shenandoah North A**
- **Shenandoah North A (option 2)**

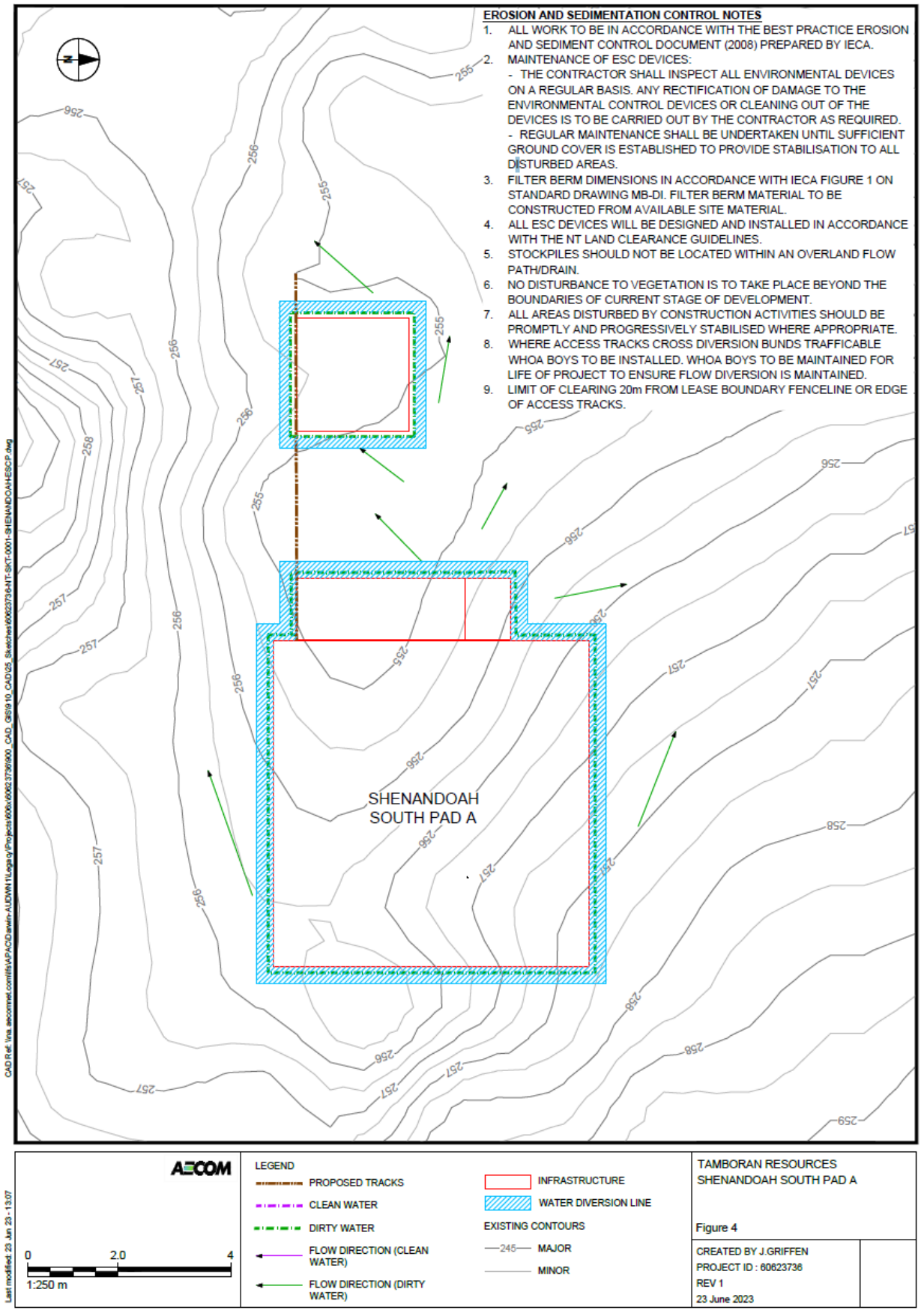

Flow Direction (Dirty Water)
Flow Direction (Clean Water)
Diversion Bund/Debris Stockpile (Dirty Water)
Diversion Bund/Debris Stockpile (Clean Water)
Limit of Clearing
Camp Pad
Access Road
Lease Expansion Area
Amungee NW-1H
Drill Lease Pad
EROSION AND SEDIMENTATION CONTROL NOTES
1. ALL WORK TO BE IN ACCORDANCE WITH THE BEST PRACTICE EROSION AND SEDIMENT CONTROL DOCUMENT (2008) PREPARED BY IECA.
2. MAINTENANCE OF ESC DEVICES:
- THE CONTRACTOR SHALL INSPECT ALL ENVIRONMENTAL DEVICES ON A REGULAR BASIS. ANY RECTIFICATION OF DAMAGE TO THE ENVIRONMENTAL CONTROL DEVICES OR CLEANING OUT OF THE DEVICES IS TO BE CARRIED OUT BY THE CONTRACTOR AS REQUIRED.
- REGULAR MAINTENANCE SHALL BE UNDERTAKEN UNTIL SUFFICIENT GROUND COVER IS ESTABLISHED TO PROVIDE STABILISATION TO ALL DISTURBED AREAS.
3. FILTER BERM DIMENSIONS IN ACCORDANCE WITH IECA FIGURE 1 ON STANDARD DRAWING MB—DI. FILTER BERM MATERIAL TO BE CONSTRUCTED FROM AVAILABLE SITE MATERIAL.
4. ALL ESC DEVICES WILL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH THE NT LAND CLEARANCE GUIDELINES.
5. STOCKPILES SHOULD NOT BE LOCATED WITHIN AN OVERLAND FLOW PATH/DRAIN.
6. NO DISTURBANCE TO VEGETATION IS TO TAKE PLACE BEYOND THE BOUNDARIES OF CURRENT STAGE OF DEVELOPMENT.
7. ALL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHOULD BE PROMPTLY AND PROGRESSIVELY STABILISED WHERE APPROPRIATE.
8. WHERE ACCESS TRACKS CROSS DIVERSION BUNDS TRAFFICABLE WHOA BOYS TO BE INSTALLED. WHOA BOYS TO BE MAINTAINED FOR LIFE OF PROJECT TO ENSURE FLOW DIVERSION IS MAINTAINED.
9. LIMIT OF CLEARING 20m FROM LEASE BOUNDARY FENCELINE OR EDGE OF ACCESS TRACKS.
AECOM
www.aecom.com
N
GEOCENTRIC DATUM OF AUSTRALIA 94
0 30 60 120
Metres
1:2,265 (when printed at A3)
Well
Amungee_fenceline
Lease Pad Layout
Lease Expansion Area
tamboran RESOURCES
LOCATION
Tamboran B2 Pty Ltd
Environmental Management Plan
Amungee NW
Erosion and Sediment Control Plan
PROJECT ID 60623736
CREATED BY david.vandenhoek
LAST MODIFIED 10-May-2023
VERSION 2
A3 size

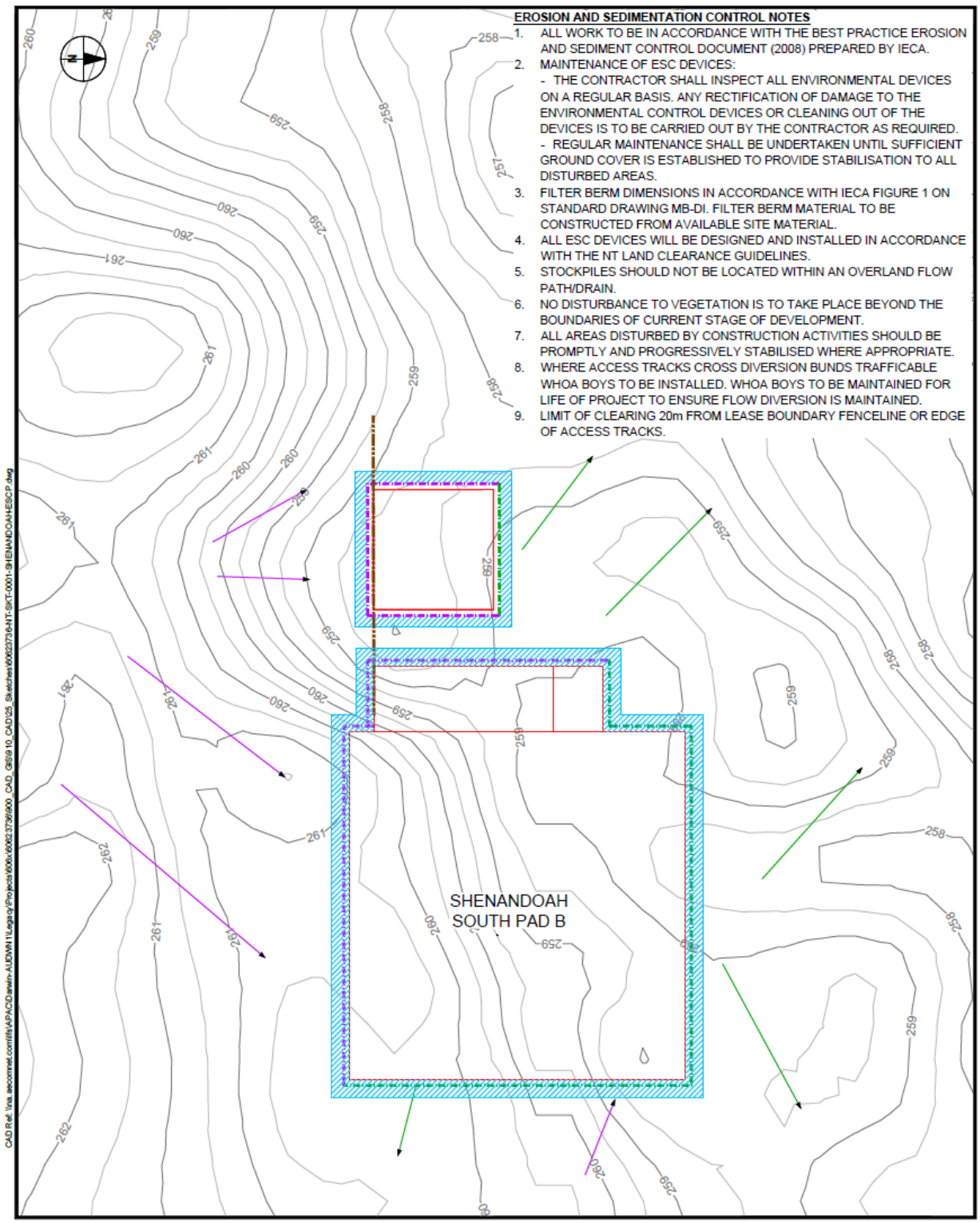

Flow Direction (Clean Water)
Flow Direction (Dirty Water)
Amungee NW-2
N
AECOM
www.aecom.com
Projection: GDA94 MGA Zone 53
0 25 50 100
Meters
Proposed Tracks
Clean Water
Dirty Water
Infrastructure
Water Diversion Line
tamboran RESOURCES
Tamboran B2 Pty Ltd
Environmental Management Plan
PROJECT ID 60480548
CREATED BY david.vanderhoek
LAST MODIFIED 08-Jul-2022
VERSION 1


LEGEND
EXISTING
CONTOURS
PROPOSED
FILTER BERM/LENGTH (DIRTY WATER)
FILTER BERM/LENGTH (CLEAN WATER)
FLOW DIRETION (DIRTY WATER)
FLOW DIRETION (CLEAN WATER)
CONTOURS (INDICATIVE ONLY)
NOTES:
1. ALL WORKS TO BE IN ACCORDANCE WITH THE INTERNATIONAL EROSION CONTROL ASSOCIATION (IECA) GUIDELINES.
2. TOPSOIL STRIPPING DEPTH ASSESSMENT MUST BE UNDERTAKEN IN ACCORDANCE WITH THE BEETALOO TOPSOIL STRIPPING TECHNICAL INSTRUCTION (NT-2050-15-TI-0001) AND AMELIORATION RATES AGREED WITH THE ORIGIN SUPERVISOR. THE EXPECTED NOMINAL TOPSOIL DEPTH FOR THE SITE IS 150mm. FINAL STRIP DEPTH TO BE CONFIRMED IN THE FIELD.
3. MAINTENANCE OF ESC DEVICES:
- THE CONTRACTOR SHALL INSPECT ALL ENVIRONMENTAL DEVICES ON A REGULAR BASIS. ANY RECTIFICATION OF DAMAGE TO THE ENVIRONMENTAL CONTROL DEVICES OR CLEANING OUT OF THE DEVICES IS TO BE CARRIED OUT BY THE CONTRACTOR AS REQUIRED.
- REGULAR MAINTENANCE SHALL BE UNDERTAKEN UNTIL SUFFICIENT GROUND COVER IS ESTABLISHED TO PROVIDE STABILISATION TO ALL DISTURBED AREAS.
4. FILTER BERM DIMENSIONS IN ACCORDANCE WITH IECA FIGURE 1 ON STANDARD DRAWING MB-01. FILTER BERM MATERIAL TO BE CONSTRUCTED FROM AVAILABLE SITE MATERIAL.
5. ALL ESC DEVICES WILL BE DESIGN AND INSTALLED IN ACCORDANCE WITH THE NT LAND CLEARANCE GUIDELINES.
6. THE CONTRACTOR MUST SUBMIT AN EROSION AND SEDIMENT CONTROL PLAN WHICH WILL BE APPROVED BY ORIGIN PRIOR TO MOBILISATION.
7. FINISH SURFACE LEVELS ARE TO FOLLOW EXISTING SURFACE LEVELS AS NEAR AS POSSIBLE AND TO THE GRADES SPECIFIED ON THE DRAWINGS.
8. HARDSTAND AND LEASE PAD FINISHED SURFACE LEVELS TO BE EQUAL OR SMOOTH TRANSITION TO AVOID BATTERS OR STEPS.
7. FINAL DRILLING LEASE PAD AREA GRADE TO BE CONFIRMED ON SITE BY ORIGIN SITE SUPERVISOR.
KEY PLAN
CERTIFICATION
EROSION AND SEDIMENT CONTROL PLAN
SCALE: 1200@A1
ISSUED FOR REVIEW
This drawing is confidential and shall only be used for the purposes of this project.
SCALE (@A1) 0 10 20 30 40 50 1:1000 (A1)
A JG 05.06.2023 ISSUED FOR REVIEW JJ
DESIGNED NM CHECKED JJ
DRAWN JG CHECKED NM
APPROVED JJ DATE 05.06.2023
AECOM
AECOM Australia Pty Ltd
A.B.N 20 093 846 925
www.aecom.com
NEWCASTLE
tamboran RESOURCES
TAMBORAN BEETALOO JV STAGE 4 CIVIL CONSTRUCTION
AMUNGEE NW3
DRILL PAD, ACCOMMODATION AND WATER TANK
EROSION AND SEDIMENT CONTROL PLAN
CONCEPT DESIGN
C-0401
A


Flow Direction (Clean Water)
Flow Direction (Dirty Water)
Amungee NW-4
N
AECOM
www.aecom.com
Projection: GDA94 MGA Zone 53
0 25 50 100
Meters
Proposed Tracks
Infrastructure
Clean Water
Water Diversion Line
Dirty Water
tamboran RESOURCES
Tamboran B2 Pty Ltd
Environmental Management Plan
PROJECT ID 60480648
CREATED BY david.vandonkoek
LAST MODIFIED 08-Jul-2022
VERSION 1


Flow Direction (Clean Water)
Flow Direction (Dirty Water)
Amungee NW-5
N
AECOM
www.aecom.com
Projection: GDA94 MGA Zone 53
0 25 50 100
Meters
Proposed Tracks
Clean Water
Dirty Water
Infrastructure
Water Diversion Line
tamboran RESOURCES
Tamboran B2 Pty Ltd
Environmental Management Plan
PROJECT ID 60480548
CREATED BY david.vandonkhook
LAST MODIFIED 06-Jul-2022
VERSION 1


EROSION AND SEDIMENTATION CONTROL NOTES
1. ALL WORK TO BE IN ACCORDANCE WITH THE BEST PRACTICE EROSION AND SEDIMENT CONTROL DOCUMENT (2008) PREPARED BY IECA.
2. MAINTENANCE OF ESC DEVICES:
- THE CONTRACTOR SHALL INSPECT ALL ENVIRONMENTAL DEVICES ON A REGULAR BASIS. ANY RECTIFICATION OF DAMAGE TO THE ENVIRONMENTAL CONTROL DEVICES OR CLEANING OUT OF THE DEVICES IS TO BE CARRIED OUT BY THE CONTRACTOR AS REQUIRED.
- REGULAR MAINTENANCE SHALL BE UNDERTAKEN UNTIL SUFFICIENT GROUND COVER IS ESTABLISHED TO PROVIDE STABILISATION TO ALL DISTURBED AREAS.
3. FILTER BERM DIMENSIONS IN ACCORDANCE WITH IECA FIGURE 1 ON STANDARD DRAWING MB-DI. FILTER BERM MATERIAL TO BE CONSTRUCTED FROM AVAILABLE SITE MATERIAL.
4. ALL ESC DEVICES WILL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH THE NT LAND CLEARANCE GUIDELINES.
5. STOCKPILES SHOULD NOT BE LOCATED WITHIN AN OVERLAND FLOW PATH/DRAIN.
6. NO DISTURBANCE TO VEGETATION IS TO TAKE PLACE BEYOND THE BOUNDARIES OF CURRENT STAGE OF DEVELOPMENT.
7. ALL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHOULD BE PROMPTLY AND PROGRESSIVELY STABILISED WHERE APPROPRIATE.
8. WHERE ACCESS TRACKS CROSS DIVERSION BUNDS TRAFFICABLE WHOA BOYS TO BE INSTALLED. WHOA BOYS TO BE MAINTAINED FOR LIFE OF PROJECT TO ENSURE FLOW DIVERSION IS MAINTAINED.
9. LIMIT OF CLEARING 20m FROM LEASE BOUNDARY FENCELINE OR EDGE OF ACCESS TRACKS.
SHENANDOAH SOUTH PAD A
CAD Ref: \\na.aecomnet.com\ilis\APAC\Darwin-AUDWN1\Legacy\Projects\60x\60623736\900_CAD_GIS\10_CAD\25_Sketches\60623736-HT-SKT-0001-SHENANDOAHESCP.dwg
Last modified: 23 Jun 23 - 13:07
AECOM
0 2.0 4
1:250 m
LEGEND
PROPOSED TRACKS
CLEAN WATER
DIRTY WATER
FLOW DIRECTION (CLEAN WATER)
FLOW DIRECTION (DIRTY WATER)
INFRASTRUCTURE
WATER DIVERSION LINE
EXISTING CONTOURS
245 MAJOR
MINOR
TAMBORAN RESOURCES
SHENANDOAH SOUTH PAD A
Figure 4
CREATED BY J.GRIFFEN
PROJECT ID : 60623736
REV 1
23 June 2023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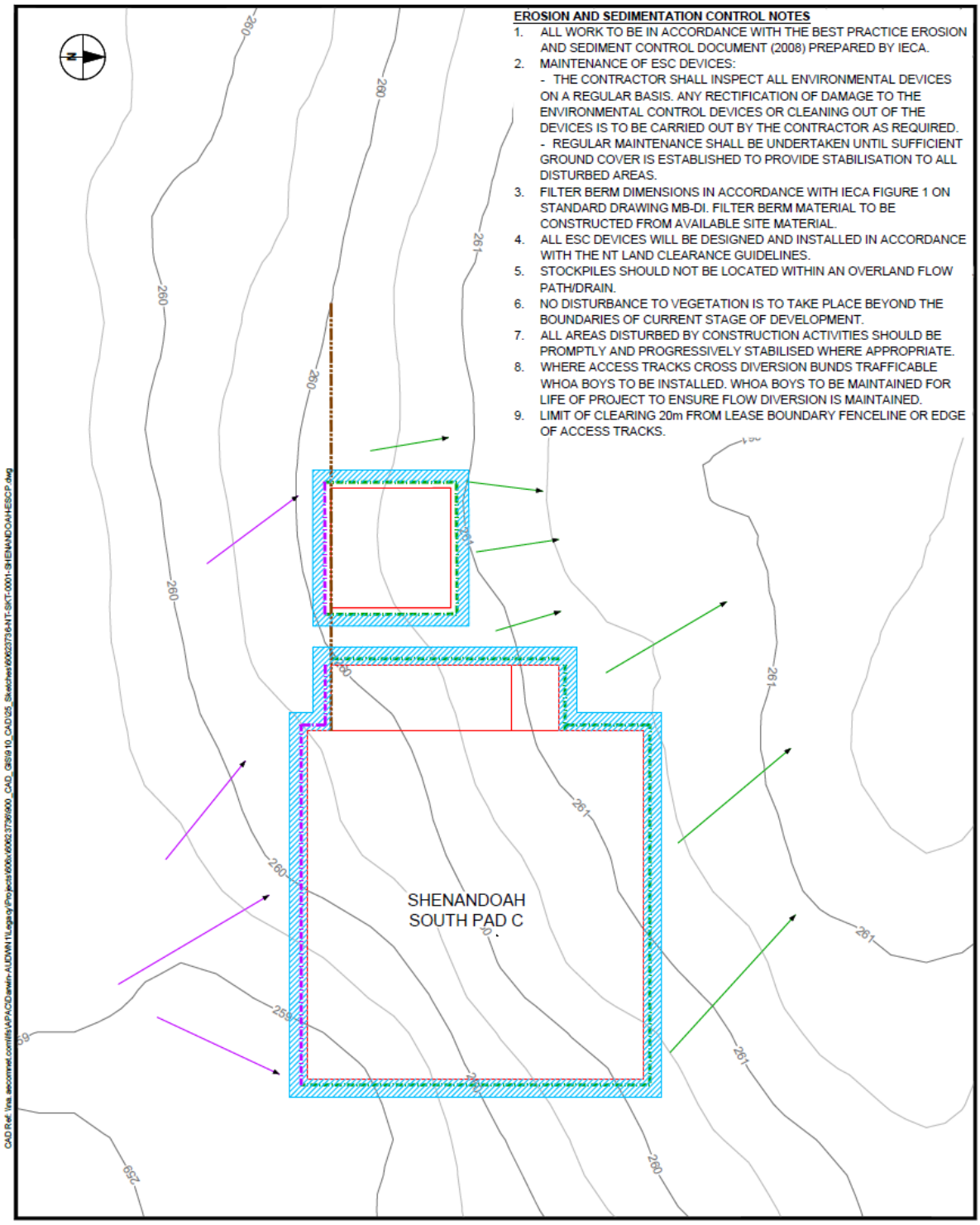
SHENANDOAH
SOUTH PAD B
AECOM
LEGEND
PROPOSED TRACKS
CLEAN WATER
DIRTY WATER
FLOW DIRECTION (CLEAN WATER)
FLOW DIRECTION (DIRTY WATER)
INFRASTRUCTURE
WATER DIVERSION LINE
EXISTING CONTOURS
245 MAJOR
MINOR
0 2.0 4
1:250 m
TAMBORAN RESOURCES
SHENANDOAH SOUTH PAD B
Figure 5
CREATED BY J.GRIFFEN
PROJECT ID : 60623736
REV 1
23 June 2023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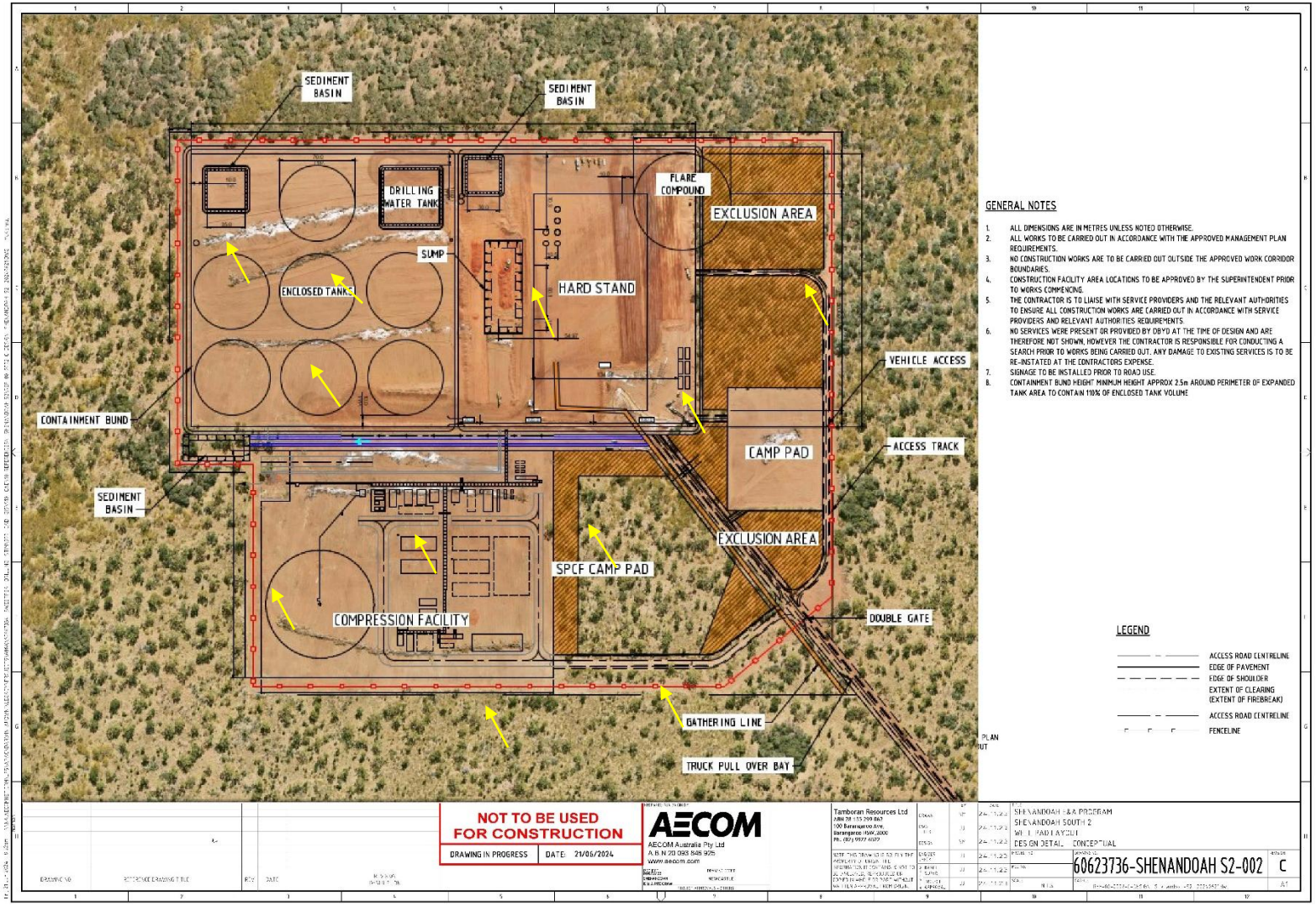
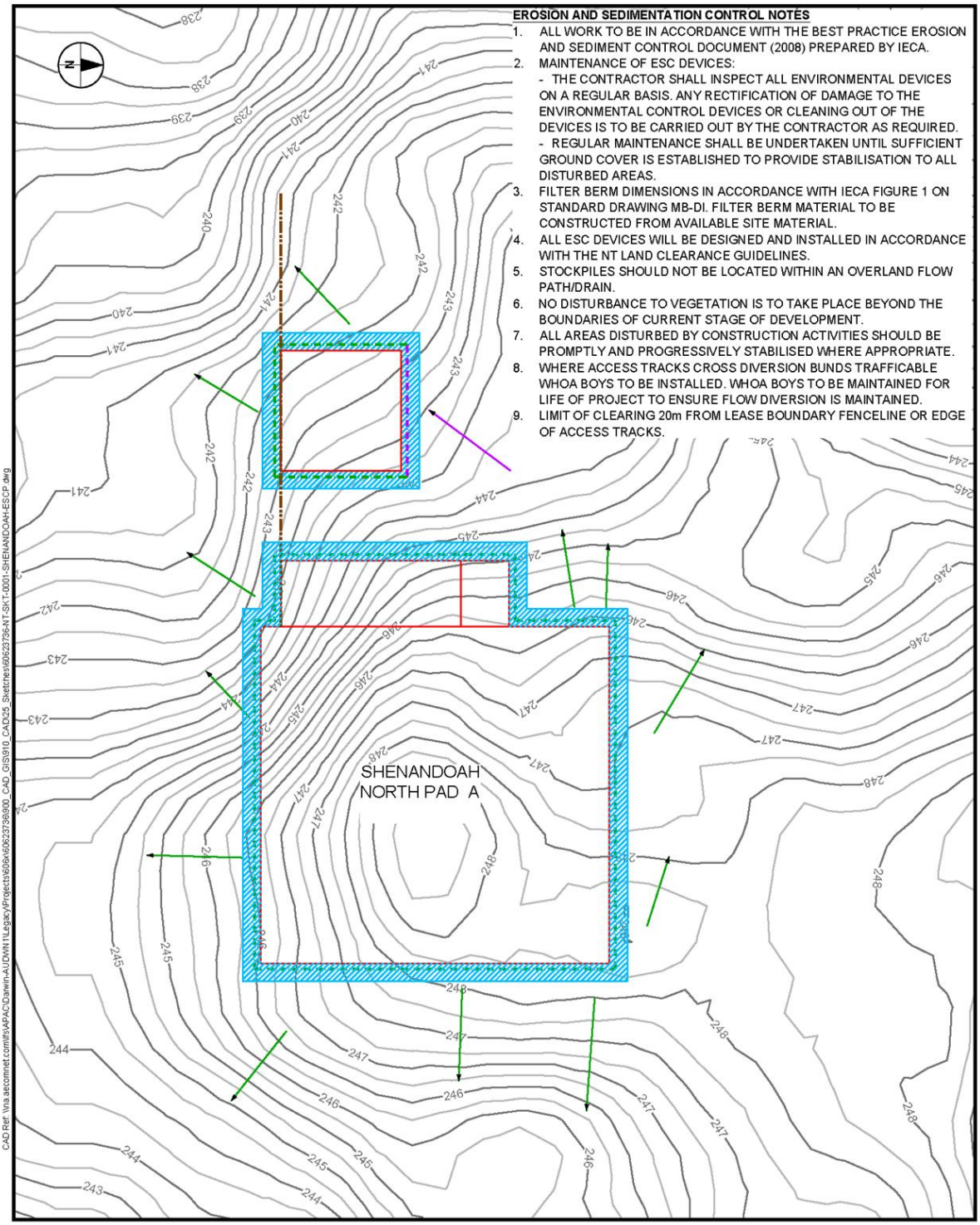
SHENANDOAH SOUTH PAD C
AECOM
LEGEND
PROPOSED TRACKS
CLEAN WATER
DIRTY WATER
FLOW DIRECTION (CLEAN WATER)
FLOW DIRECTION (DIRTY WATER)
INFRASTRUCTURE
WATER DIVERSION LINE
EXISTING CONTOURS
MAJOR
MINOR
0 2.0 4
1:250 m
TAMBORAN RESOURCES
SHENANDOAH SOUTH PAD C
Figure 6
CREATED BY J.GRIFFEN
PROJECT ID : 60623736
REV 1
23 June 2023



NB: This ESCP shows the directional flow for the Shenandoah S2 site, including the proposed integration between the well site and the SPCF.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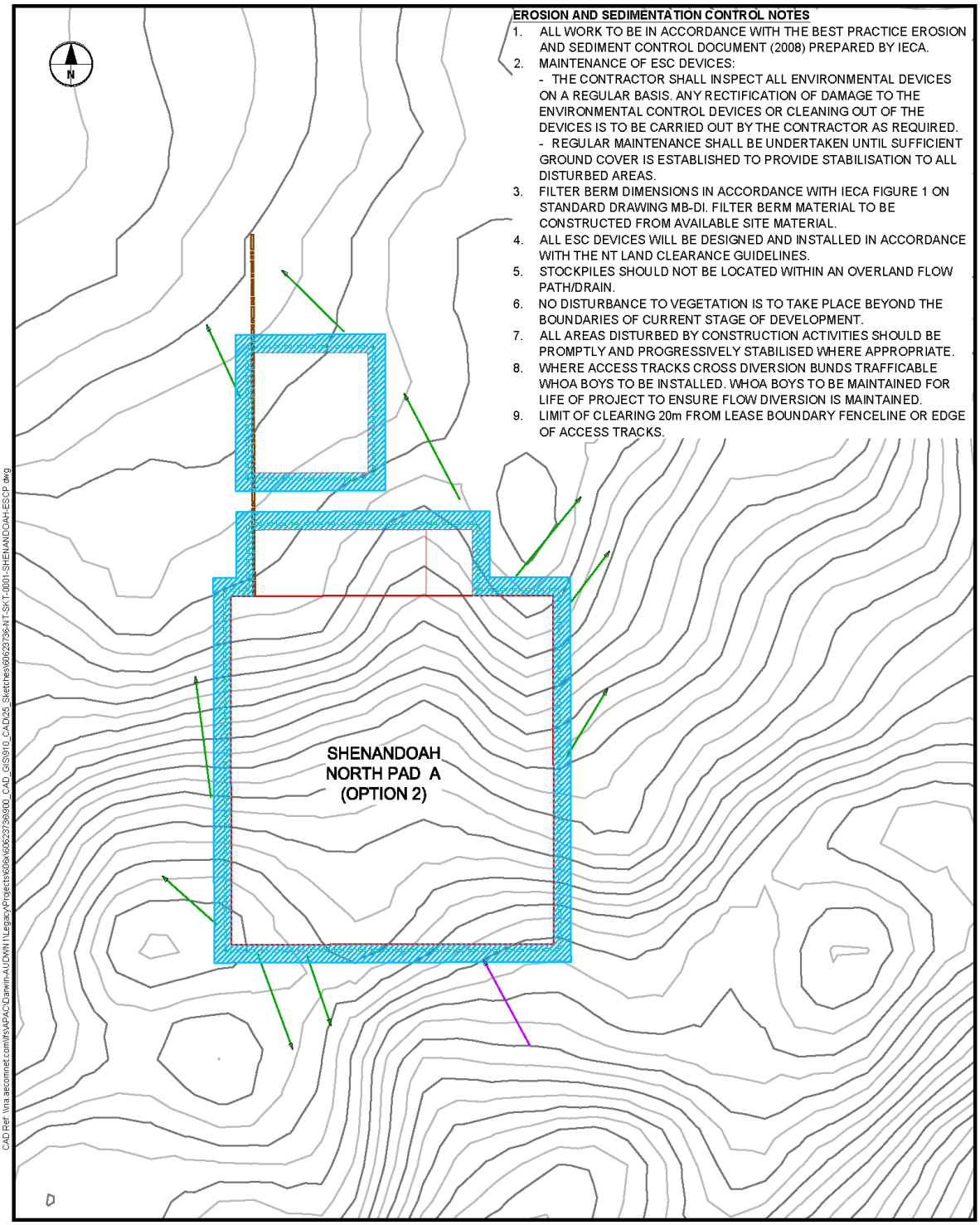
9. LIMIT OF CLEARING 20m FROM LEASE BOUNDARY FENCELINE OR EDGE OF ACCESS TRACKS.
SHENANDOAH NORTH PAD A
N
CAD Ref: \\na.aecomnet.com\fs\APAC\Darwin-AU\DWN1\Legacy\Projects\60\60623736\900_CAD_GIS\910_CAD\25_Sketches\60623736-NT-SKT-0001-SHENANDOAH-ESCP.dwg
Last modified: 02 Aug 23 - 10:35
AECOM
0 2.0 4
1:250 m
LEGEND
PROPOSED TRACKS
CLEAN WATER
DIRTY WATER
FLOW DIRECTION (CLEAN WATER)
FLOW DIRECTION (DIRTY WATER)
INFRASTRUCTURE
WATER DIVERSION LINE
EXISTING CONTOURS
245 MAJOR
MINOR
TAMBORAN RESOURCES
SHENANDOAH NORTH PAD A (OPTION 1)
Figure 1
CREATED BY J.GRIFFEN
PROJECT ID : 60623736
REV 1
2 August 2023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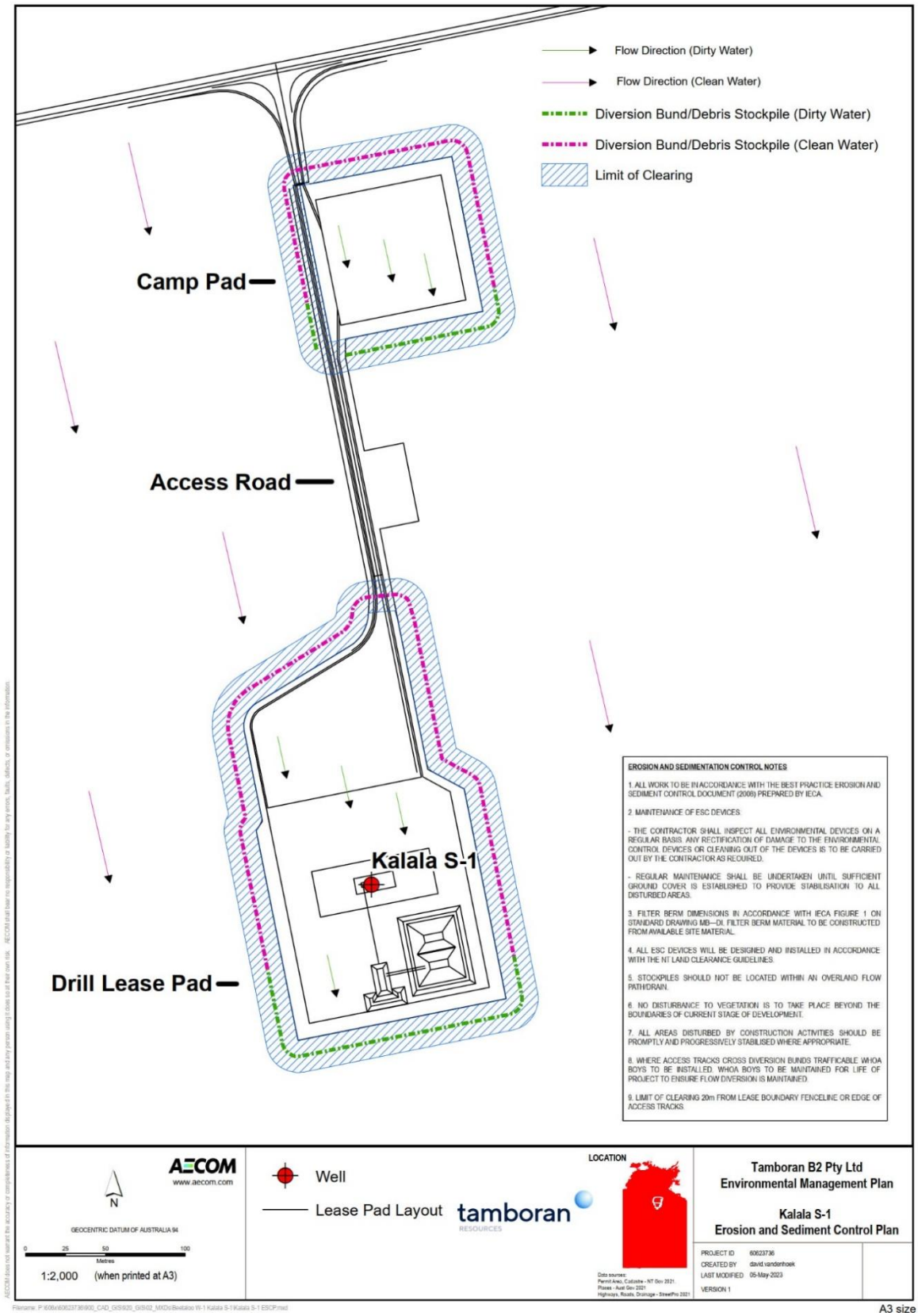
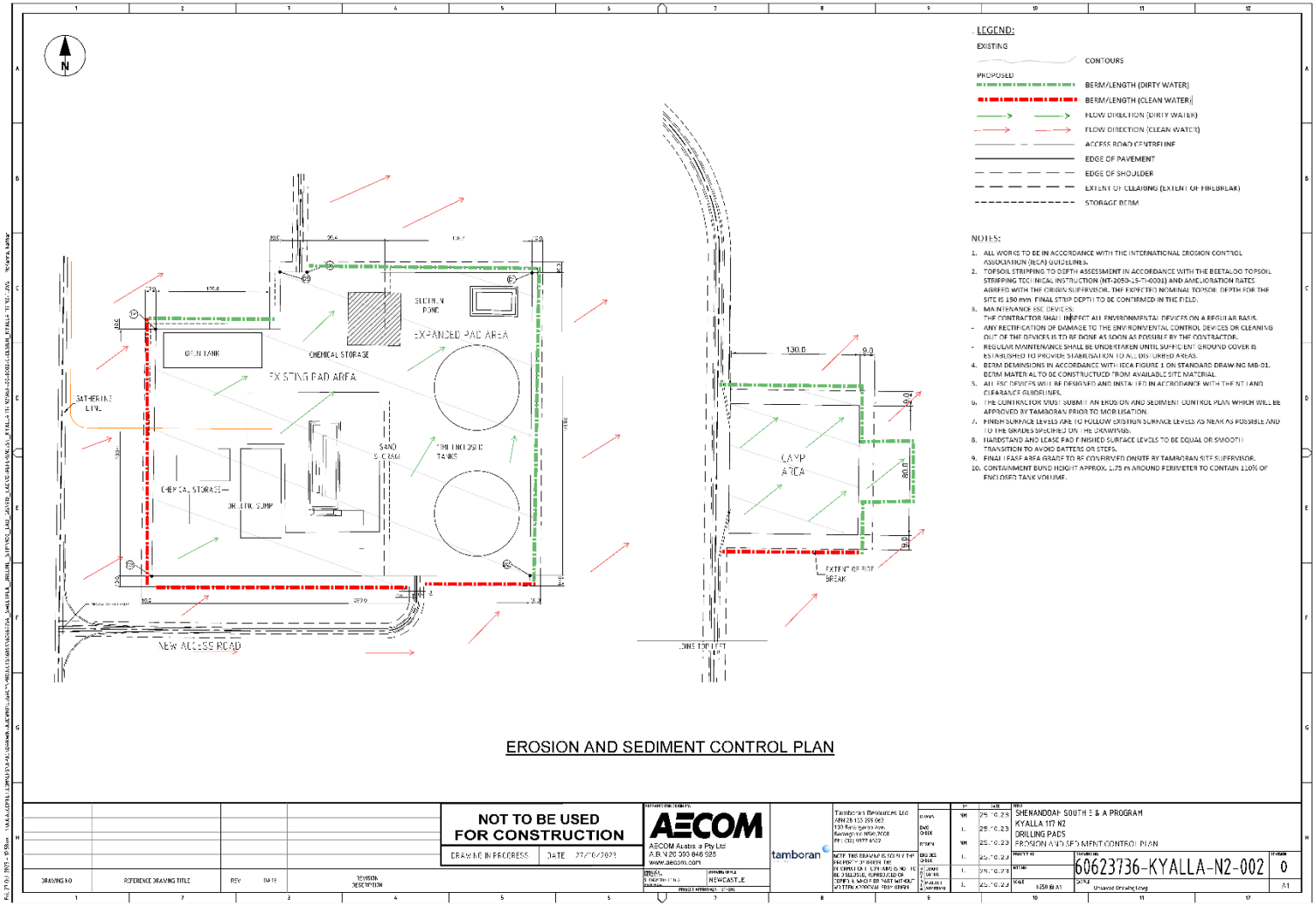
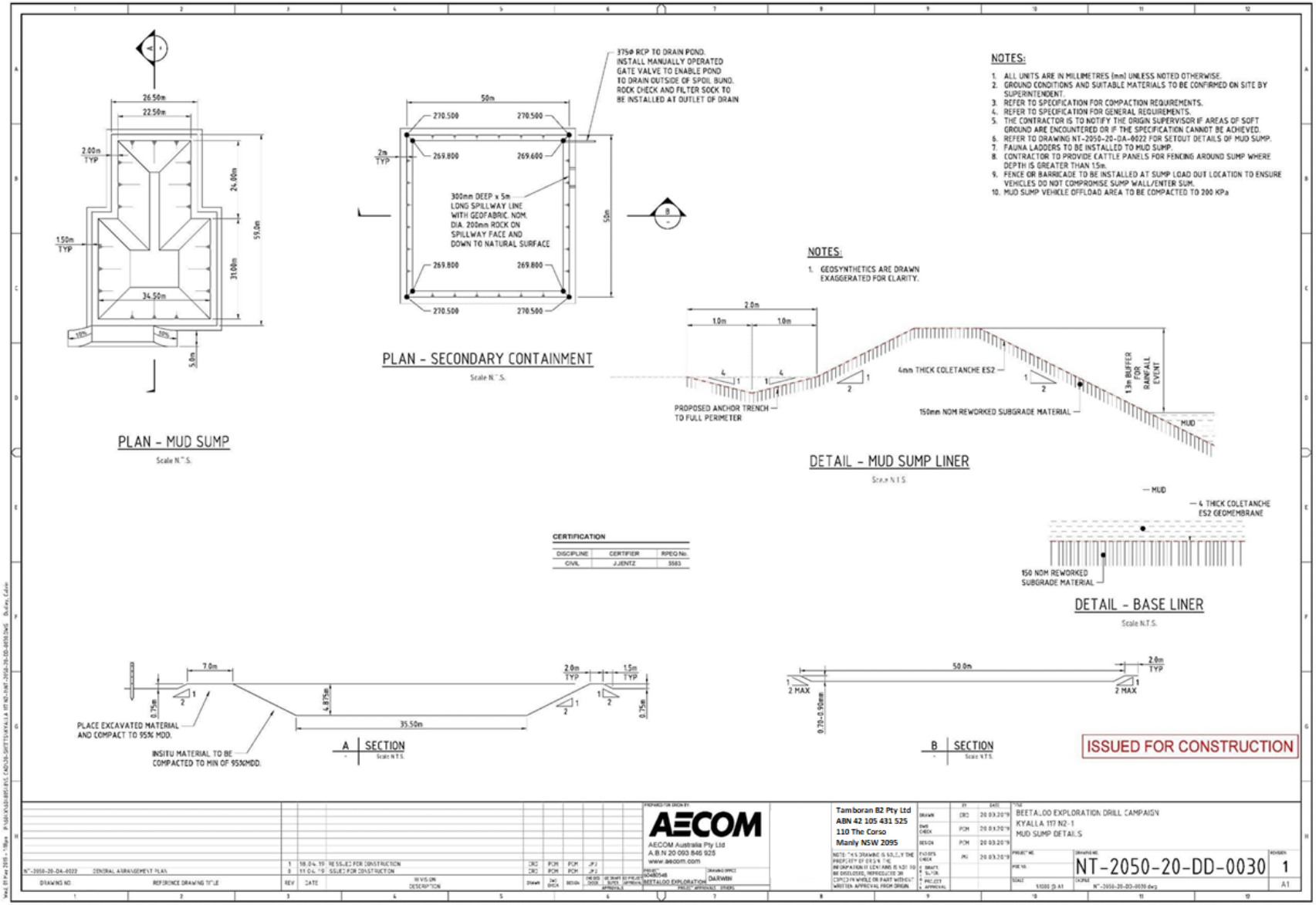
N
SHENANDOAH NORTH PAD A (OPTION 2)
CAD Ref: \\na.aecomnet.com\ifs\APAC\Darwin\AUDWN1\Legacy\Projects\60x\60623736\900_CAD_GIS\910_CAD\05_Sketches\60623736-NT-SKT-0001-SHENANDOAH-ESCP.dwg
Last modified: 02 Aug 23 - 10:35
AECOM
0
2.0
4
1:250 m
LEGEND
PROPOSED TRACKS
CLEAN WATER
DIRTY WATER
FLOW DIRECTION (CLEAN WATER)
FLOW DIRECTION (DIRTY WATER)
INFRASTRUCTURE
WATER DIVERSION LINE
EXISTING CONTOURS
245 MAJOR
MINOR
TAMBORAN RESOURCES
SHENANDOAH NORTH PAD A (OPTION 2)
Figure 2
CREATED BY J.GRIFFEN
PROJECT ID : 60623736
REV 1
2 August 2023

Appendix F Erosion and sediment control plan for Kalala S1



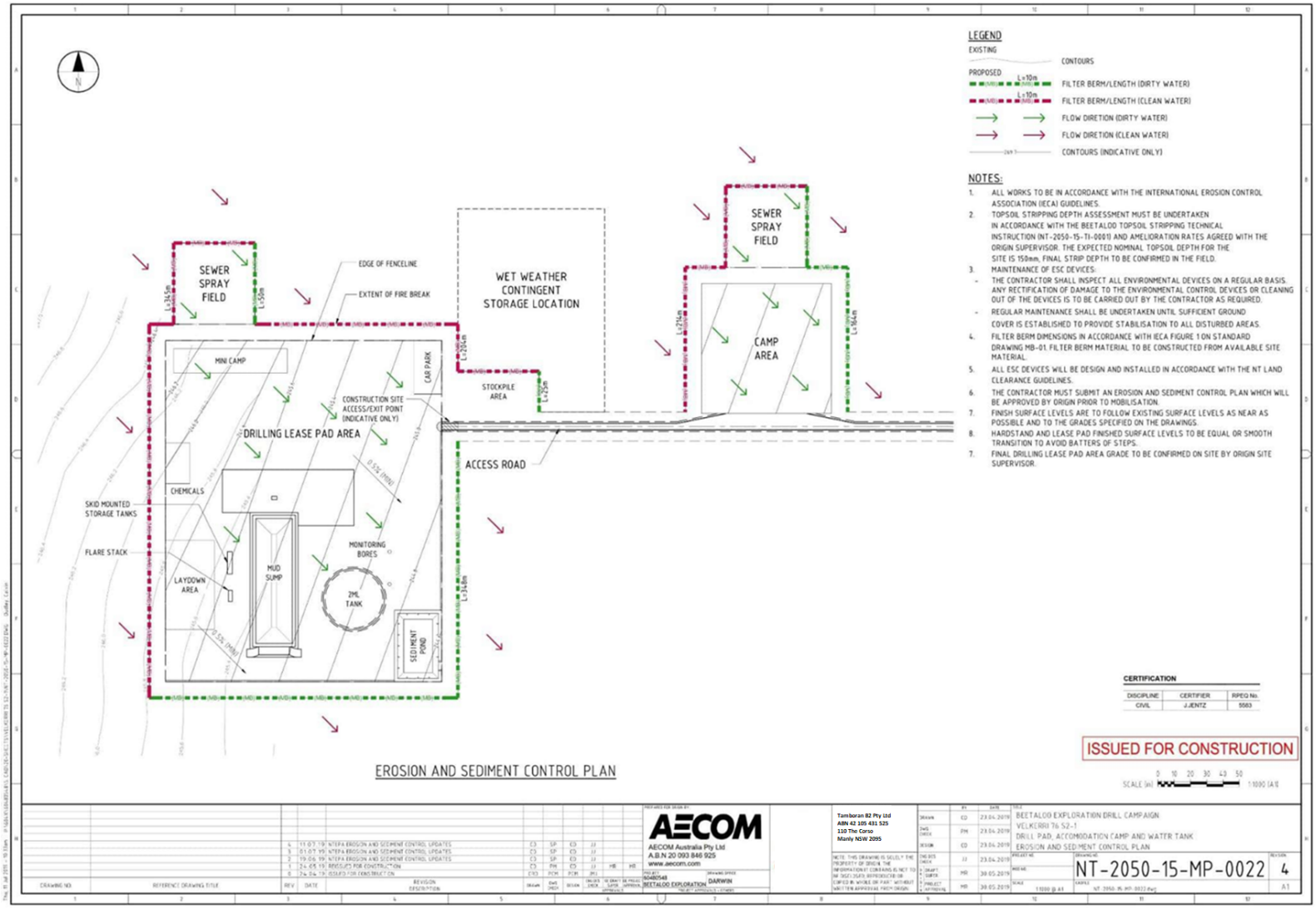
Appendix G Erosion and sediment control plan for Kyalla 117-N2

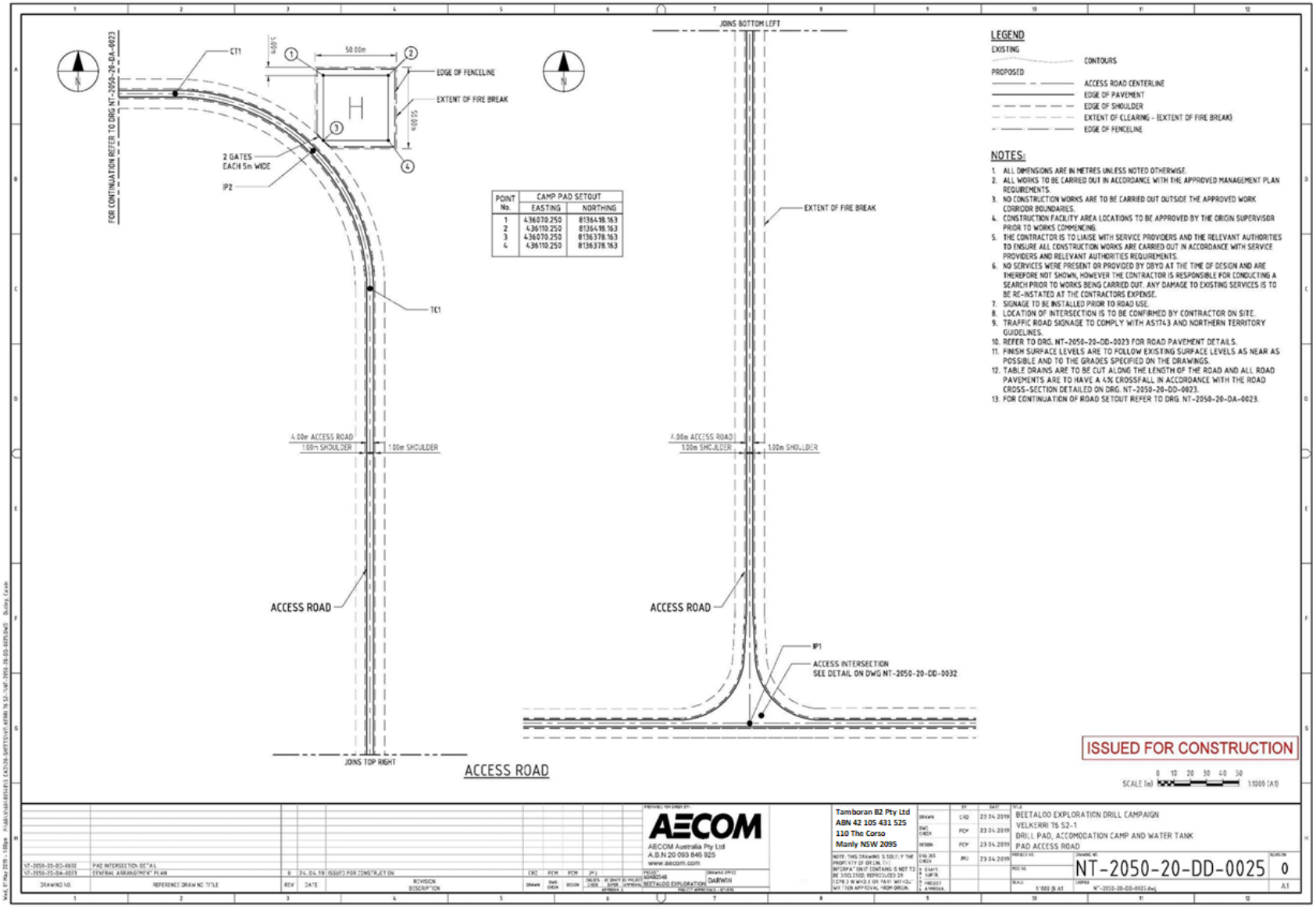


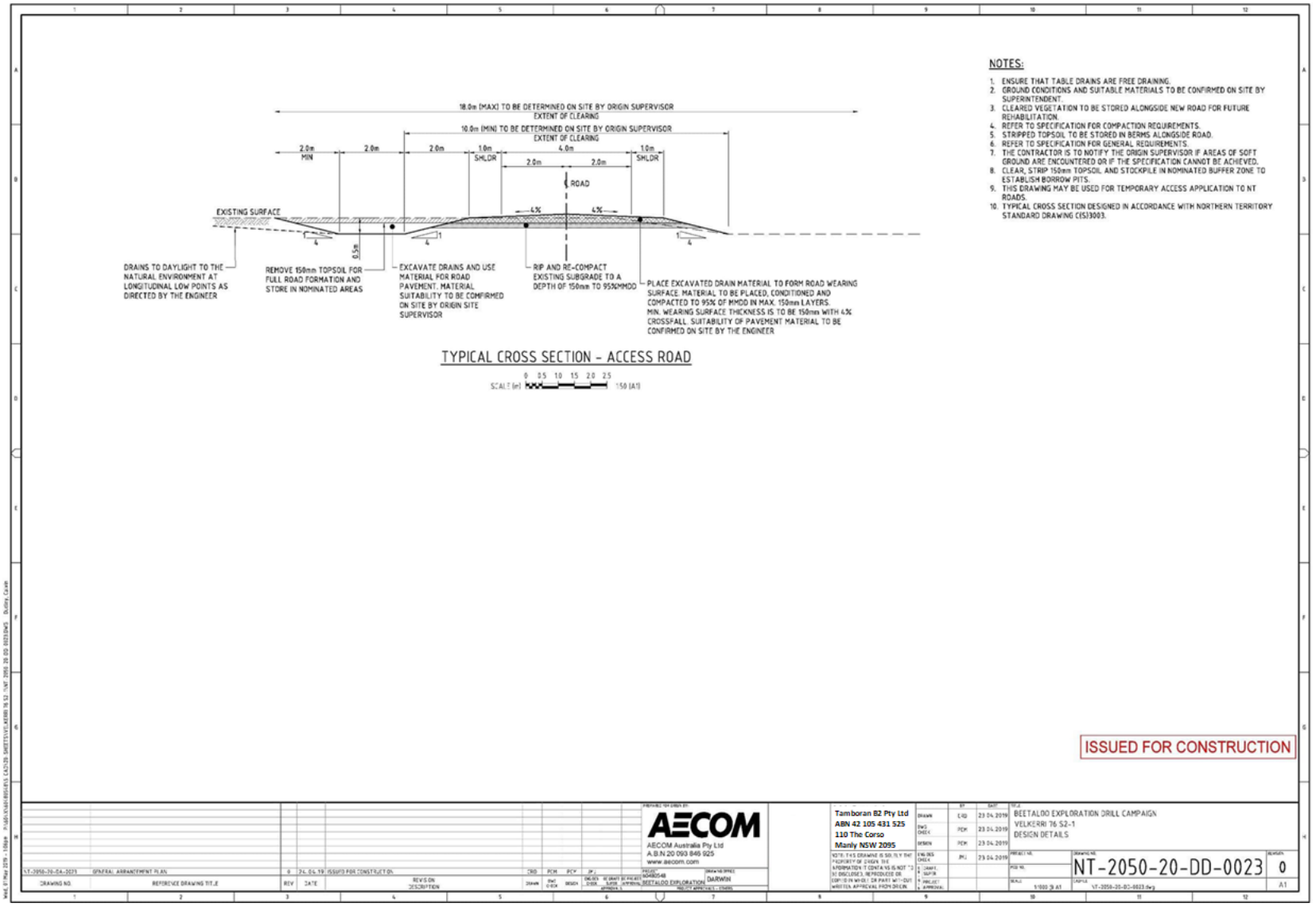


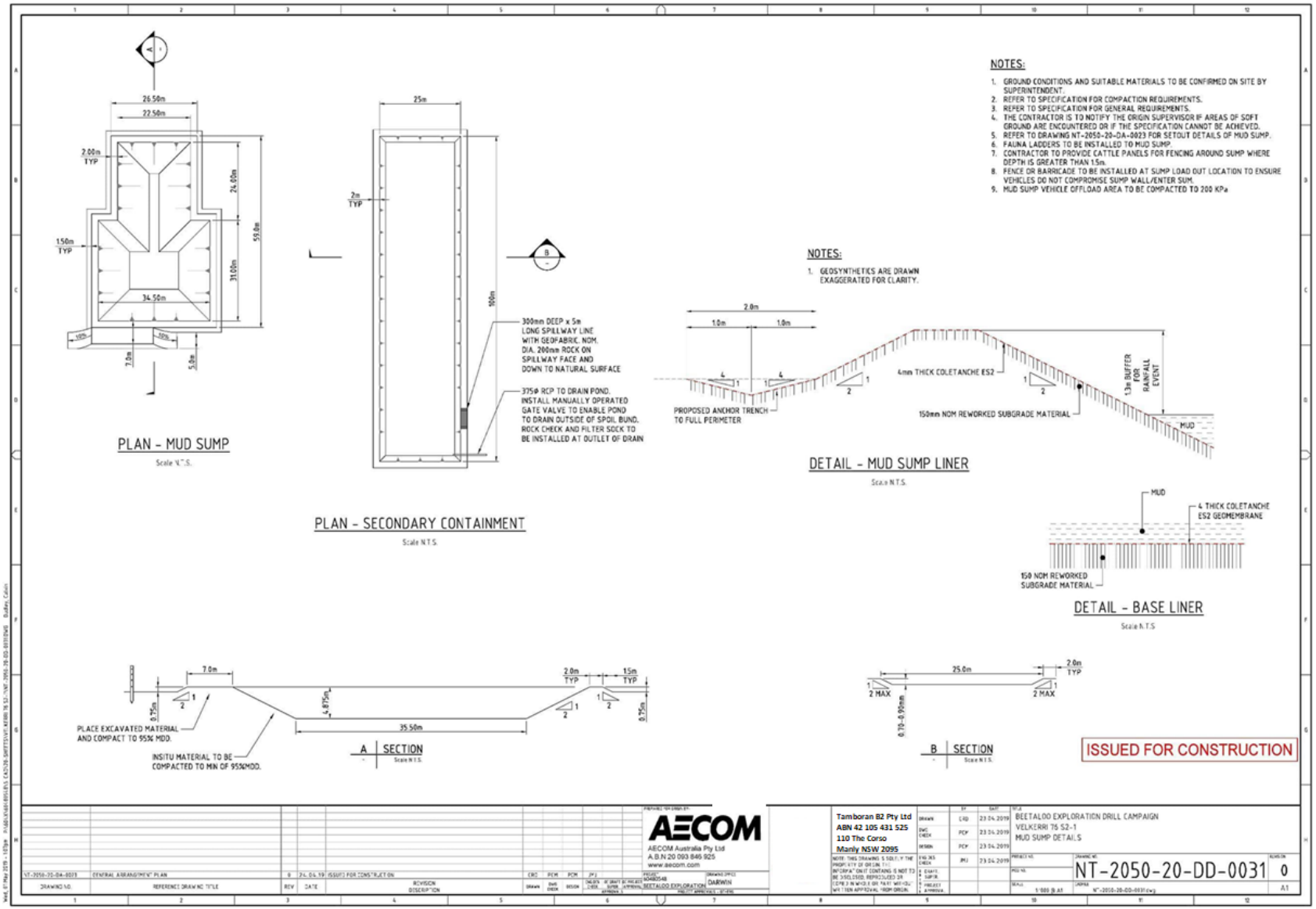
Review due: 01/10/26

Appendix H Erosion and sediment control plan for Velkerri 76 S2



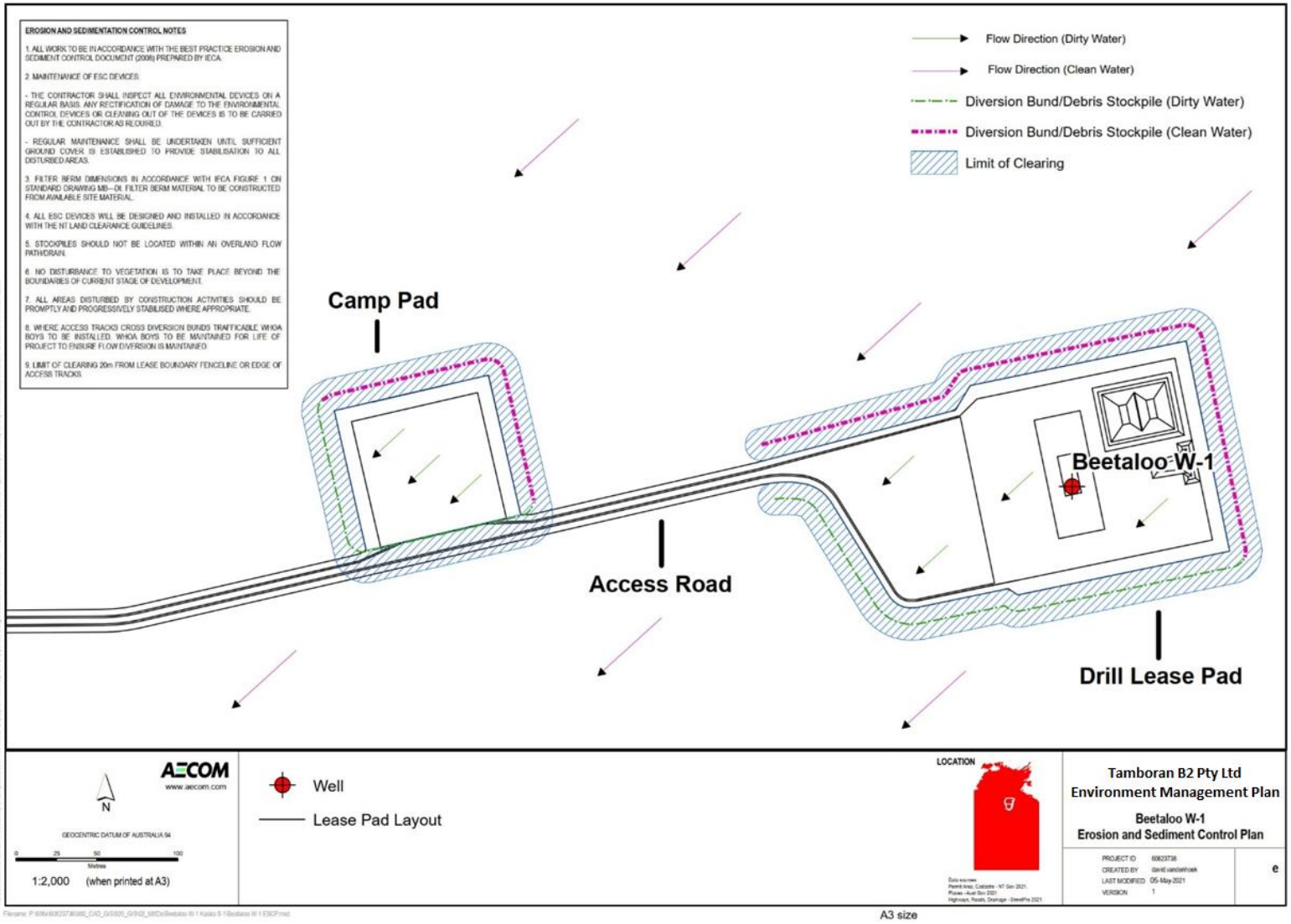

FOR CONTINUATION REFER TO DRG NT-2050-20-DA-0023
CT1
50.00m
EDGE OF FENCELINE
EXTENT OF FIRE BREAK
2 GATES EACH 5m WIDE
IP2
TC1
4.00m ACCESS ROAD
1.00m SHOULDER
1.00m SHOULDER
ACCESS ROAD
JOINS TOP RIGHT
ACCESS ROAD
JOINS BOTTOM LEFT
EXTENT OF FIRE BREAK
4.00m ACCESS ROAD
1.00m SHOULDER
1.00m SHOULDER
ACCESS ROAD
IP1
ACCESS INTERSECTION
SEE DETAIL ON DWG NT-2050-20-DD-0032
POINT No.
CAMP PAD SETOUT
EASTING
NORTHING
1 436070.250 8136498.163
2 436110.250 8136498.163
3 436070.250 8136378.163
4 436110.250 8136378.163
LEGEND
EXISTING
CONTOURS
PROPOSED
ACCESS ROAD CENTERLINE
EDGE OF PAVEMENT
EDGE OF SHOULDER
EXTENT OF CLEARING - (EXTENT OF FIRE BREAK)
EDGE OF FENCELINE
NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED MANAGEMENT PLAN REQUIREMENTS.
3. NO CONSTRUCTION WORKS ARE TO BE CARRIED OUT OUTSIDE THE APPROVED WORK CORRIDOR BOUNDARIES.
4. CONSTRUCTION FACILITY AREA LOCATIONS TO BE APPROVED BY THE ORIGIN SUPERVISOR PRIOR TO WORKS COMMENCING.
5. THE CONTRACTOR IS TO LIAISE WITH SERVICE PROVIDERS AND THE RELEVANT AUTHORITIES TO ENSURE ALL CONSTRUCTION WORKS ARE CARRIED OUT IN ACCORDANCE WITH SERVICE PROVIDERS AND RELEVANT AUTHORITIES REQUIREMENTS.
6. NO SERVICES WERE PRESENT OR PROVIDED BY DBYD AT THE TIME OF DESIGN AND ARE THEREFORE NOT SHOWN, HOWEVER THE CONTRACTOR IS RESPONSIBLE FOR CONDUCTING A SEARCH PRIOR TO WORKS BEING CARRIED OUT. ANY DAMAGE TO EXISTING SERVICES IS TO BE RE-INSTATED AT THE CONTRACTORS EXPENSE.
7. SIGNAGE TO BE INSTALLED PRIOR TO ROAD USE.
8. LOCATION OF INTERSECTION IS TO BE CONFIRMED BY CONTRACTOR ON SITE.
9. TRAFFIC ROAD SIGNAGE TO COMPLY WITH AS1743 AND NORTHERN TERRITORY GUIDELINES.
10. REFER TO DRG. NT-2050-20-DD-0023 FOR ROAD PAVEMENT DETAILS.
11. FINISH SURFACE LEVELS ARE TO FOLLOW EXISTING SURFACE LEVELS AS NEAR AS POSSIBLE AND TO THE GRADES SPECIFIED ON THE DRAWINGS.
12. TABLE DRAINS ARE TO BE CUT ALONG THE LENGTH OF THE ROAD AND ALL ROAD PAVEMENTS ARE TO HAVE A 4% CROSSFALL IN ACCORDANCE WITH THE ROAD CROSS-SECTION DETAILED ON DRG. NT-2050-20-DD-0023.
13. FOR CONTINUATION OF ROAD SETOUT REFER TO DRG. NT-2050-20-DA-0023.
ISSUED FOR CONSTRUCTION
SCALE (m) 0 10 20 30 40 50 1:1000 (A1)
AECOM
AECOM Australia Pty Ltd
A.B.N 20 093 846 925
www.aecom.com
DARWIN
Tamboran B2 Pty Ltd
ABN 42 105 431 525
110 The Corso
Manly NSW 2095
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DRILL PAD, ACCOMODATION CAMP AND WATER TANK
PAD ACCESS ROAD
NT-2050-20-DD-0025
0
A1


18.0m (MAX) TO BE DETERMINED ON SITE BY ORIGIN SUPERVISOR
EXTENT OF CLEARING
10.0m (MIN) TO BE DETERMINED ON SITE BY ORIGIN SUPERVISOR
EXTENT OF CLEARING
2.0m MIN
2.0m
2.0m
1.0m SHLDR
4.0m
2.0m
2.0m
1.0m SHLDR
ROAD
EXISTING SURFACE
4%
4%
0.5m
DRAINS TO DAYLIGHT TO THE NATURAL ENVIRONMENT AT LONGITUDINAL LOW POINTS AS DIRECTED BY THE ENGINEER
REMOVE 150mm TOPSOIL FOR FULL ROAD FORMATION AND STORE IN NOMINATED AREAS
EXCAVATE DRAINS AND USE MATERIAL FOR ROAD PAVEMENT. MATERIAL SUITABILITY TO BE CONFIRMED ON SITE BY ORIGIN SITE SUPERVISOR
RIP AND RE-COMPACT EXISTING SUBGRADE TO A DEPTH OF 150mm TO 95%MMDD
PLACE EXCAVATED DRAIN MATERIAL TO FORM ROAD WEARING SURFACE. MATERIAL TO BE PLACED, CONDITIONED AND COMPACTED TO 95% OF MMDD IN MAX. 150mm LAYERS. MIN. WEARING SURFACE THICKNESS IS TO BE 150mm WITH 4% CROSSFALL. SUITABILITY OF PAVEMENT MATERIAL TO BE CONFIRMED ON SITE BY THE ENGINEER
TYPICAL CROSS SECTION - ACCESS ROAD
0 0.5 1.0 1.5 2.0 2.5
SCALE (m) 1:50 (A1)
NOTES:
1. ENSURE THAT TABLE DRAINS ARE FREE DRAINING.
2. GROUND CONDITIONS AND SUITABLE MATERIALS TO BE CONFIRMED ON SITE BY SUPERINTENDENT.
3. CLEARED VEGETATION TO BE STORED ALONGSIDE NEW ROAD FOR FUTURE REHABILITATION.
4. REFER TO SPECIFICATION FOR COMPACTION REQUIREMENTS.
5. STRIPPED TOPSOIL TO BE STORED IN BERMS ALONGSIDE ROAD.
6. REFER TO SPECIFICATION FOR GENERAL REQUIREMENTS.
7. THE CONTRACTOR IS TO NOTIFY THE ORIGIN SUPERVISOR IF AREAS OF SOFT GROUND ARE ENCOUNTERED OR IF THE SPECIFICATION CANNOT BE ACHIEVED.
8. CLEAR, STRIP 150mm TOPSOIL AND STOCKPILE IN NOMINATED BUFFER ZONE TO ESTABLISH BORROW PITS.
9. THIS DRAWING MAY BE USED FOR TEMPORARY ACCESS APPLICATION TO NT ROADS.
10. TYPICAL CROSS SECTION DESIGNED IN ACCORDANCE WITH NORTHERN TERRITORY STANDARD DRAWING CI(S)3003.
ISSUED FOR CONSTRUCTION
AECOM
AECOM Australia Pty Ltd
A.B.N 20 093 846 925
www.aecom.com
Tamboran B2 Pty Ltd
ABN 42 105 431 525
110 The Corso
Manly NSW 2095
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DESIGN DETAILS
NT-2050-20-DD-0023
0
A1
1:100 @ A1
0 24.04.19 ISSUED FOR CONSTRUCTION

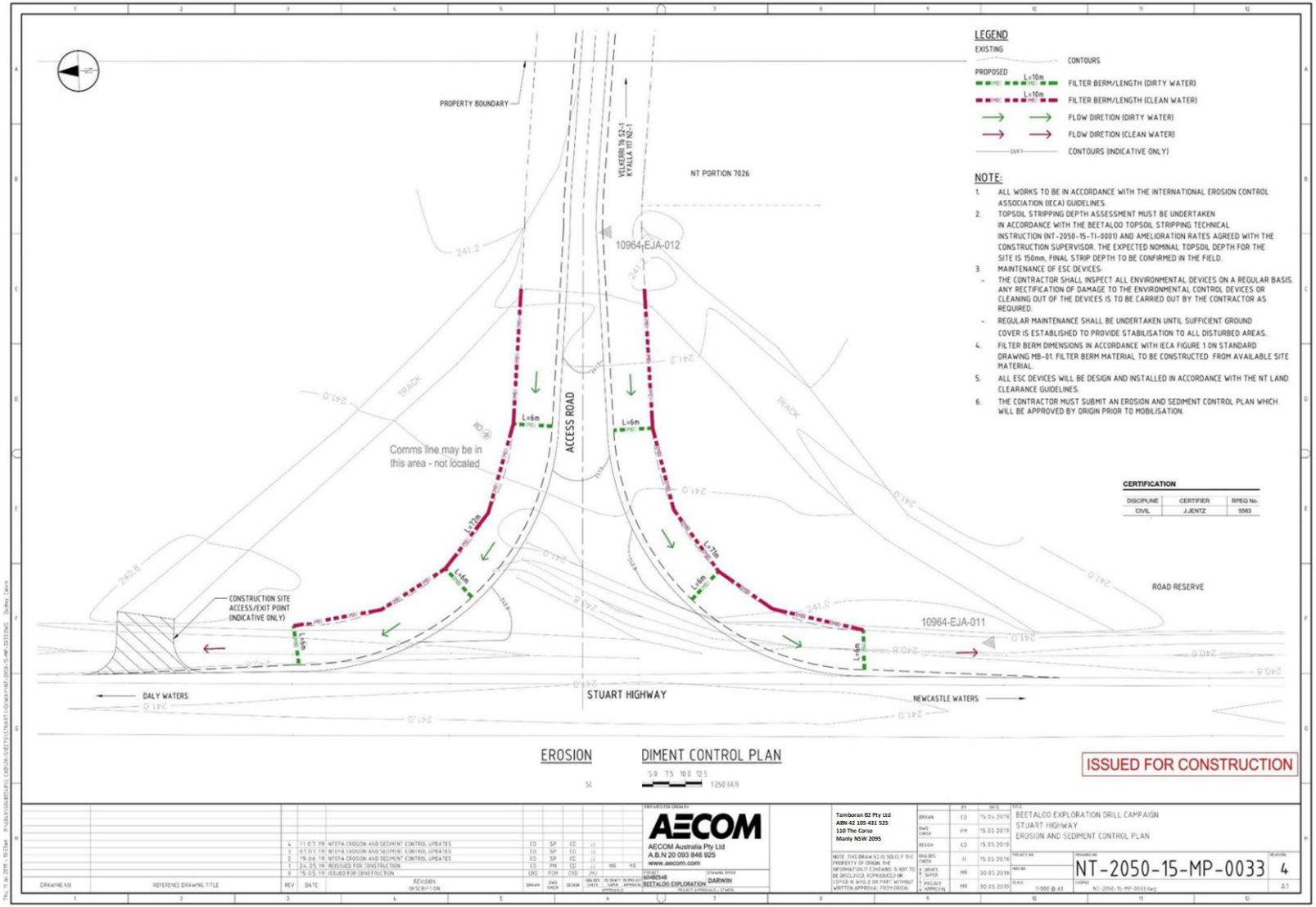


Review due: 01/10/26

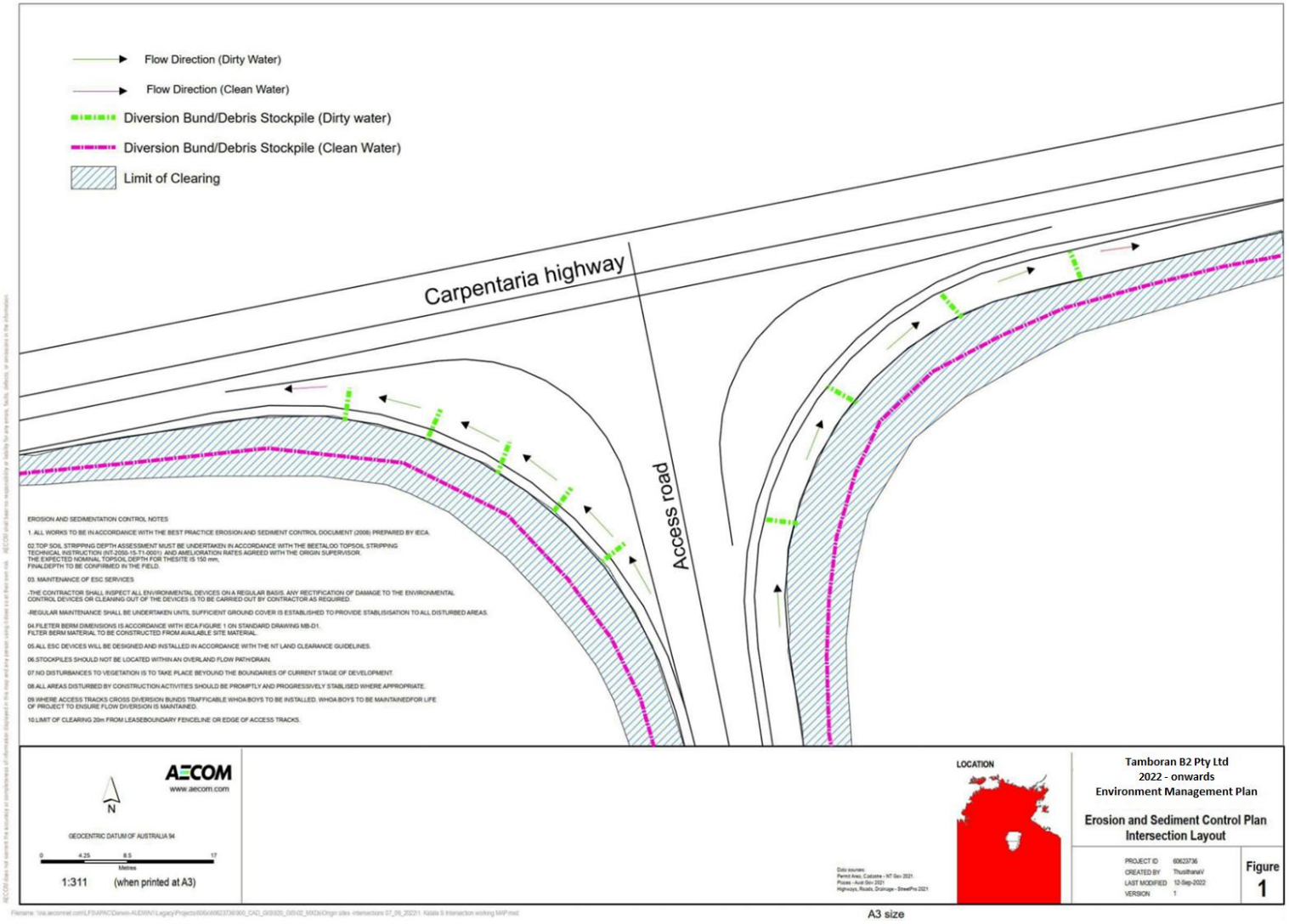
Appendix I Erosion and sediment control plan for Beetaloo W



Appendix J Erosion and sediment control plan for Stuart Highway intersection

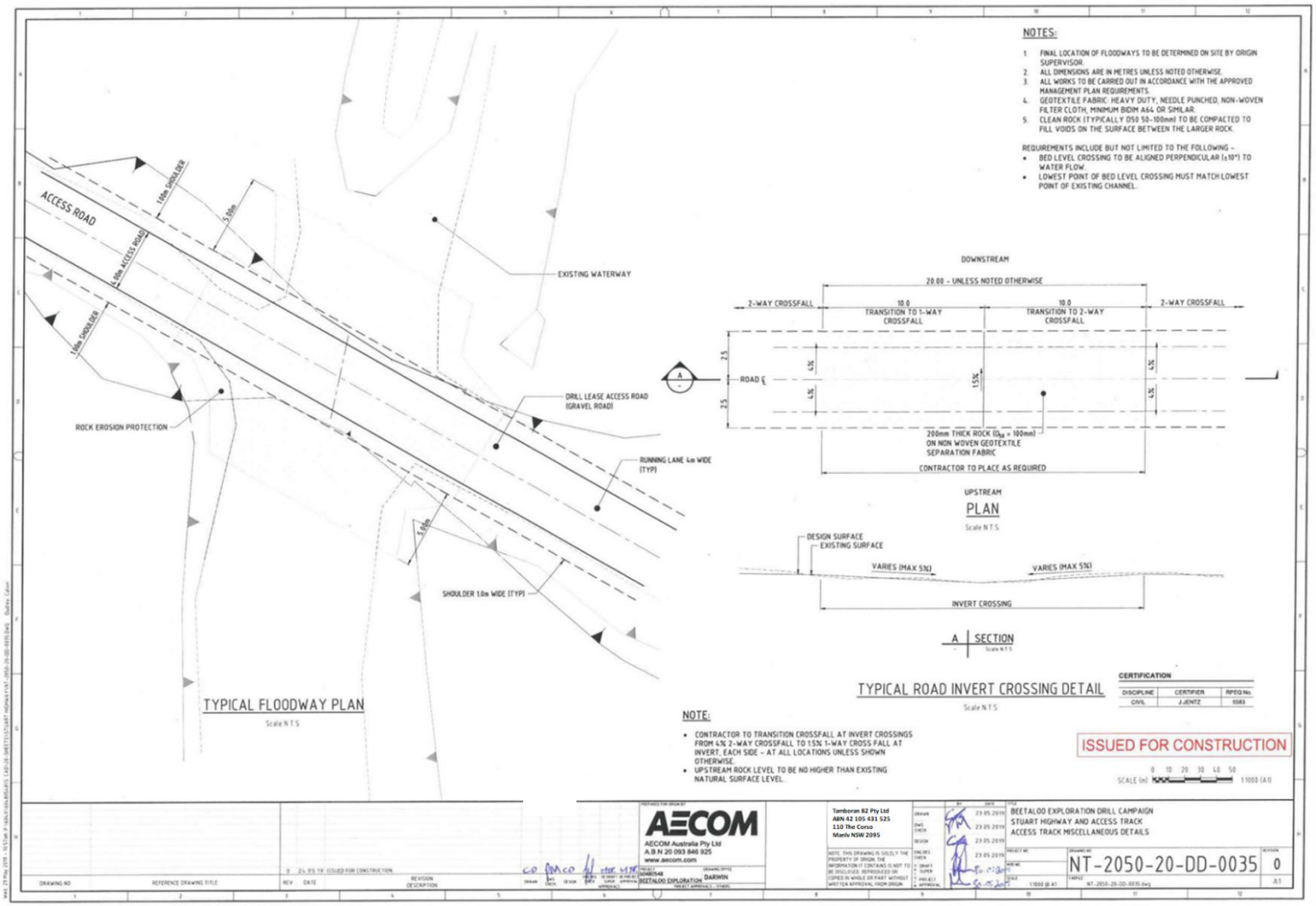


Appendix K Erosion and sediment control plan for typical Carpentaria Highway intersection

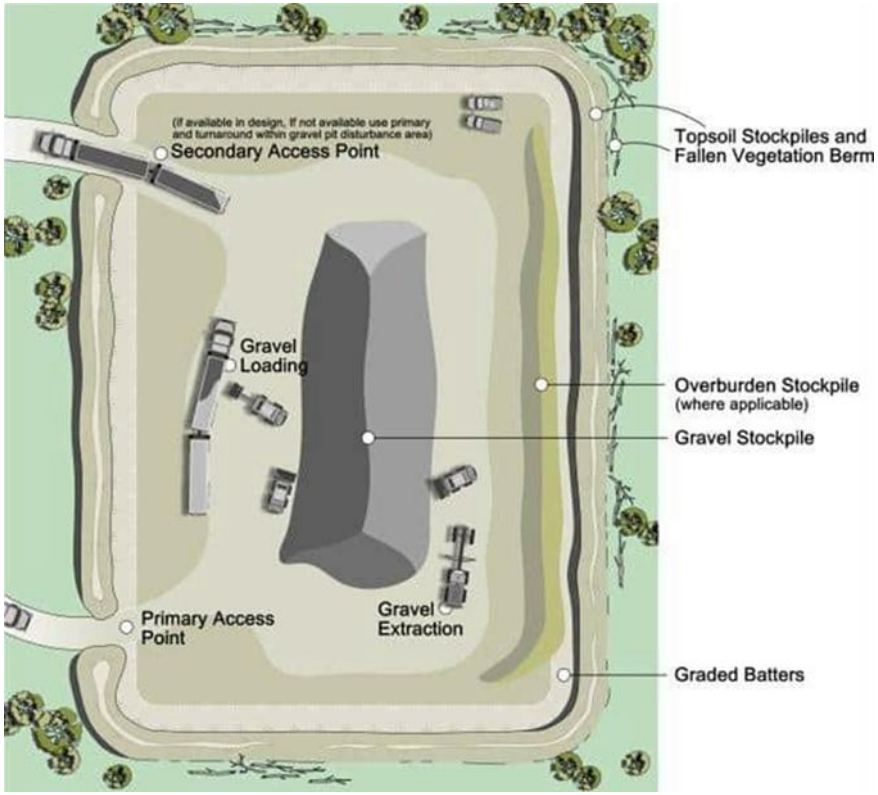


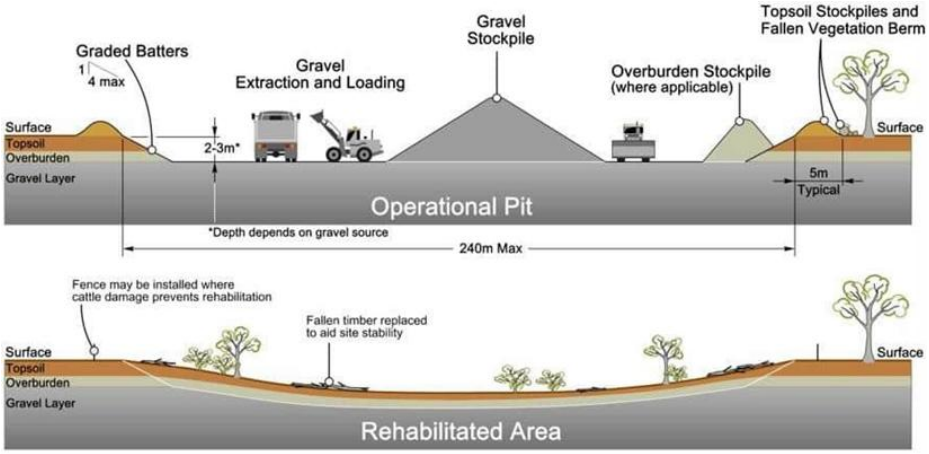
A3 size

Appendix L Erosion and sediment control plan for typical road invert crossing



Appendix M Erosion and sediment control schematic for typical gravel pit





Appendix N Other IECA standard specifications (as required)

MATERIALS

(i) MULCH MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(ii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m.

(iii) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN SELECTING THE LOCATION OF A MULCH FILTER BERM, TO THE MAXIMUM DEGREE PRACTICAL, ENSURE THE BERM IS LOCATED:

(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;

(ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);

(iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;

(iv) AWAY FROM AREAS OF CONCENTRATED FLOW.

3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE END OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED SUCH THAT PONDING UP-SLOPE OF THE BERM IS MAXIMISED.

5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.

6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL BERMS AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.

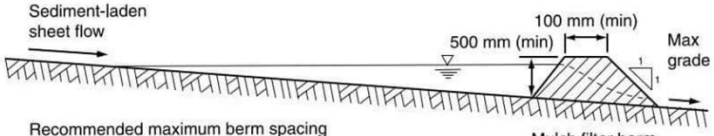
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.

2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.



Recommended maximum berm spacing

Land slope	Max spacing
< 2%	30 m
5%	25 m
10%	15 m
20%	8 m

Figure 1 - Typical placement of mulch filter berm

Drawn:	Date:		
GMW	Apr-10	Mulch Filter Berms	MB-01

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MATERIAL

ROCK MULCH: 25–75mm DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE (IF SPECIFIED).

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND APPLICATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF APPLICATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. SPREAD ENOUGH ROCK TO COMPLETELY COVER THE SURFACE OF THE SOIL AT THE DENSITY OR THICKNESS SPECIFIED IN THE APPROVED PLANS. IF THE APPLICATION DENSITY IS NOT SUPPLIED, THEN APPLY AT A THICKNESS OF AT LEAST 50mm OR TWICE THE NOMINAL ROCK SIZE (WHICHEVER IS GREATER).

3. IF THE EXPOSED SOILS ARE DISPERSIVE, THEN ENSURE THESE SOILS ARE COVERED WITH A LAYER OF NON-DISPERSIVE SOIL (MINIMUM 200mm) BEFORE PLACEMENT OF ROCK.

4. MAKE ALL NECESSARY ADJUSTMENTS TO ENSURE ANY SURFACE FLOW IS ALLOWED TO PASS FREELY ACROSS THE TREATED AREA FOLLOWING ITS NATURAL DRAINAGE PATH.

MAINTENANCE

1. INSPECT ALL TREATED SURFACES FORTNIGHTLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. CHECK FOR RILL EROSION, OR DISLODGMENT OF THE ROCKS.

3. REPLACE ANY DISPLACED ROCKS TO MAINTAIN THE REQUIRED COVERAGE.

4. IF WASH-OUTS OCCUR, REPAIR THE SLOPE AND REINSTALL ROCK COVER.

5. IF THE ROCK MULCHING IS NOT EFFECTIVE IN CONTAINING THE SOIL EROSION IT SHOULD BE REPLACED, OR AN ALTERNATIVE EROSION CONTROL PROCEDURE ADOPTED.

Drawn:	Date:		
GMW	Dec-09	Rock Mulching	MR-01

PREPARATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND DIMENSIONAL DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR EXTENT, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. TAKE ALL NECESSARY STEPS TO ENSURE DISTURBANCE TO THE BUFFER ZONE IS MINIMISED THROUGHOUT THE TIME IT IS USED AS A SEDIMENT TRAP.

3. TO THE MAXIMUM DEGREE PRACTICABLE, ENSURE FLOW PASSING THROUGH THE BUFFER ZONE IS NOT ALLOWED TO CONCENTRATE WITHIN DRAINAGE DEPRESSIONS, SWALES, RILLS OR WHEEL TRACKS.

4. WHERE NECESSARY, INSTALL APPROPRIATE DRAINAGE CONTROLS UP-SLOPE OF THE BUFFER ZONE TO DISTRIBUTE THE INFLOW ALONG THE FULLY LENGTH OF THE BUFFER ZONE AS 'SHEET FLOW'.

5. WHERE NECESSARY, INSTALL A COARSE SEDIMENT TRAP, SUCH AS A SEDIMENT FENCE, UP-SLOPE OF THE BUFFER ZONE TO REDUCE THE QUANTITY OF SEDIMENT PASSING ONTO THE GRASS. GENERALLY THIS IS REQUIRED IF LARGE QUANTITIES OF COARSE SEDIMENT ARE EXPECTED.

6. IF REQUIRED, INSTALL A LIGHT BARRIER FENCE TO CLEARLY IDENTIFY THE BUFFER ZONE AND HELP EXCLUDE CONSTRUCTION TRAFFIC.

MAINTENANCE

1. INSPECT THE BUFFER ZONE ON A REGULAR BASIS AND AFTER RUNOFF-PRODUCING RAINFALL.

2. ENSURE THAT THERE IS NO SOIL EROSION AND THAT SEDIMENT DEPOSITION IS NOT CAUSING THE CONCENTRATION OF FLOW THROUGH THE BUFFER ZONE, OR FLOW BYPASSING.

3. IF THE BUFFER ZONE HAS BEEN DISTURBED, TAKE NECESSARY STEPS TO RE-ESTABLISH SUITABLE SHEET FLOW CONDITIONS.

4. REMOVE EXCESSIVE ACCUMULATIONS OF SEDIMENT THAT MAY CAUSE THE CONCENTRATION OF FLOW. EXCESSIVE SEDIMENT SHOULD BE REMOVED AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT, OR WHERE APPROPRIATE, EVENLY RAKED INTO THE SOIL. SEDIMENT SHOULD BE REMOVED IN A MANNER THAT AVOIDS DAMAGE TO THE BUFFER ZONE OR THE CREATION OF WHEEL TRACKS DOWN THE SLOPE.

5. EXCESSIVE SEDIMENT MAY BE DEFINED AS:

(i) ANY SEDIMENT THAT COVERS A PORTION OF THE GRASSED SURFACE; OR

(ii) SEDIMENT DEPOSITION SUCH THAT THE GRASS STRAND HEIGHT ABOVE THE SEDIMENT IS LESS THAN 50mm; OR

(iii) A DEPOSITION OF SEDIMENT IN EXCESS OF 750g/m^2 (APPROXIMATELY THE EQUIVALENT OF THREE 70mm DIAMETER BALLS OF DRY SOIL).

6. THE SOURCE OF ANY EXCESSIVE SEDIMENT SHOULD BE INVESTIGATED AND CONTROLLED WHERE PRACTICAL.

7. TAKE APPROPRIATE STEPS TO MAINTAIN AT LEAST 75% GRASS COVER OVER THE BUFFER ZONE.

8. WHERE PRACTICAL, MAINTAIN ANY GROUNDCOVER VEGETATION AT A HEIGHT GREATER THAN THE EXPECTED DEPTH OF WATER FLOW AND AT LEAST 50mm.

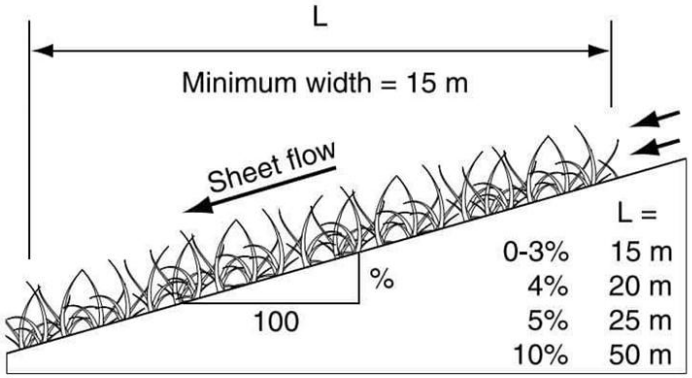

Figure 1 - Minimum dimensional requirements of a grassed buffer zone

Drawn:	Date:		
GMW	Apr-10	Buffer Zones (grassed)	BZ-01

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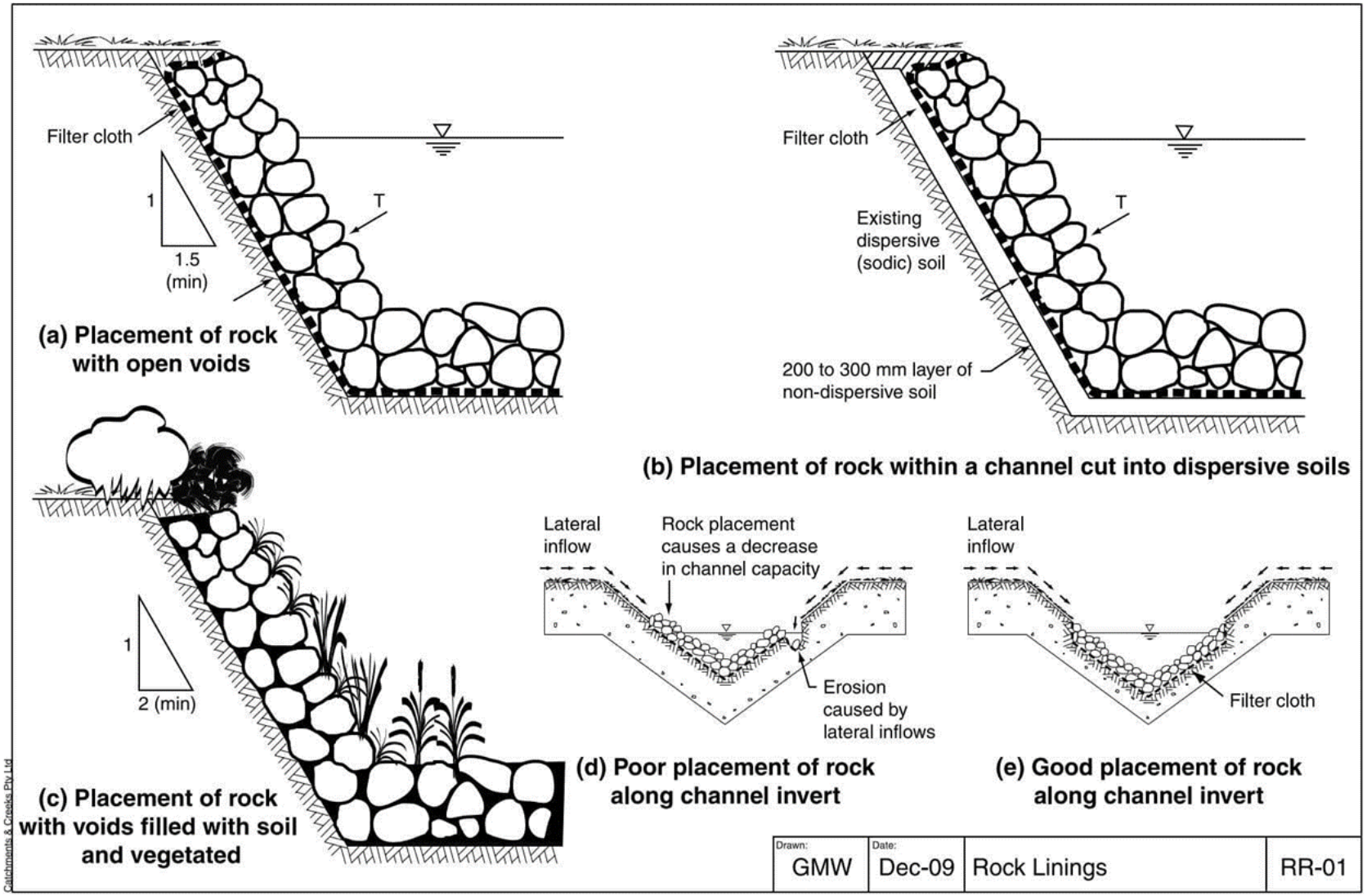
Filter cloth
1
1.5
(min)
T
(a) Placement of rock with open voids
Filter cloth
T
Existing dispersive (sodic) soil
200 to 300 mm layer of non-dispersive soil
(b) Placement of rock within a channel cut into dispersive soils
1
2 (min)
(c) Placement of rock with voids filled with soil and vegetated
Lateral inflow
Rock placement causes a decrease in channel capacity
Erosion caused by lateral inflows
(d) Poor placement of rock along channel invert
Lateral inflow
Filter cloth
(e) Good placement of rock along channel invert
Catchments & Creeks Pty Ltd
Drawn: GMW
Date: Dec-09
Rock Linings
RR-01

MATERIALS

ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE AND SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. SPECIFIC GRAVITY TO BE AT LEAST 2.5.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE PROPOSED CHANNEL AREA OF TREES, STUMPS, ROOTS, LOOSE ROCK, AND OTHER OBJECTIONABLE MATERIALS.

3. EXCAVATE THE CHANNEL TO THE LINES AND GRADES AS SHOWN ON THE PLANS. OVER-CUT THE CHANNEL TO A DEPTH EQUAL TO THE SPECIFIED DEPTH OF ROCK PLACEMENT SUCH THAT THE FINISHED ROCK SURFACE WILL BE AT THE ELEVATION OF THE SURROUNDING LAND.

4. ROCK MUST BE PLACED WITHIN THE CHANNEL AS SPECIFIED WITHIN THE APPROVED PLANS, INCLUDING THE PLACEMENT OF ANY SPECIFIED FILTER LAYER.

5. IF DETAILS ARE NOT PROVIDED ON THE ROCK PLACEMENT, THEN THE PRIMARY ARMOUR ROCK MUST BE EITHER PLACED ON:

(i) A FILTER BED FORMED FROM A LAYER OF SPECIFIED SMALLER ROCK (ROCK FILTER LAYER);

(ii) AN EARTH BED LINED WITH FILTER CLOTH;

(iii) AN EARTH BED NOT LINED IN FILTER CLOTH, BUT ONLY IF ALL VOIDS BETWEEN THE ARMOUR ROCK ARE TO BE FILLED WITH SOIL AND POCKET PLANTED IMMEDIATELY AFTER PLACEMENT OF THE ROCK.

6. IF A ROCK/AGGREGATE FILTER LAYER IS SPECIFIED, THEN PLACE THE FILTER LAYER IMMEDIATELY AFTER THE FOUNDATIONS ARE PREPARED. SPREAD THE FILTER ROCK IN A UNIFORM LAYER TO THE SPECIFIED DEPTH BUT A MINIMUM OF 150mm. WHERE MORE THAN ONE LAYER OF FILTER MATERIAL HAS BEEN SPECIFIED, SPREAD EACH LAYER SUCH THAT MINIMAL MIXING OCCURS BETWEEN EACH LAYER OF ROCK.

7. IF A GEOTEXTILE (FILTER CLOTH) UNDERLAY IS SPECIFIED, PLACE THE FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN ONE SHEET OF FABRIC IS REQUIRED TO OVER THE AREA, OVERLAP THE EDGE OF EACH SHEET AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP.

8. ENSURE THE GEOTEXTILE FABRIC IS PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION OF THE FABRIC AND THE ROCK. REPAIR ANY DAMAGE BY REMOVING THE ROCK AND PLACING WITH ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA OVERLAPPING THE EXISTING FABRIC A MINIMUM OF 300mm.

9. WHERE NECESSARY, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE OR SAND SHOULD BE PLACED OVER THE FABRIC TO PROTECT IT FROM DAMAGE.

10. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER LAYER. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS.

11. PLACE ROCK TO ITS FULL THICKNESS IN ONE OPERATION. DO NOT PLACE ROCK BY DUMPING THROUGH CHUTES OR OTHER METHODS THAT CAUSE SEGREGATION OF ROCK SIZES.

12. THE FINISHED SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.

13. IMMEDIATELY UPON COMPLETION OF THE CHANNEL, VEGETATE ALL DISTURBED AREAS OR OTHERWISE PROTECT THEM AGAINST SOIL EROSION.

14. WHERE SPECIFIED, FILL ALL VOIDS WITH SOIL AND VEGETATE THE ROCK SURFACE IN ACCORDANCE WITH THE APPROVED PLAN.

MAINTENANCE

1. ROCK-LINED CHANNELS SHOULD BE INSPECTED PERIODICALLY AND AFTER SIGNIFICANT STORM EVENTS. CHECK FOR SCOUR OR DISLODGED ROCK. REPAIR DAMAGED AREAS IMMEDIATELY.

2. CLOSELY INSPECT THE OUTER EDGES OF THE ROCK PROTECTION. ENSURE WATER ENTRY INTO THE CHANNEL OR CHUTE IS NOT CAUSING EROSION ALONG THE EDGE OF THE ROCK PROTECTION.

3. CAREFULLY CHECK THE STABILITY OF THE ROCK LOOKING FOR INDICATIONS OF PIPING, SCOUR HOLES, OR BANK FAILURES.

4. REPLACE ANY DISPLACED ROCK WITH ROCK OF A SIGNIFICANTLY (MINIMUM 110%) LARGER SIZE THAN THE DISPLACED ROCK.

Drawn:	Date:		
GMW	May-10	Rock Linings	RR-02

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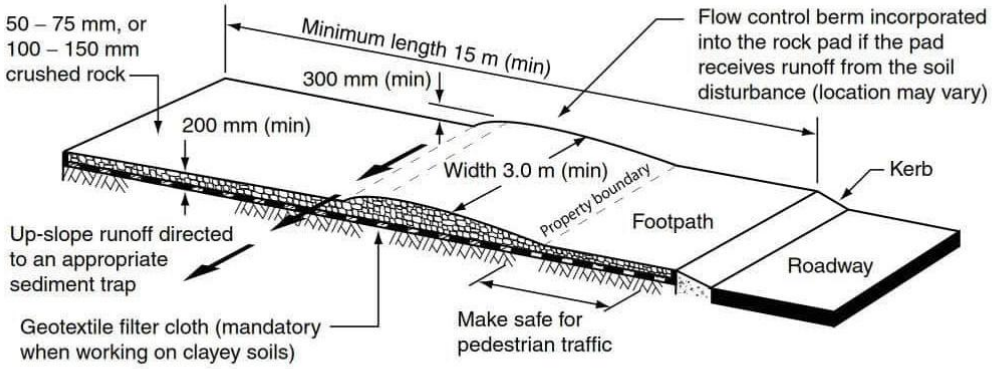
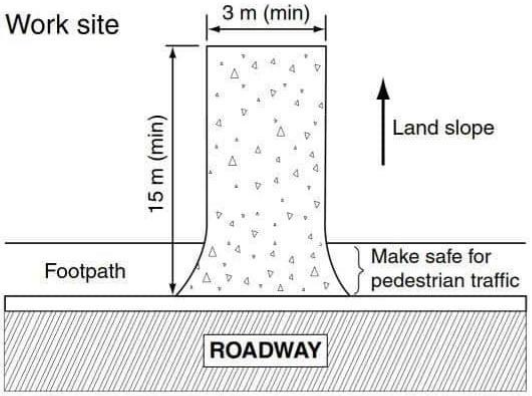
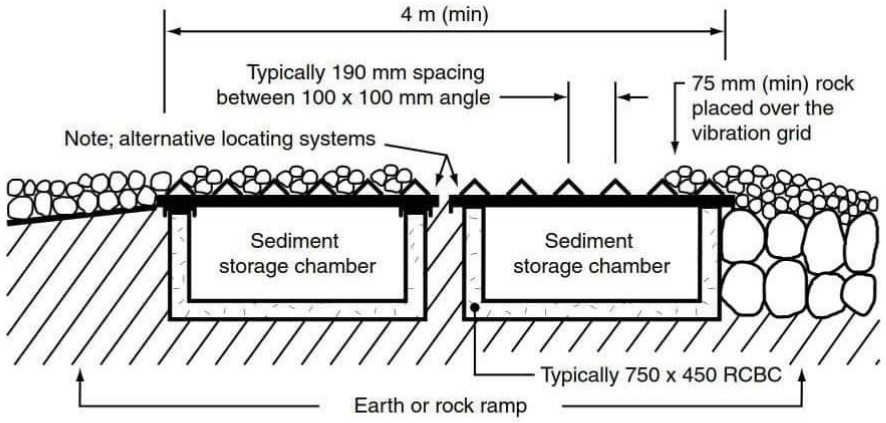


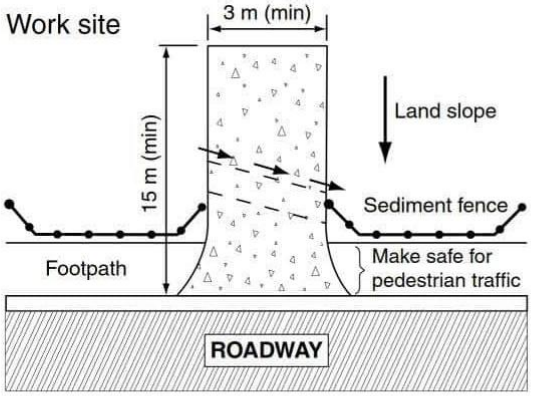
(a) Rock entry/exit pad for construction sites (refer to Standard Drawing Exit-03 for building sites)



(b) Rock pad sloping away from road



(c) Alternative low maintenance arrangement (still under development)



(d) Rock pad sloping towards the road

Drawn:	Date:		
GMW	Apr-10	Construction Exit - Rock Pad (construction sites only)	Exit-01

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MATERIALS

ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, NOMINAL DIAMETER OF 50 TO 75mm (SMALL DISTURBANCES) OR 100 TO 150mm (LARGE DISTURBANCES). ALL REASONABLE MEASURES MUST BE TAKEN TO OBTAIN ROCK OF NEAR UNIFORM SIZE.

FOOTPATH STABILISING AGGREGATE: 25 TO 50mm GRAVEL OR AGGREGATE.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH ('BIDIM' A24 OR EQUIVALENT).

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND DIMENSIONAL DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION OF THE ROCK PAD, REMOVING STUMPS, ROOTS AND OTHER VEGETATION TO PROVIDE A FIRM FOUNDATION SO THAT THE ROCK IS NOT PRESSED INTO SOFT GROUND. CLEAR SUFFICIENT WIDTH TO ALLOW PASSAGE OF LARGE VEHICLES, BUT CLEAR ONLY THAT NECESSARY FOR THE EXIT. DO NOT CLEAR ADJACENT AREAS UNTIL THE REQUIRED EROSION AND SEDIMENT CONTROL DEVICES ARE IN PLACE.

3. IF THE EXPOSED SOIL IS SOFT, PLASTIC OR CLAYEY, PLACE A SUB-BASE OF CRUSHED ROCK OR A LAYER OF HEAVY-DUTY FILTER CLOTH TO PROVIDE A FIRM FOUNDATION.

4. PLACE THE ROCK PAD FORMING A MINIMUM 200mm THICK LAYER OF CLEAN, OPEN-VOID ROCK.

5. IF THE ASSOCIATED CONSTRUCTION SITE IS UP-SLOPE OF THE ROCK PAD, THUS CAUSING STORMWATER RUNOFF TO FLOW TOWARDS THE ROCK PAD, THEN FORM A MINIMUM 300mm HIGH FLOW CONTROL BERM ACROSS THE ROCK PAD TO DIVERT SUCH RUNOFF TO A SUITABLE SEDIMENT TRAP.

6. THE LENGTH OF THE ROCK PAD SHOULD BE AT LEAST 15m WHERE PRACTICABLE, AND AS WIDE AS THE FULL WIDTH OF THE ENTRY OR EXIT AND AT LEAST 3m. THE ROCK PAD SHOULD COMMENCE AT THE EDGE OF THE OFF-SITE SEALED ROAD OR PAVEMENT.

7. FLARE THE END OF THE ROCK PAD WHERE IT MEETS THE PAVEMENT SO THAT THE WHEELS OF TURNING VEHICLES DO NOT TRAVEL OVER UNPROTECTED SOIL.

8. IF THE FOOTPATH IS OPEN TO PEDESTRIAN MOVEMENT, THEN COVER THE COARSE ROCK WITH FINE AGGREGATE OR GRAVEL, OR OTHERWISE TAKE WHATEVER MEASURES ARE NEEDED TO MAKE THE AREA SAFE.

MAINTENANCE

1. INSPECT ALL SITE ENTRY AND EXIT POINTS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER RUNOFF-PRODUCING RAINFALL, OR OTHERWISE AT FORTNIGHTLY INTERVALS.

2. IF SAND, SOIL, SEDIMENT OR MUD IS TRACKED OR WASHED ONTO THE ADJACENT SEALED ROADWAY, THEN SUCH MATERIAL MUST BE PHYSICALLY REMOVED, FIRST USING A SQUARE-EDGED SHOVEL, AND THEN A STIFF-BRISTLED BROOM, AND THEN BY A MECHANICAL VACUUM UNIT, IF AVAILABLE.

3. IF NECESSARY FOR SAFETY REASONS, THE ROADWAY SHALL ONLY BE WASHED CLEAN AFTER ALL REASONABLE EFFORTS HAVE BEEN TAKEN TO SHOVEL AND SWEEP THE MATERIAL FROM THE ROADWAY.

4. WHEN THE VOIDS BETWEEN THE ROCK BECOMES FILLED WITH MATERIAL AND THE EFFECTIVENESS OF THE ROCK PAD IS REDUCED TO A POINT WHERE SEDIMENT IS BEING TRACKED OFF THE SITE, A NEW 100mm LAYER OF ROCK MUST BE ADDED AND/OR THE ROCK PAD MUST BE EXTENDED.

5. ENSURE ANY ASSOCIATED DRAINAGE CONTROL MEASURES (e.g. FLOW CONTROL BERM) ARE MAINTAINED IN ACCORDANCE WITH THEIR DESIRED OPERATIONAL CONDITIONS.

6. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. THE ROCK PAD SHOULD BE REMOVED ONLY AFTER IT IS NO LONGER NEEDED AS A SEDIMENT TRAP.

2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. RE-GRADE AND STABILISE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

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Drawn:	Date:		
GMW	Apr-10	Construction Exit - Rock Pad (construction sites only)	Exit-02

APPLICATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND APPLICATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF APPLICATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. FILL OR SUITABLY CONTOUR ANY EXISTING RUTTING, RILLING OR GULLIES.

3. SUITABLY DIVERT UP-SLOPE STORMWATER RUNOFF AROUND TREATED AREA AS DIRECTED WITHIN THE APPROVED PLANS, OR OTHERWISE AS DIRECTED BY THE SITE ENGINEER.

4. APPLY TREATMENT TO THE AREA TO THE DEPTH AND FREQUENCY (SPACING) SPECIFIED ON THE APPROVED PLANS, OR OTHERWISE AS DIRECTED BY THE SITE ENGINEER.

5. IMMEDIATELY SEED AND MULCH ROUGHENED AREAS TO OPTIMISE SEED GERMINATION AND GROWING CONDITIONS.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT THE TREATED AREA PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING RAINFALL, OR OTHERWISE ON A WEEKLY BASIS.

2. FILL EROSION RILLS SLIGHTLY ABOVE THE ORIGINAL GRADE, OR REGRADE THE SLOPE AS DIRECTED TO REMOVE THE RILLS.

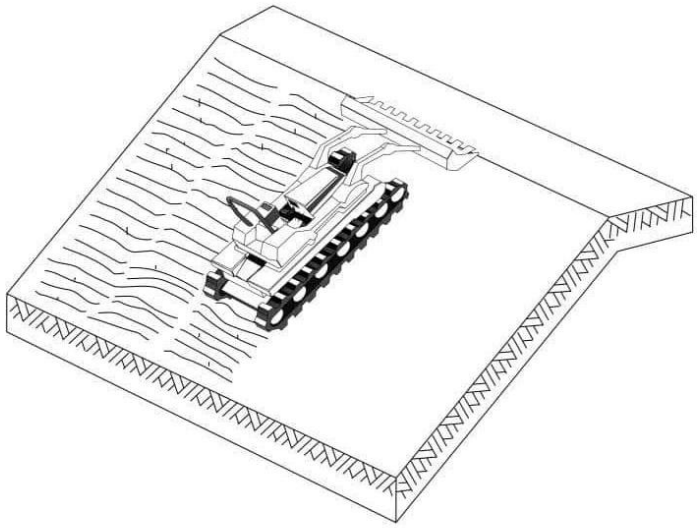

Figure 1 - Application of surface roughening on slope

Drawn:	Date:		
GMW	Dec-09	Surface Roughening	SR-01

Catchments & Creeks Pty Ltd

Appendix O Table 4.4.7 IECA best practice land clearing and rehabilitation requirements

Risk[1]	Best practice requirements
All cases	• All reasonable and practicable steps taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the building/construction works.
Very low	• Land clearing limited to 8 weeks of work if rainfall is reasonably possible. • Disturbed soil surfaces stabilised with minimum 60% cover[2] within 30 days of completion of works if rainfall is reasonably possible. • Unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 30 days.
Low	• Land clearing limited to maximum 8 weeks of work. • Disturbed soil surfaces stabilised with minimum 70% cover[2] within 30 days of completion of works within any area of a work site. • Unfinished earthworks are suitably stabilised if rainfall is reasonably possible and disturbance is expected to be suspended for a period exceeding 30 days. • Appropriate protection of all planned garden beds is strongly recommended.
Moderate	• Land clearing limited to a maximum 6 weeks of work. • Disturbed soil surfaces stabilised with minimum 70% cover[2] within 20 days of completion of work within any area of a work site. • All planned garden beds protected with a minimum 75mm layer of organic *Mulching*, heavy *Erosion Control Blanket, Rock Mulching,* or the equivalent. • Staged construction and stabilisation of earth batters (steeper than 6H:1V) in maximum 3m vertical increments wherever reasonable and practicable. • The use of turf to form grassed surfaces given appropriate consideration. • Soil stockpiles and unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 10 days.

Risk[1]	Best practice requirements
High	• Land clearing limited to a maximum 4 weeks of work. • Disturbed soil surface stabilised with minimum 75% cover[2] within 10 days of completion of works within any area of a work site. • All planned garden beds protected with a minimum 75mm layer of organic *Mulching*, heavy *Erosion Control Blanket, Rock Mulching,* or the equivalent. • Staged construction and stabilisation of earth batters (steeper than 6H:1V) in maximum 3m vertical increments wherever reasonable and practicable. • The use of turf to form grassed surfaces given appropriate consideration. • Soil stockpiles and unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 10 days.
Extreme	• Land clearing limited to maximum 2 weeks of work. • Disturbed soil surfaces stabilised with minimum 80% cover[2] within 5 days of completion of works within any area of a work site. • All planned garden beds protected with a minimum 75mm layer of organic *Mulching*, heavy *Erosion Control Blanket, Rock Mulching,* or the equivalent. • Staged construction and stabilisation of earth batters (steeper than 6H:1V) in maximum 2m vertical increments wherever reasonable and practicable. • High priority given to the use of turf to form grassed surfaces. • Soil stockpiles and unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 5 days.

1. Erosion risk based on monthly erosivity (Table 4.4.1), average monthly rainfall depth (Table 4.4.2), or soil loss rate (Table 4.4.3) as directed by the regulatory authority.
2. Minimum cover requirements may be redirected if the natural cover of the immediate land is less than the nominated value, for example in arid and semi-arid areas or on coastal sand dunes.

Appendix P Erosion and sediment control treatment – seismic lines

Blade up erosion controls

Figure 1 shows the condition of land following blade up traverse of survey area. No treatment required.

Figure 1 Typical condition 'blade up' treatment

Surface bladed by grader (including woodland areas)

Erosion control treatments as follows:

- A diversion bank shall be installed along sections of the survey lines where material has been stripped from the surface (refer Table 12).
- The bank shall be constructed as a cut and push operation. Lines shall be ripped across the area at a grade of 0.3%. A shallow channel should be cut along this line (approximately 0.6 metres deep). Excavated material is dumped on the down slope side of the channel then compacted and smoothed out to form a bank with even batters and a level top (refer Figure 2).
- To aid trafficability, an approach and departure ramp shall be shaped during construction of the bank.
- The bank should direct runoff into undisturbed vegetation or into an existing drain (care needs to taken to ensure that erosion does not occur where the water runs down into the drain).
- Ensure the diversion bank is not eroded by traffic.
- Undertake maintenance as necessary.

Table 12: Bank spacing requirements (m)

Slope		Diversion bank spacing (m)
%	Gradient	
0.5	1:200	170-180
1	1:100	120-130
2	1:50	90-100
3	1:33	70-80
4	1:25	60-70
5	1:20	55-60
6	1:17	40-45

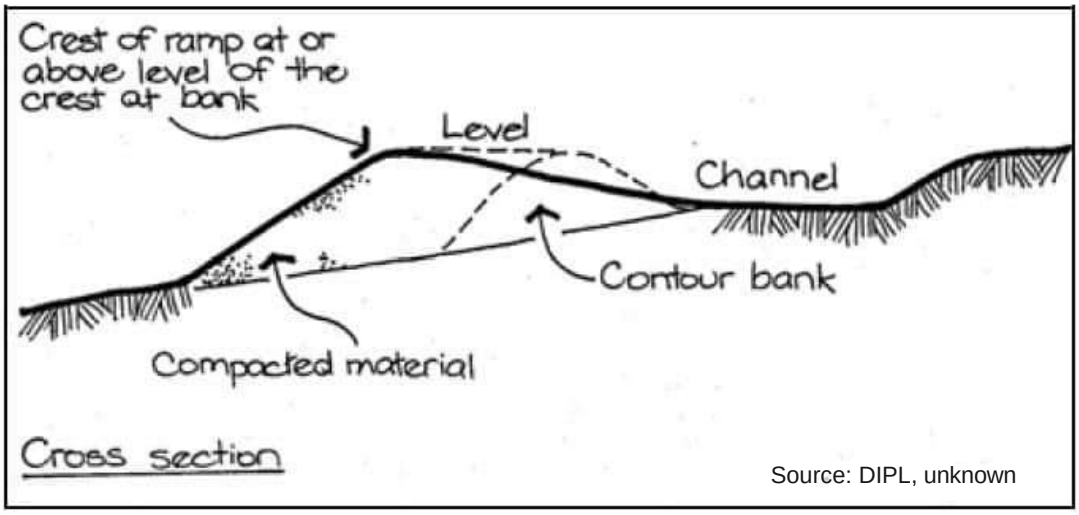

Figure 2 Whoa boys or roll over banks drawing

Woodland area erosion controls

Figure 3 shows the expected final rehabilitation treatment for woodland areas disturbed by the seismic survey activities. In the event of an expected significant rainfall event which will require the site to be abandoned, a similar treatment is to be adopted.

- Step 1. Respread windrowed topsoil of disturbed area and ripped into the soil surface.
- Step 2. Spread vegetation over top soiled area in an even layer.

Felled vegetation will be evenly spread over the top soiled area to provide additional protection against erosion.

Figure 3 Treatment for woodland areas

Typical offlet drain detail of access tracks

Figure 4 shows the typical offlet drain and table drain block detail, which consists of the following actions:

- Construct access tracks with table drains that are free draining.
- Avoid road crowning to allow water to naturally cross the road.
- Form tracks to allow off-road drainage. Where track intercepts the direction of overland flow and re-directs this flow to a non-natural drainage line, install erosion control works to minimise potential erosion.
- The design and position of erosion control measures to be determined by experienced operator and site engineer, based on the site characteristics of the access track location.
- Where construction of table drains are deemed necessary, they should have a broad flat base at least 1 m wide and should not be graded to produce a 'V' shape. To minimise erosion,
- the slope should be no greater than 0.5% on erodible soils or 1% on stable soils.
- Where encounter dispersive / erosive soils they should be stabilised with gypsum or other stabiliser, as determined by laboratory analysis of soils.
- Where cut-out drains are required, they should be spaced based on the slope of the area i.e. 0.5% slope, allow for cut-out draining every 170-180 m or 1 % slope, allow for cut-out drainage every 120-130 m etc. (refer to NT Road Drainage Fact Sheet). It is noted that the recommended distance between turn-out drains is a guide and may not apply to all locations along the access track.

- Monitor road conditions to ensure deterioration does not occur. Assist in the maintenance and repair work on roads and tracks used.

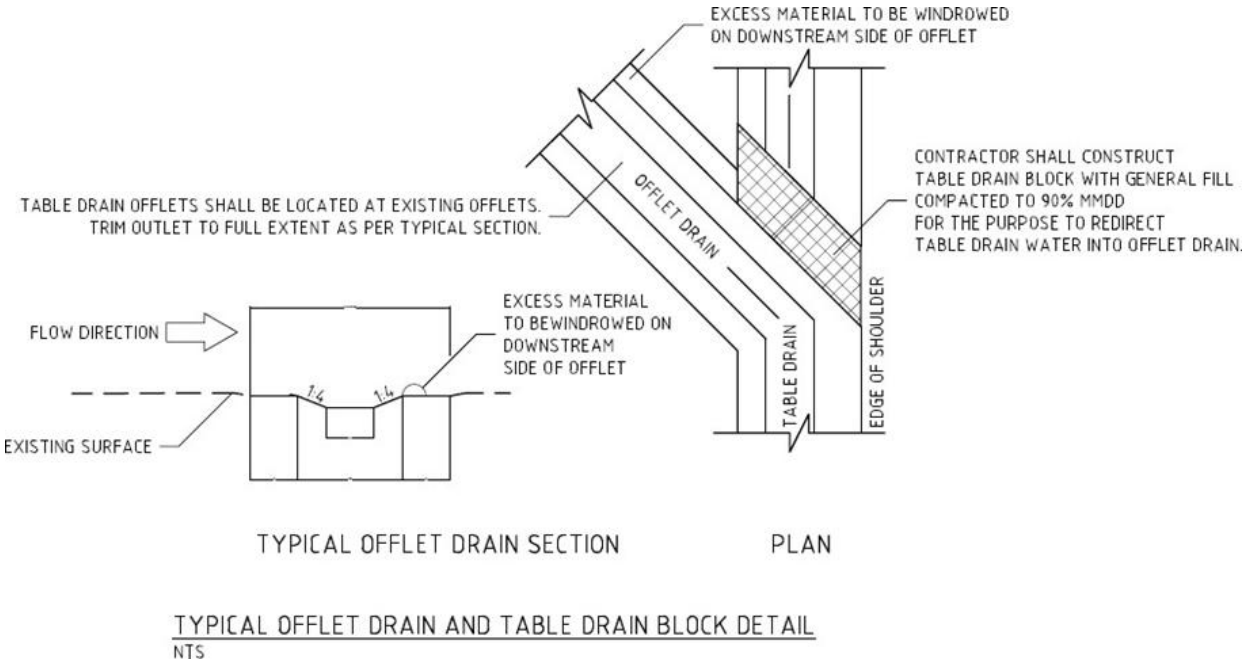

Figure 4 Typical offlet drain and table drain block diagram

APPENDIX I

Methane Emission Management Plan

tamboran
RESOURCES

MEMP

NT-2050-MP-15- 030

BEETALOO EXPLORATION PROGRAM

Methane Emission Management Plan

Review record

Rev	Date	Reason for issue	Reviewer(s)	Consolidator	Approver
0	15/04/2019	Released for use	MK	LF	MH
1	12/04/2023	Minor amendments	LP	LP	LP
2	15/03/2024	Response to regulation 10 and 11	LP	LP	MK

Review date: 18/05/2024.

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Abbreviations

Acronym	Definition
API	American Petroleum Institute
CRDS	cavity ring-down spectrometer
ISO	International Organization for Standardization
m	metres
mm	millimetres
MEMP	Methane Emissions Management Plan
N/A	not applicable
NORSOK	Standards Norway (originally “the Norwegian shelf’s competitive position”)
ppb	parts per billion
ppm	parts per million
REC	reduced emission completions
US EPA	United States Environment Protection Authority

1 Purpose

This Methane Emissions Management Plan (MEMP) is designed to outline the measures as to how the risks of methane emissions associated with Tamboran B2 Pty Ltd Beetaloo Basin exploration activities will be managed. This Plan has been developed in accordance with the *Code of Practice for Petroleum Activities in the Northern Territory* ("the Code").

2 Key Legislation

Key legislation and documents consulted in the development of this plan are provided below. A full list of applicable legislation is provided in the corresponding management plans.

- **Code of Practice for Petroleum activities in the Northern Territory:** Mandatory code of practice legislating the management of chemicals and wastewater onsite, including the use of secondary containment, lined tanks and spill management plan
- **National Greenhouse and Energy Reporting Act 2007:** Regulates the reporting of greenhouse gas emissions, energy production and energy consumption associated with company activities. Data to be supplied annually to the regulator in accordance with emission/energy use guidance manuals.

3 Activity Description

The activities undertaken as a part of this MEMP are summarised in Table 1. These activities are restricted to the drilling, stimulation, well testing and ongoing operation of exploration wells. They do not cover any production, compression or pipeline activities as these are currently not proposed.

Table 1: Activity and emission description summary

Activity	Emission description	Controls	Emission monitoring
Drilling	Methane emissions are small (<1 tonne) and restricted to outgassing of hydrocarbon within intersected shales brought to surface.	• Drilling is overbalanced, preventing gas influx into well bore. • Shale formations have negligible permeability with limited influx of gas from target formations.	• Due to low emission level, gas is qualitatively monitored in mud stream as a concentration (not flow rate). • Gas desorption data is collected from target reservoir allowing emission estimates.
Stimulation	During stimulation, the well will be overbalanced restricting the flow of hydrocarbons to surface.	• Well is kept overbalanced to prevent gas influx during and after stimulation. • Flowback kept within the formation after each stage.	N/A
Well testing	• Well is unloaded to allow hydrocarbons and fluid to flow to surface; • All fluids and hydrocarbons diverted to a separator and then a flare onsite; • Small emissions (<1	• Well heads are designed in accordance with the Code and API standards to minimise loss of methane containment. • A reduced emission completion will be utilised; where all gas is sent to a separator and then flared. Personal gas detector during all	• Personal gas detector during well testing activities. • All flared gas measured using flow meters.

Activity	Emission description	Controls	Emission monitoring
	tonne) of methane may be released prior to the onsite of flaring, as the hydrocarbon production rate may not be enough to sustain a flare initially; • Small volumes (kg/day) of methane is entrained within liquid hydrocarbons; and • flowback fluid and will be released to atmosphere.	operational visits.	
Gathering line operations	• Emissions from pipelines, high point vents and drains	• Gas pipelines are designed in accordance with Australian Standards • Pipelines are pressure tested prior to use • HPV's and LPD are constructed with gas tight fittings	• 6 monthly inspection of gathering lines and surface facilities.
Ongoing well operations/ suspension	Methane emissions restricted to unplanned leaks from well heads, including surface casing vents.	• Operation staff to carry personal calibrated gas detectors during every routine operational visit to well sites. • Routine wellhead maintenance as per the Integrity Management System. • Each well and equipment on the well pad to be inspected every 6 months for leaks using the US EPA Method 21 compliance technique.	• Personal gas detector during well testing activities. • 6 monthly leak detection.

4 Equipment Selection and Activity Design

The uncontrolled emissions of natural gas during drilling, stimulation and well testing activities represents a potential hazard to workers and the environment. All equipment will be selected to minimise the emissions during production activities.

- Exploration wells and associated surface infrastructure shall be designed to mitigate leaks in accordance with the relevant standards. These Standards include:

- ISO 16530-1-2017 Petroleum and natural gas industries- Well Integrity - Life cycle governance
- API SPEC 5CT 2016 Casing and Tubing
- API SPEC 16D 2013 Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
- API RP 59 2012 Well control operations
- API SPEC 6A 2016 Wellhead and Christmas Tree equipment
- NORSOK Standard D-010, Well integrity in drilling and well operations

- Leak detection implemented consistent with Codes of Practice.
- Ongoing well maintenance as per the Well Operations Management Plan.

5 Flowback Activities

5.1 Reduced emission completion

- A reduced emission completions (REC) shall be used to minimise the amount of venting.
- A REC for the purpose of the Beetaloo exploration project is a separator equipped with a flare.
- Venting shall only be used where the capture or flaring is not possible.
- The recovery of gas and hydrocarbons for sale will be prioritised (where practicable) to minimise flaring.

6 Leak Detection Inspections

The leak inspection programs will be implemented in accordance with Table 2.

Table 2: Leak detection program

Facility/ system	Frequency	Monitoring methodology
Routine operational inspections		Calibrated personal gas detector
Well heads and above ground facility	6 monthly	US EPA Method 21
Gathering lines and low pressure pipelines	6 monthly	US EPA Method 21
Compressor stations and pneumatic devices	Quarterly	US EPA Method 21
All gas containing equipment following major maintenance	48 hours of commissioning	US EPA Method 21

7 Monitoring Methodology

Mandatory inspections will be completed on all surface infrastructure (vents, flanges, valves, connections, drains, pressure relief vents, etc.) of the exploration well in accordance with the US EPA Method 21 requirements or a vehicle mounted cavity ring-down spectrometer (CRDS).

7.1 Instrument Selection

- A Method 21 detector must be able to detect methane at the minimum detection range of 10 parts per million (ppm), with an +/- accuracy of 50 ppm.
- A vehicle mounted CRDS detectors shall have a 10 parts per billion (ppb) minimum detection accuracy

with an accuracy of +/- 10 ppb.

- The instrument shall be intrinsically safe (where used within hazardous areas) and equipped with an electrically driven pump, to ensure that a sample is provided to the detector at a constant flow rate.

7.2 Qualifications

- Inspections must be carried out by a suitably qualified person.
- A suitably qualified person is defined as a person that has been specifically trained in leak detection or has at least 3 years industry experience in conducting leak detection activities.

7.3 Calibrations

- Gas detectors must be maintained and calibrated in accordance with the manufacturers' instructions. Records of instrument calibration shall be retained.
- A two-stage calibration shall be used, with an air calibration and a 10 ppm by volume CH_4 calibration gas used.
- The instrument response time shall be less than 30 seconds.

7.4 Testing procedure

7.4.1 Method 21

Method 21 inspections are used to survey individual pieces of equipment. These types of inspections require access to the surface of the equipment and are extremely effective at pinpointing leaks. The following procedure is to be followed when conducting method 21 inspections:

1. Ensure gas detector is calibrated and functioning properly.
2. Ensure the appropriate permitting is obtained before entry into a hazardous area.
3. Place the probe inlet at the surface of the component interface where leakage could occur.
4. Move the probe along the interface periphery while observing the instrument readout. If an increased meter reading is observed, slowly sample the interface where leakage is indicated until the maximum meter reading is obtained.
5. Leave the probe inlet at this maximum reading location for approximately two times the instrument response time (i.e. at least a minute).
6. If the maximum observed meter reading is greater than 500 ppm at the surface of a piece of infrastructure, the leak is to be measured again at 150 mm immediately above (and downwind) of the leak in an open-air environment.
7. The leak shall be classified in accordance with section 7.
8. The location of the leak shall be clearly documented and photographs taken (if safe to do so).
9. Any liquid petroleum leaks should also be identified, along with estimates of leak rate and volume released.

7.4.2 Vehicle mounted CRDS

Vehicle mounted CSRDS uses highly sensitive, PPB level detectors to screen clumps of infrastructure for leaks. They are extremely effective at providing a rapid assessment and are used in combination of method 21 assessment to pinpoint leaks. The following procedure shall be followed when conducting vehicle mounted CRDS inspections:

1. The vehicle shall be driven within 20 m up and downwind of the infrastructure at a speed below 20 km/hour: it is advisable to drive around a piece of infrastructure in a circular motion to obtain up and down wind in the same pass.
2. Where a survey cannot be made within 20 m downwind of a piece of infrastructure, a method 21 inspection shall be undertaken.
3. Downwind methane concentrations shall be compared to upwind (background) concentration.
4. Where an emission is identified at 5 ppm above background, a method 21 inspection shall be undertaken.
5. Where enrichment is recorded below 5 ppm, the infrastructure has no material leaks present.

8 Leak Classification, Repair and Notification

Each leak shall be classified, repaired and reported in accordance with Table 3. It should be noted, that classification of leaks is only undertaken using a method 21 approach outlined in 7.4.1.

Table 3: Leak classification and remediation summary

Classification	Threshold	Response	Notification	Comments
Minor Leak	>500 ppm measured at the surface of the component in accordance with section 6.4.1	All minor leaks must be documented and repaired as soon as practicable, but within 30 days. Where 30 days in unachievable, the reason for the delay and target date for completion must be submitted.	All minor leaks must be documented	A minor leak is an unplanned release that does not occur during commissioning or bringing equipment back into service. These leaks should be corrected immediately as a part of commissioning
Significant Leak	>5000 ppm (or 10% of the Lower Explosive Limit) when measured at the surface of the leak source. Or A Liquid Petroleum (condensate/oil) loss of containment that exceeds 200 L. Or The leak is too large or not safe to measure. Or A leak due to an unplanned release from a gathering system -subsurface pipeline that, at ground level; gives a sustained reading greater than 500 ppm (by volume) for a 15 second duration.	1. The activities safety management plan, risk assessment and emergency response requirements must be followed. 2. Remediation work must only commence after a suitable risk assessment has been undertaken (at a level appropriate to the nature of the leak) and the relevant safety procedures are followed including the consideration of all the required Personal Protective Equipment and emergency response material. 3. If safe to do so, the leak source should be isolated and repaired immediately. The response priority must be to make the site safe above all other actions. 4. The leak shall be repaired or made safe as soon as practicable, as follows: i) the leak must be isolated, repaired if possible, contained or otherwise made safe within 72 hours. ii) Where isolation and repair are not	In the case of an emergency, DPIR must be notified within 24 hours via the emergency response hotline number 1300 935 250. Notification must include the date of identification, nature and level of the leak, infrastructure name, number and location as well as the initial actions to minimise the risk. The landowner or occupier of the property in which these leaks are occurring must be notified in the following circumstances: i) if the leak cannot be repaired immediately; and ii) if the leak is likely to affect any of the landowners or occupiers'	A significant leak is an unplanned release that does not occur during commissioning or bringing equipment back into service. These leaks should be corrected immediately as a part of commissioning.

Classification	Threshold	Response	Notification	Comments
		possible, an exclusion zone must be established around the leak and appropriate restrictions to on access to the exclusion zone imposed. iii) in the event the 72-hour deadline is unachievable, the reason for the delay and the target date for repair shall be submitted to DPIR before the deadline has passed. 5. If it is contended that the risk of immediately repairing the leak exceeds the risk posed by the leak, an extension of the 72-hour deadline may be sought provided that other measures to mitigate the risk are undertaken (e.g. ensuring an appropriate exclusion zone has been implemented). 6. For leaks identified on well equipment, higher order controls such as containment by repair must be implemented wherever possible. 7. For leaks identified on well casings or adjacent to the well casing (where a work over rig is necessary to effect repair) it must be determined whether the leak requires immediate repair, or whether the risk can be adequately managed via other control measures until a work over of the well is scheduled for normal operational reasons. The risk assessment to determine the above shall consider the location of the well, likely access to the well from landholders or the public, and	facilities or activities. A written close-out report must be submitted within 5 business days of the remediation of the leak, specifying the date of identification, nature and level of leak, location and name of the operating plant, and the rectification actions taken. If finalising the remediation is delayed more than 7 business days from the identification of the leak an update must be submitted on that day. The final close out report shall be provided when all work is completed.	

Classification	Threshold	Response	Notification	Comments
		landholder/community concerns in relation to the leak. 8. For leaks identified on gathering systems (where an excavation is necessary to effect repair) repairs must be completed as soon as reasonably practicable in consideration of the location of the site, safety to personnel and the public, potential environmental harm, likely access to the site from landholders or the general public, and landholder/community concerns in relation to the leak.		

9 Reporting

9.1 Flaring and Venting Emissions

Where natural gas is vented or flared during exploration activities, these emissions shall be measured or estimated using methods consistent with those outlined under the National Greenhouse and Energy Reporting (Measurement) Determination 2008. This includes:

1. Leaks, venting and flaring during flowback activities.
2. Equipment blowdowns, system upsets and accidental releases.

9.2 Annual reporting

An annual report will be provided to the Northern Territory Government summarising the following:

3. The records of the stages of flowback activities including:

i. the date and time of the onset of flowback;

ii. the date and time of each attempt to route flowback fluid to the separator;

iii. the date and time of each occurrence in which the operator reverted to the initial flowback stage;

iv. the date and time of well shut in or connected into adjacent gathering lines;

v. the date and time that temporary flowback equipment is disconnected; and

vi. the total duration of venting, combustion and flaring over the flowback period.

4. The results of leak detection surveys (in the annual report under the Act) outlining:

i. the extent of compliance with the leak management plan;

ii. a summary of monitoring undertaken during the period;

iii. a summary of minor and significant leaks identified during the reporting period,

iv. including the date of identification and repair for each leak and those leaks that

v. could not be repaired; and

vi. an explanation of why any component could not be repaired and what actions will be taken to either decommission the component or otherwise remedy the problem.

5. Emission estimates using NGERS methodology covering all emissions associated with the activity, including fuel combustion, wastewater emissions, venting and flaring.

APPENDIX J

Water Monitoring Suite

Appendix J Water Monitoring Suites

Groundwater monitoring suite extracted from the *Code of Practice for Onshore Petroleum Activities in the Northern Territory*

Table 6: Minimum suite of analytes for groundwater monitoring.

General	LOR	Cations and Metals	LOR
pH	0.01 pH units	Calcium	1 mg/L
Electrical conductivity	1 µS/cm	Chromium	0.001 mg/L
Total Dissolved Solids	10 mg/L	Copper	0.001 mg/L
Total Suspended Solids	1 mg/L	Iron	0.05 mg/L
Alkalinity	1 mg/L	Lead	0.001 mg/L
Gross Alpha	0.05 Bq/L	Magnesium	1 mg/L
Gross Beta	0.1 Bq/L	Manganese	0.001 mg/L
Water level	±10 cm (AHD)	Mercury	0.0001 mg/L
Groundwater pressure		Potassium	1 mg/L
Anions		Silver	0.001 mg/L
Chloride	1 mg/L	Arsenic	0.001 mg/L
Fluoride	0.1 mg/L	**Barium**	0.001 mg/L
Sulfate	1 mg/L	Boron	0.05 mg/L
Nitrate	0.01 mg/L	Cadmium	0.0001 mg/L
Nitrite	0.01 mg/L	Lithium	0.001 mg/L
Petroleum		Selenium	0.01 mg/L
TRH	100 µg//L	Silica	0.1 mg/L
PAH Suite	0.5 µg//L	**Strontium**	0.001 mg/L
BTEX	1 µg/L	Sodium	1 mg/L
Diss. Methane	10 µg/L	Zinc	0.005 mg/L
Diss. Ethane	10 µg/L		
Diss. Propane	10 µg/L		

Wastewater characterisation suite as per Table C.8 of the Code

Parameter	Reporting units	Limit of reporting	Method
Physical Parameters			
Dissolved oxygen	mg/L	0.1	Field
Electrical Conductivity (EC)	µs/cm	1	Field
Total Dissolved Solids (TDS)	mg/L	10	APHA 2540C
Total Suspended Solids (TSS)	mg/L	5	APHA 2540C
pH	pH units	0.01	Field
Sodium Adsorption Ratio	ratio	0.01	APHA 4500 Ca, Mg, Ca, NA
Temperature	°C	0.1	Field
Nutrients			
Nitrate	mg/L	0.01	APHA VC13
Nitrite	% saturation and mg/L	0.01	APHA 4500 NO2
Total Nitrogen	mg/L	0.1	APHA 4500 NORG
Total Kjeldahl Nitrogen	mg/L	0.1	APHA NORG/TKN
Ammonia	mg/L	0.01	APHA NH4
Reactive Phosphorous	mg/L	0.01	APHA 4500P
Total Phosphorous	mg/L	0.01	APHA 4500P
Anions			
Sulfate	mg/L	1	APHA 4500-SO4-C
Chlorine/chloride	mg/L	1	APHA 4500-Cl-C
Carbonate	mg/L	1	APHA 2320 B
Bicarbonate (as $CaCO_3$ equivalent)	mg/L	1	APHA 2310 B
Bicarbonate Alkalinity (as $CaCO_3$ equivalent)	mg/L	1	APHA 2320 B
Hydroxide Alkalinity (as $CaCO_3$ equivalent)	mg/L	1	APHA 2320 B
Total Alkalinity (as $CaCO_3$ equivalent)	mg/L	1	APHA 2320 B
Nitrite (NO_2 -)	mg/L	0.01	
Nitrate (NO_3-)	mg/L	0.01	
Fluoride	mg/L	0.1	APHA 4500 F-C
Bromide	mg/L	0.01	APHA 4110B
Total Cyanide	Mg/L	0.004	AWWA/APHA Method 4500
Major Cations			
Sodium	mg/L	1	APHA 4500 Na
Magnesium	mg/L	1	APHA 4500 Mg
Potassium	mg/L	1	APHA 4500 K
Calcium	mg/L	1	APHA 4500 Ca
Metals and Metalloids (total and dissolved)			
Aluminium	mg/L	0.01	USEPA 6010 ICP/AES
Antimony	mg/L	0.001	USEPA 6010 ICP/AES

Parameter	Reporting units	Limit of reporting	Method
Arsenic	mg/L	0.001	USEPA 6010 ICP/AES
Barium	mg/L	0.001	USEPA 6010 ICP/AES
Beryllium	mg/L	0.001	USEPA 6010 ICP/AES
Boron	mg/L	0.001	USEPA 6010 ICP/AES
Bromide	mg/L	0.01	USEPA 6010 ICP/AES
Cadmium	mg/L	0.0001	USEPA 6010 ICP/AES
Chromium	mg/L	0.001	USEPA 6010 ICP/AES
Cobalt	mg/L	0.001	
Copper	mg/L	0.001	USEPA 6010 ICP/AES
Iron	mg/L	0.05	USEPA 6010 ICP/AES
Lead	mg/L	0.001	USEPA 6010 ICP/AES
Manganese	mg/L	0.001	USEPA 6010 ICP/AES
Mercury	mg/L	0.0001	USEPA 6010 ICP/AES
Molybdenum	mg/L	0.001	USEPA 6010 ICP/AES
Nickel	mg/L	0.001	USEPA 6010 ICP/AES
Selenium	mg/L	0.001	USEPA 6010 ICP/AES
Silica	mg/L	0.1	USEPA 6010 ICP/AES
Silver	mg/L	0.001	USEPA 6010 ICP/AES
Strontium	mg/L	0.001	USEPA 6010 ICP/AES
Thorium	mg/L	0.001	USEPA 6010 ICP/AES
Tin	mg/L	0.001	USEPA 6010 ICP/AES
Uranium	mg/L	0.001	USEPA 6010 ICP/AES
Vanadium	mg/L	0.05	USEPA 6010 ICP/AES
Zinc	mg/L	0.001	USEPA 6010 ICP/AES
Naturally Occurring Radioactive Material (NORM)			
alpha radiation	Bq/L	0.05 – 0.1	ASTM D7283-06
beta radiation	Bq/L	0.05 – 0.1	ASTM D7283-06
Gamma	Bq/L	0.05 – 0.1	ASTM D7283-06
BTEX			
Benzene	µg/L	1	USEPA 5030/8260 HS or P&T/GC/MS
Toluene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
Ethylbenzene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
M and P Xylene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
O Xylene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
Total Xylene	µg/L	2	USEPA 5030/8260 HS or P&T/GC/MS
Hydrocarbons			
TRH C6 - C10	µg/L	20	USEPA 5030/8260 HS or P&T/GC/MS
TRH C6 - C10 less BTEX	µg/L	20	USEPA 5030/8260 HS or P&T/GC/MS

Parameter	Reporting units	Limit of reporting	Method
TRH >C10 - C16	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
TRH >C10 - C16 less Naphthalene	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
TRH >C16 - C34	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
TRH >C34 - C40	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
Total TRH C6 - C40	µg/L	100	USEPA 5030/8260 HS or P&T/GC/MS
Polycyclic Aromatic Hydrocarbons			
3-Methylcholanthrene	µg/L	1	USEPA 3510/8270 GC/MS
7, 12- Dimethylbenz(a)anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Acenaphthene	µg/L	1	USEPA 3510/8270 GC/MS
Acenaphthylene	µg/L	1	USEPA 3510/8270 GC/MS
Anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (a) pyrene	µg/L	0.5	USEPA 3510/8270 GC/MS
Benzo (b) fluoranthene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (ghi) perylene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (k) fluoranthene	µg/L	1	USEPA 3510/8270 GC/MS
Benzo (a) anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Chrysene	µg/L	1	USEPA 3510/8270 GC/MS
Dibenz (ah) anthracene	µg/L	1	USEPA 3510/8270 GC/MS
Fluoranthene	µg/L	1	USEPA 3510/8270 GC/MS
Fluorene	µg/L	1	USEPA 3510/8270 GC/MS
Indeno (1,2,3-cd) pyrene	µg/L	1	USEPA 3510/8270 GC/MS
Napthalene	µg/L	1	USEPA 3510/8270 GC/MS
Phenanthrene	µg/L	1	USEPA 3510/8270 GC/MS
Pyrene	µg/L	1	USEPA 3510/8270 GC/MS
Carcinogenic PAHs (benzo[a}pyrene equivalents	µg/L	0.5	USEPA 3510/8270 GC/MS
Total PAH	µg/L	0.5	USEPA 3510/8270 GC/MS
Volatile Organic Compounds			
2,3,4,6-Tetrachlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4,5-Trichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4,6-Trichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4-Dichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4-Dimethylphenol	µg/L	1	USEPA 3510/8270 GC/MS
2,4-Dinitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
2,6-Dichlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2-Chlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
2-Methyl-4,6-dinitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
2-Nitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
4-Chloro-3-methylphenol	µg/L	1	USEPA 3510/8270 GC/MS
4-Nitrophenol	µg/L	1	USEPA 3510/8270 GC/MS
Dinoseb	µg/L	1	USEPA 3510/8270 GC/MS

Parameter	Reporting units	Limit of reporting	Method
Formaldehyde	mg/L	1	USEPA 3510/8270 GC/MS
Hexachlorophene	µg/L	1	USEPA 3510/8270 GC/MS
m- and p-Cresol	µg/L	1	USEPA 3510/8270 GC/MS
Pentachlorophenol	µg/L	1	USEPA 3510/8270 GC/MS
Phenol	µg/L	1	USEPA 3510/8270 GC/MS
Organic Carbon			
Dissolved Organic Carbon	mg/L	1	APHA 5310 B
Total Organic Carbon	mg/L	1	APHA 5310 B