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

APPENDIX A to APPENDIX D

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 A

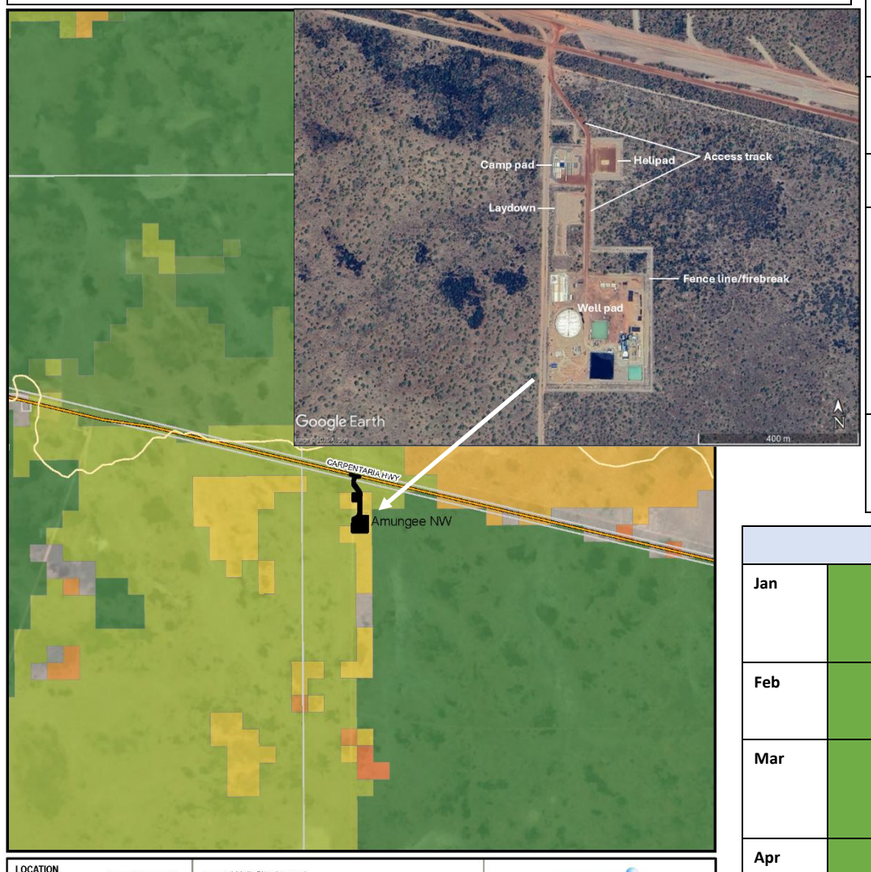
Bushfire Management Plans

Exploration Permit 117
Bushfire Management Plan 2022 onwards
Amungee NW (Rev 4, Mar-2025)

Location of Amungee NW	
Property and land uses	Gas exploration, cattle grazing, and native title rights and interests recognised by the native title determinations over the land and waters.
Site fire management aim	To reduce the occurrence of, and minimise the impact of bushfires, thereby reducing the threat to life, property, cultural values and the environment.
Site fire management objectives	Mitigate the potential impact of unplanned fires on Tamboran's people, assets and operations and neighbouring land uses.

Fire Management Risks

- Ignitions (humans and lightening) on or off site resulting in harm to workers and loss of equipment.
- Fire scar mapping indicates fires occur in the vicinity of the EP approximately every 2 - 4 years.
- Bullwaddy and Lancewood vegetation communities occur in areas across the permit and are fire sensitive. Hot fires have the ability to reduce habitat quality for flora and fauna species that use these vegetation communities.
- Spread of high fuel load grassy weeds could increase fire intensity, e.g. gamba, grader and buffel grass, adjacent to infrastructure areas and access tracks.



The BMP should be read in conjunction with the overarching Environment Management Plan and Emergency Response Plan for Tamboran's operations in the Beetaloo Basin.

Bushfire Officer	Contact Details	Name
	Mobile: [redacted] Satellite Phone: [redacted] Email: [redacted]	Robert Wear

Neighbours	Contact Details		Name
Amungee Mungee Station	[redacted] Katherine [redacted] Direct [redacted] Homestead	UHF [redacted] VHF [redacted]	[redacted]

Stakeholders	Contact Details
Emergency	000 or 112 mobile
Bushfire NT Katherine office (Savanna)	(08) 8973 8871 / BushfiresNT.Katherine@nt.gov.au
Bushfire NT Alice Springs office (Barkly)	(08) 8951 9266
NAFI North	https://www.firenorth.org.au/nafi3/
Secure NT (Fire Bans and Alerts)	https://securent.nt.gov.au/alerts
Fire incident map	https://www.pfes.nt.gov.au/incidentmap/

Bushfire Management Actions

Well pad	• Remove and or maintain vegetation within the well pad area and implement erosion and sediment control plan. • Treat emerging vegetation with herbicide. • Hot works are not permitted on total fire ban days without written approval from a fire control officer or fire warden. • When the site is suspended, the well pad can be sufficient to satisfy APZ requirements depending on the level of infrastructure/ assets present.
Fire management break	• A 10 m wide cleared perimeter around well pads and tank pads during operations. • An additional 10 m wide bare earth fire break incorporating a 4 m wide fire access trail during operations.
Fire access trails	• Create and maintain 4 m wide access trail by grading or spraying.
Asset protection zones (APZ)	• Site manager to assess fuel load prior to camp establishment and again at end of wet season if infrastructure is still in place (refer to Fuel Load Criteria). • Establish a 20 m low fuel zone around well pads and well pads during operations (i.e. an area low in combustible material and obstructions). • Monitor for grassy weeds and control where appropriate. • If deemed necessary, conduct controlled burns where other controls are not effective and in consultation with neighbouring properties. • Ensure 4 m wide fire access trail around the perimeter of the asset protection zone is trafficable by firefighting appliances.
Neighbouring property fire management zone	• Fire management planning meeting with neighbouring properties prior to commencing activities and reviewed annually. • Neighbour to advise proponent of planned burns. • Working with pastoralist to assist in responding to fire where it is safe and practicable.

Bushfire Preparedness and Planning

Mandatory for all Severe, Extreme and Catastrophic FDI days

The following must be reviewed daily. If fire alerts are active or presenting with a known fire risk, personnel must execute their contingency plans which need to encompass the following:

- ☐ Procedure on identifying and notifying of a bushfire.
- ☐ Critical equipment to be removed / isolated/ shut down.
- ☐ Safe evacuation routes from site and muster points.
- ☐ Communication methods:
  - ✓ Team channels and / or phone numbers
  - ✓ Area channels and/or phone numbers
- ☐ Closest safe havens.

Monitoring

- ☐ Provide timely advice on changes in level of fire risk as available.
- ☐ Monitor team and area common channels for bushfire early warning.
- ☐ Update changes in work location.

Bushfire First Responder Checklist

The following sequence must be followed by the first person responding to a fire:

1. Danger – Remove yourself and others from danger is safe to do so.

2. Alarm – Raise the alarm either on common radio channel or other agreed process.

3. Gather Information –

- ☐ Location – Direction from known reference points, (e.g. roads and Tamboran's infrastructure such as well pad location).
- ☐ Impacts (actual and potential) – Life, property and the environment.
- ☐ Fire characteristics – Grass or woodlands, flame height, fire front and direction of travel.
- ☐ Weather – Wind strength and direction.
- ☐ Response in progress – What response is underway and by who (Tamboran contractors, pastoralist or Emergency Services).
- ☐ Response required – Tamboran contractors and / or pastoralist and / or emergency services.
- ☐ Access – Safe access and egress routes.

4. Notify Tamboran – Fire Officer/Supervisor

5. Notify Pastoralists – Refer to property contacts

6. Notify Emergency Services—Call 000 or 112 if Tamboran and pastoralist unable to manage situation

7. Respond and Monitor —If safe to do so in consultation with pastoralist and emergency services.

CSIRO Fuel Load Criteria

- ☐ Fuel quantity (tonnes of fuel per ha).
- ☐ Assess vegetation type i.e. grassland, shrubland, scrub, woodland or forest.
- ☐ Fuel size and shape e.g. fine fuel such as grass that burns quick vs course fuel (thick branches/trunks) that burn slowly.
- ☐ Fuel arrangement (i.e. separation of understory to canopy, dense or light understory).
- ☐ Moisture content (strong winds, high temperatures and low humidity will decrease moisture content).

Annual Works Calendar

Jan	Low	• No fire management activity	**July**	High	• Manage vegetation onsite (including weeds), fire break and fire access trail • Monitor NAFI, fire danger ratings and fire weather warnings (daily or as required), and visually check horizon for smoke • Liaise with neighbour regarding bushfires
Feb	Low	• No fire management activity	**Aug**	High	• Monitor NAFI, fire danger ratings and fire weather warnings (daily or as required), and visually check horizon for smoke • Liaise with neighbour regarding bushfires
Mar	Low	• Weed survey • Planning meeting with neighbour • Annual fire mapping to monitor changes to fire frequency in the area	**Sep**	High	• Monitor NAFI, fire danger ratings and fire weather warnings (daily or as required), and visually check horizon for smoke • Liaise with neighbour regarding bushfires
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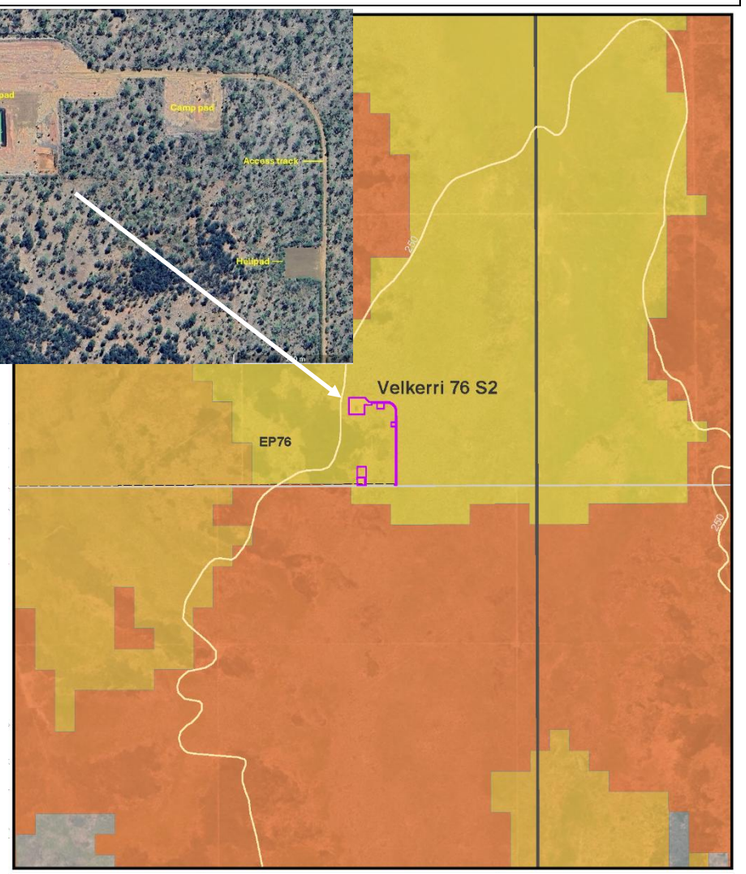
May	Low	• No fire management activity • Liaise with neighbour regarding bushfires • Review the preparedness planning requirements	**Nov**	Medium	• Monitor NAFI, fire danger ratings and fire weather warnings (daily or as required), and visually check horizon for smoke • Liaise with neighbour regarding bushfires
Jun	Medium	• Manage vegetation onsite, fire break and fire access trail • Monitor NAFI, fire danger ratings and fire weather warnings • Review the preparedness planning requirements	**Dec**	Low	• No fire management activity • Review the preparedness planning requirements

Exploration Permit 76
Bushfire Management Plan 2022 onwards
Velkerri 76 S2 (Rev 3, Mar-2025)

Location of Velkerri 76 S2	
Property and land uses	Gas exploration, cattle grazing, and native title rights and interests recognised by the native title determinations over the land and waters.
Site fire management aim	To reduce the occurrence of, and minimise the impact of bushfires, thereby reducing the threat to life, property, cultural values and the environment.
Site fire management objectives	Mitigate the potential impact of unplanned fires on Tamboran's people, assets and operations and neighbouring land uses.

Fire Management Risks

- Ignitions (humans and lightening) on or off site resulting in harm to workers and loss of equipment.
- Fire scar mapping indicates fires occur in the vicinity of the EP approximately every 7 years.
- Bullwaddy and Lancewood vegetation communities occur in areas across the permit and are fire sensitive. Hot fires have the ability to reduce habitat quality for flora and fauna species that use these vegetation communities.
- Spread of high fuel load grassy weeds could increase fire intensity, e.g. gamba, grader and buffel grass, adjacent to infrastructure areas and access tracks.



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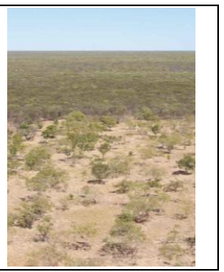

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Jun	Medium	• Manage vegetation onsite, fire break and fire access trail • Monitor NAFI, fire danger ratings and fire weather warnings • Review the preparedness planning requirements	**Dec**	Low	• No fire management activity • Review the preparedness planning requirements

The BMP should be read in conjunction with the overarching Environment Management Plan and Emergency Response Plan for Tamboran's operations in the Beetaloo Basin.

APPENDIX B

Water Extraction Licence

Review date: 09/10/2024

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Water Extraction Licence Decision

Application

1. The following application to renew an existing licence and increase the maximum water entitlement of a licence to take water from a bore (**application**) was lodged in accordance with section 60 of the *Water Act 1992* (**Act**) by Tamboran B2 Pty Ltd (**applicant**).

Table 1. Overview of application

Applicant:	Tamboran B2 Pty Ltd
Date Licence applied for:	22 November 2023
Licence applied for:	Amend licence GRF10285 to increase take of groundwater from a bore, under section 60A of the Act
Licence number:	GRF10285
Purpose for which licence is sought:	Petroleum Activity
Maximum quantity of water proposed to be taken annually for each beneficial use: Petroleum Activity	450 ML, increase of 275 ML/year
Land on which water will be taken and used:	NT Portion 7026 (14981 Stuart Hwy Birdum) NT Portion 7027 (4500 Carpentaria Hwy Birdum) NT Portion 1079 (8240 Carpentaria Hwy Arnold) NT Portion 1077 (1143 Buchanan Hwy, Birdum) Permits: EP76, EP98, EP117
Bore from which water will be taken:	RN041132, RN041136, RN040894, RN043018, RN040134
Groundwater resource:	Gum Ridge Formation
Water control district:	Daly Roper Beetaloo Water Control District
Water allocation plan:	Georgina Wiso Water Allocation Plan 2023-2031
Groundwater management zone:	Georgina Basin

Decision

2. In accordance with sections 60, 60A and 71C of the Act, I have decided renew the licence GRF10285 **(licence)** for a period of 10 years and to grant an amendment to increase the entitlement in accordance with the details in Table 1.

Context

3. On 11 November 2022, licence GRF10285 was granted to the applicant with an entitlement of 175 ML/year for the beneficial use of petroleum activity. The water is extracted and used on NT Portions 702, 1079, 7026, 7027 and 701 and has an expiry of 31 December 2024.

NORTHERN TERRITORY GOVERNMENT

4. The applicant has applied to increase the entitlement on the licence by 275 ML/year for a maximum entitlement of 450 ML/year for a 10 year period. The applicant plans to use the increased entitlement for civil construction, shale gas exploration and hydraulic stimulation. The application was submitted on the 22 November 2023 and was accepted as complete by the department on 12 February 2024.

Reasons for the Decision

Procedural requirements

5. I am satisfied that all substantive procedural requirements relating to the making of the application have been met. This includes that:
   a. the application was duly made in the approved form and includes all information required under the Act and the Water Regulations 1992
   b. the applicant is a legal entity
   c. the applicant has the authority to access the land from which water is proposed to be taken under the licence and on which the water will be used (**land**).

Advertisement of NOI

6. Section 71A(2)(a) provides that in making a decision in relation to a water extraction licence, Part 6A of the Act applies.
7. Section 71B(1) of the Act provides that within 20 business days after lodgement of an application to which Part 6A of the Act applies, the Controller must give notice of the Controller's intention to make a water extraction licence decision (**NOI**). Section 71B(2) of the Act requires a copy of the NOI to be published in a newspaper circulating in the general locality to which the application relates.
8. The NOI was published on Friday 15 March 2024 in the NT News. The NOI was not within the required 20 business day time frame. However, because the notice was published and the public were given 20 business days to provide comment on the application I believe that the principles of natural justice and procedural fairness intended under section 71B(1) of the Act have been met.
9. The content of the NOI complied with the requirements of section 71B of the Act[1].

Provision of NOI to the owners and occupiers of adjacent land

10. Section 71B(6) of the Act requires the Controller to give a copy of the NOI to owners and occupiers of land immediately adjacent to:
    a. land from which the water will be taken; and
    b. land on which the water will be used.
11. All owners and occupiers of land immediately adjacent to the land were identified in NR Maps using a buffer selection of adjacent properties. A copy of the NOI was sent to each owner and occupier of land adjacent to the land. A copy of the NOI was also sent to the Northern Land Council being a representative (or potential representative body) for registered native titleholders (or applicants) both exclusive and non-exclusive who are occupiers of the land or adjoining the land itself. The letters were sent at the same time as the publication of the NOI.
12. The land owners and occupiers were given 20 business days in which to respond to the NOI. Four submissions were received within the 20 business day timeframe.

[1] Section 71B(3) of the Act sets out the general information that must be included in the NOI and s 71B(4) requires the NOI to include an invitation to make written comments about an application to the Controller within 30 days after publication of the notice. The NOI includes all of that information.

Decision-maker

13. In accordance with section 18 of the Act, I was appointed the Controller of Water Resources **(Controller)** on 1 May 2023. That appointment remains current and there are no limitations in the terms of my appointment that would prevent me from deciding this application.

14. I am not aware of any professional or personal reasons that would disqualify me from making the decision.

Assessment undertaken, evidence used

Section 90(1) factors relevant to the application

15. My decision about this application is a water extraction licence decision under section 60A of the Act.

16. Section 90(1) of the Act provides that in making a decision I must take into account any of the following factors that are relevant to the decision. The following is an assessment of each of the factors specified in section 90(1) of the Act:

(a) the availability of water in the area in question

17. The applicant's operation is situated on the Stuart Highway between Daly Waters and Newcastle Waters within the Daly Roper Beetaloo Water Control District (the District). Currently, the applicant possesses a groundwater extraction licence with an annual entitlement of 175 ML/year for the beneficial use of petroleum activity. The applicant accesses water from the Gum Ridge Formation (GRF), a significant aquifer within the Georgina Basin and part of the broader Cambrian Limestone Aquifer (CLA) groundwater system. This application is to increase the existing entitlement by 275 ML/year.

18. The GRF has an estimated total aquifer volume of 45,292,000 ML and the Georgina Basin which the GRF is a part of has an estimated storage of 660,000,000 ML.

19. The estimated sustainable yield (ESY) for groundwater from the Georgina Basin is outlined in the *Georgina-Wiso Water Allocation Plan 2023-2031* (the plan)[2].

20. The ESY is determined after prioritising water for non-consumptive uses, which is the majority of water within the resource that is retained in the environment to maintain important ecological functions and for the cultural purposes and values of water in the region. The ESY for the Georgina Basin is 186,154 ML/year and the plan apportions that volume to various beneficial uses. 4.3% of the ESY, or 8000 ML/year, has been allocated to the beneficial use of petroleum activity.

21. There are currently four water licences in the Georgina Basin plan area including the applicant's, that are extracting groundwater for the beneficial use of petroleum activity. In total, these licences are authorised to extract 752 ML/year. Granting this application would increase this to 1027 ML/year, which is 13% of the 8,000 ML/year available from the Georgina Basin for petroleum activities. Accordingly, I am satisfied that there is sufficient water available to support the applied for increase in entitlement.

(ab) any water allocation plan applying to the area in question

22. As discussed above, the *Georgina-Wiso Water Allocation Plan 2023-2031* is currently declared over the area that encompasses the applicant's land. The plan applies to an area approximately 155,000 km^2 and manages the Cambrian Limestone Aquifer System that is made up of the Georgina and Wiso Basins.

[2] Available Online: Government Gazette No. S77, 10 November 2023

23. In addition to determining the ESY and allocation to beneficial uses, the plan outlines a number of water sharing objectives to be achieved through the effective management of the water resource:
    a. Balancing the retention and preservation of key environmental values dependent on water with the overall benefits provided by the water resources
    b. Ensure water licence decisions account for Aboriginal and other cultural values dependent on water
    c. Predict and protect water for rural stock and domestic purposes
    d. Provide long term security of a sufficient quantity and quality of water for public water supplies
    e. Set aside water to support local Aboriginal economic development
    f. Provide access to water to support sustainable development for the benefit of the region.
24. These objectives relate to ensuring the availability, security and quality of water for different purposes. These objectives are largely achieved through the calculation of the ESY and the allocation of water to different beneficial uses, and by not granting water licences where it would result in the total volume of licensed water exceeding the volume allocated to that beneficial use.
25. The plan also proposes specific actions toward these objectives that should be considered in the process of water licensing:
    a. That the condition of groundwater dependent ecosystems (GDE) and other key environmental values are monitored as far as practicable and appropriately accounted for in water licensing; and
    b. that key Aboriginal cultural sites that rely on water, and other cultural values that rely on water, are monitored and potential impacts on such values are appropriately accounted for in water licensing.
26. The water table of the GRF underlying the applicant's land, has depths ranging from 80-120mbgl and is considered outside the zone where groundwater could support terrestrial groundwater dependant ecosystems. Identified GDEs within the area of operation utilise a perched aquifer system which is hydraulically disconnected from the regional water table that the applicant targets. As such, I do not consider there to be a significant risk to GDEs associated with the applicant's licensed take of water and therefore do not consider additional monitoring conditions as a requirement of the licence.
27. Other key environmental values, such as springs and areas of outstanding or high environmental value identified by the Strategic Regional Environmental Baseline Assessment (SREBA), are not within the proximity of the applicant's bores. Simulated drawdown conducted by the department for extraction bores ranging from 40-64 km from the applicant's production bores, shows that consistent pumping of all of the applicant's bores for a 10 year period would result in minimal drawdown at those locations (less than 0.1m of drawdown). Areas such as the Roper Discharge Zone and Lake Woods, identified in the SREBA and also raised in a comment received through the NOI, are significantly further away than the extraction bores used in the department's simulation and are therefore will not be affected by the applicant's proposed activity.
28. Similarly, no Aboriginal cultural sites that rely on water, or other cultural values that rely on water, have been identified within proximity of the applicant's activities.
29. There are four land portions of Aboriginal land that intersect the radius of drawdown from the applicant's proposed activities. The magnitude of simulated drawdown is less than 0.1m for all portions and would not affect access to groundwater on land to which the Aboriginal water reserve applies. The plan allocates 17,109 ML/year to the beneficial use of Aboriginal economic development. The applicant's proposed extraction does not prevent access to this allocation from any of the portions that intersect the radius of drawdown from the applicant's proposed activities.
30. Granting this licence is consistent with the objectives of the plan and this water licence does not require specific conditions to meet the water sharing objectives of the plan.

(b) the existing and likely future demand for water for domestic purposes in the area in question

31. Land owners and occupiers have a statutory right under the Act to take water for stock and domestic purposes.

32. I have considered the existing and potential future increase in water demand for domestic purposes in my consideration of water availability above, in line with the future predicted domestic demand outlined in the plan.

33. There are three registered bores within 15 km of the applicant's activities that are listed for stock and domestic purposes. A model of the predicted drawdown from the extraction of 450 ML/year specifies that drawdown is limited to less than 1m for all three stock and domestic bores in the vicinity of the applicant's production bores.

34. The land where water is currently taken is largely surrounded by pastoral leases and has limited demand for domestic use. The plan accounts for rural stock and domestic (RS&D) usage and provides an ESY of 15,050 ML/year. It is not projected that there will be increased future demand within the area due to the remote location and pastoral land use.

35. I am of the view that granting the application will not adversely affect existing domestic users from their statutory right to access water, and there is sufficient water available in the event of increased future demand in the area.

(c) any adverse effects likely to be created as a result of activities under the permit, licence or consent on the supply of water to which any person other than the applicant is entitled under this Act;

36. In considering adverse effects likely to be created as a result of the activities, I have referred to the *Final Report of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory*[3] and the recommendations made to mitigate groundwater impacts from onshore gas developments.

37. The inquiry recommended the prohibition of the extraction of water from a bore to supply water for hydraulic fracturing if the water bore is within a 1 km radius of existing bores used for stock and domestic purposes. This recommendation has been legislated through amendments to the Act. Section 60A prohibits granting a water licence for petroleum activity including hydraulic fracturing, if there are stock and domestic or other licensed bores within a 1km radius of the proposed bore, unless the owner of each bore consents, or the groundwater modelling indicates that there will not be any adverse effect on the supply of water to those bores.

38. In this case, the nearest water supply bore is 1.1 km away and belongs to the applicant. The nearest stock and domestic bore is 5 km away. Simulation by the department shows that maximum drawdown at that bore over a 10 year period is insignificant (less than 0.1m).

39. Some commenters remarked on the risk to contamination between aquifers or to the target aquifer itself. The predominant risk associated with the applicant's take of water is the process of drilling through aquifers during bore construction. This is mitigated by the application of the *Minimum Construction Requirements for Water Bores in Australia*[4]. It is a standard condition for all bore work permits and water licences issued in the Northern Territory that bores are constructed and maintained in accordance with those guidelines.

40. The construction standards for petroleum wells, established as part of the recommendations from the inquiry, have been incorporated into the *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Permits in the Beetaloo Sub-basin*[5] and groundwater monitoring requirements are outlined in the *Code of Practice: Onshore Petroleum Activities in the Northern Territory*[6].

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[3] Available Online: Final Report of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory

[4] Available Online: Minimum Construction Requirements for Water Bores in Australia

[5] Available Online: Preliminary Guideline: Groundwater Monitoring Bores for Exploration Permits in the Beetaloo Sub-basin

[6] Available Online: Code of practice: Onshore petroleum activities in the Northern Territory

41. These standards and requirements have been developed in order to minimise the risk of groundwater contamination from leaking gas wells. The requirement to conduct groundwater monitoring, as well as wastewater management and other environmental considerations, are incorporated into the applicant's environment management plan and regulated under the *Petroleum (Environment) Regulations 2016.*

42. Having considered the relevant information, I am not of the view that the applicant's activities are likely to cause an adverse effect to the supply of water to which any person other than the applicant is entitled.

(d) the quantity or quality of water to which the applicant is or may be entitled from other sources;

43. There is no other water source in the vicinity of the applicant's land that could provide the necessary quantity of water for the stated beneficial use. Groundwater is therefore the only viable source of water to enable the applicant to carry out their activities.

44. This factor supports the granting of the application.

(e) the designated beneficial uses of the water and the quality criteria pertaining to the beneficial uses

45. Pursuant to section 22A, the *Northern Territory Government Gazette G41*, dated 19 October 2022, declared the beneficial uses for the Daly Roper Beetaloo Water Control District as agriculture, aquaculture, public water supply, environment, cultural, industry, rural stock and domestic, mining activity and petroleum activity.[7]

46. The applicant proposes to use the water for the beneficial use of petroleum activity, which is a legislated beneficial use.

47. The proposed use of the water by the applicant aligns with a legislated beneficial use. I consider this factor to support the granting of the application.

(f) the provisions of any agreement made by or on behalf of the Territory with a State of the Commonwealth concerning the sharing of water;

48. There are no agreements between the Territory and the Commonwealth or a State concerning the sharing of water that is relevant to the water resource. This factor is not relevant to my decision.

(g) existing or proposed facilities on, or in the area of, the land in question for the retention, recovery or release of drainage water, whether surface or sub-surface drainage water; and

(h) the adverse effects, if any, likely to be created by such drainage water resulting from activities under the licence on the quality of any other water or on the use or potential use of any other land;

49. Facilities associated with wastewater management for petroleum activities and drainage on the mine site are managed under the applicant's environment management plan and the *Petroleum Act 1984*. As these consideration fall under other regulatory controls, I do not consider this factor precludes the grating of the application, however I have included a condition on the water licence that the applicant holds an authorised environment management plan and must inform the department if that plan is revoked.

(j) ***the provisions under the Planning Act relating to the development or use of land in the area in question;***

50. The Northern Territory Planning Scheme (NTPS) does not apply to the land. This factor is not relevant to my decision.

(k) other factors the Controller considers should be taken into account or that the Controller is required to take into account under any other law in force in the Territory.

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[7] Available online: Government Gazette No. G41, 19 October 2022

Bores

51. The proposed extraction bores display airlift yields ranging from 5-20 L/s. This would suggest that the applicant is accessing water in a highly productive zone of the GRF and will be sufficient to meet the increased entitlement of 450 ML/year.

Comments received in response to NOI

52. As previously identified, four submissions were received in response to the NOI. I am required to consider each comment when deciding whether to grant the application. The following table is a summary of the issues raised by the commenter, and my response.

Table 2. Summary of submission and how they have been addressed in my decision.

Issue Raised	How matter has been addressed	Commenter No.
Inadequate and non-compliant measures to protect water resources	The *Petroleum Act 1984* & Petroleum (Environment) Regulations 2016 manage the compliance of waste water production from petroleum activities through the applicants approved EMP. Even so, I have imposed a number of conditions on licence to monitor the water resource to add additional layers of compliance.	1, 4
Unexplained or excessive increase in groundwater use for fracking	The water will be used for a variety of uses, including hydraulic fracturing stimulation, exploration, and on site civil construction. The requested entitlement is appropriate to sustain the applicant's operation.	1, 2, 4
Tamboran has not implemented recommendations from the Pepper Inquiry.	As discussed in section 90(1) (c), there have been a number of recommendations from the inquiry that has been implemented to ensure compliance with water extraction for petroleum activities.	1,
Tamboran's environmental track record and previous non-compliance make them unfit to hold a water extraction licence	The applicant's recorded non-compliance events relate to the use of water for petroleum activities not the extraction of water under their existing water extraction licence. The applicant's EMP and the requirements of the Petroleum (Environment) Regulations 2016 will continue to regulate the applicant's petroleum activities.	1, 2 , 4
Relevant SREBA recommendations not implemented	Recommendations related to the take of water have been implemented as part of this assessment.	2, 4
Discrepancies in extraction bore numbers and locations	The existing licence was amended in 2023 to consolidate the bores listed on the applicant's second licence which has now lapsed. The licence for this increase will list five bores as specified by the applicant and the remaining two will be removed.	2, 3, 4
The application has not adequately outlined the water use schedule information	The applicant has sufficiently outlined their predicted water use in the schedule. As addressed, due to the nature of the project they cannot accurately provide a volume of water to be taken by each bore. There are conditions on the licence to limit the amount of water that can be taken from a bore to minimise impacts from extraction.	1, 2, 3, 4

Potential impacts to Anthony lagoon formation not assessed	The impacts to Anthony lagoon have been assessed as part of the assessment into water availability and adverse impacts, 90(1) (a) (c). Even with likely interconnectivity between aquifers, the volumes taken out of the aquifers storage should not impact the storage of Anthony lagoon. Impacts to water between the aquifers will be mitigated by the requirements set out by the *Minimum Construction Requirements for Water Bores in Australia* when constructing bores.	2, 4
Stygofauna and GDEs impacts have not been adequately assessed.	The impacts to stygofauna and GDEs have been considered in the decision. As stated in the technical memo from DEPWS and RDM's assessment, there is a significant unsaturated zone >100m between the GRF where the applicant will be extracting from. This depth below ground level makes the chance of stygofauna being present, highly unlikely. Surface dwelling GDE's are likely utilising perched shallowed aquifer systems that are hydraulically disconnected from the GRF.	2, 3, 4
Impacts to the perched aquifer system not considered	The impacts to the perched aquifer system have been considered. The perched aquifer is associated with surficial sediments and is hydraulically disconnected from the regional water table from an unsaturated zone 100m thick. As such, I do not anticipate impacts to the perched aquifer from the applicant's proposed increased extraction from the GRF.	2, 4
There is a lack of knowledge of the resource the applicant is targeting	There is extensive knowledge of the resource which has guided this decision.	2, 3, 4
Excessive duration of application	The licence will be issued for 10 years. The applicant will require water over the lifetime of the operation and in the event of closure and remediation.	2, 4
Wastewater management does not do enough to mitigate risks	The applicants EMP's contains the relevant waste management plan to mitigate and regulate possible risks. I have also imposed additional conditions to monitor the water quality within the aquifer to provide another layer of risk mitigation.	3, 4
There are key deficiencies in the EMP submitted which has been used to support the application.	In assessing the section 90(1) factors, I have relied on the plan and the reports provided by departmental staff and by the applicant to determine if this application is supported. The applicant must hold an approved EMP before any extraction can occur, as per the conditions on the licence.	3

Commenter Number	Commenter Name
Commenter 1	Central Australia Frack Free Alliance
Commenter 2	Peter Robertson
Commenter 3	Environment Centre NT
Commenter 4	Nurrdalinji Native Title Aboriginal Corporation

Summary of the section 90(1) factors

53. In consideration of the section 90 factors, I have decided to grant the licence with a maximum licence volume of 450 ML/year for a period of 10 years, on the basis that:
    a. there is water available to support this volume;
    b. potential impacts to other water users are considered low and can be managed by licence conditions; and
    c. there is a purpose for the water which aligns with the declared beneficial uses for groundwater in the area.

Conditions of Licence

54. The conditions of the licence reflect my decision and the assessment above. In summary these include:
    a. A minimum extraction limit.
    b. Require water metering and reporting of water taken and include annual announced allocation decisions that allow entitlements to be managed according to environmental conditions.

Special Conditions

55. Regulation 9AA requires that a licence holder must pay annual fee of $3000 if the beneficial use under the licence is petroleum activity that includes hydraulic fracturing. A condition requiring this payment has been included on the licence.

Andrew Johnson

Andrew Johnson
Controller of Water Resources
16 July 2024

APPENDIX C

Weed Management Plan

Review date: 09/10/2025

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BEETALOO EXPLORATION PROJECT
WEED MANAGEMENT PLAN

Review date: 09/10/2025

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Weed Management Plan

TB2-HSE-MP-11

Review record

REV	DATE	REASON FOR ISSUE	AUTHOR	APPROVER
0	05/10/2018	Issue for release	A Court	M Kernke
1	29/03/2019	Issue for release	A Court	M Kernke
2	20/05/2019	Minor Update	A Court	M Kernke
2.1	10/09/2019	Minor update	M Kernke	M Hanson
2.2	10/09/2019	Minor update to include feedback from Amungee NW-1H EMP review		M Kernke
2.3	25/08/2021	Minor update to content based on DEPWS feedback	M/Kernke	M Kernke
2.4	10/11/2021	Update to include 2021 weed survey	M Kernke	M Kernke
2.5	18/01/2022	Update to include revised RWMP		M Kernke
2.6	27/02/2022	Update to include DEPWs comments	L Pugh	M Kernke
2.7	30/08/2022	Update to refence the *Tennant Creek Weeds Strategy 2021-2026* and Gamba Grass eradication in Zone A	L Pugh	M Kernke
3.0	30/03/2023	Updates to Section 1, 2 and minor edits	L Pugh	L Pugh
3.1	14/04/2023	Edits to figures	L Pugh	L Pugh
3.2	13/03/2024	Addresses regulation 10 and regulation 11 feedback from DEPWS, 29-Feb-2024	L Pugh	L Pugh
3.3	10/07/2024	Buffel grass status revised to a declared weed	L Pugh	L Pugh
3.4	27/09/2024	Updates to section 5 and 9; addresses regulation 10 feedback from DEPWS, 26-Sept-2024	L Pugh	L Pugh
4.0	10/10/2024	Update for SS 3D Seismic EMP and update of regulators of the *Petroleum Act 1984*, Petroleum Regulations 2020 and Petroleum (Environment) Regulations 2016	A Court	L Pugh

Review date: 09/10/2025

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1 Introduction

1.1 Objectives of the Weed Management Plan

This Weed Management Plan (WMP) has been developed to ensure that the risk of weed introduction and spread, resulting from activities associated with Tamboran's exploration activities are mitigated to protect the economic, community, industry and environmental interests of the Northern Territory (NT).

The plan provides an overview of:

- The project context (Section 2).
- Legal requirements in relation to weed management (Section 3).
- The appointment of a dedicated Weed Officer (Section 4).
- Identified risks and proposed mitigation measures and management objectives (Section 5 and 6).
- The weed species that are considered likely or known to occur within the permit area (Section 6 and 7).
- The annual action plan for those species that are known to occur within the permit area (Section 8).
- Control options for species known to occur within the permit area (Section 8).
- The monitoring, notification, recording and reporting requirements for the WMP (Sections 9 – 12).

This plan is supported by appendices that provide guidance on how to identify weed species in the field and collect the necessary data to support the monitoring and reporting requirements of this WMP.

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

1.2 Intent of the WMP

Weed control is a significant land management issue in the NT. This WMP forms a core component of Tamboran's overarching environmental management strategy and supports the various project Environment Management Plans (EMPs).

The movement of rigs, vehicles, machinery and other materials to, from and within the exploration permit area may result in weeds being moved around the pastoral lease, into the lease from surrounding areas or interstate, depending on where the vehicles and materials are sourced from or returned to.

The focus of this WMP is therefore to ensure that infestations are eradicated, or at the very least that existing weed infestations are controlled such that no further weed species colonise the permit area as a result of Tamboran's activities.

This document is based on the Weed Management Planning Guide - Onshore Shale Gas Development Projects produced by the Department of Environment, Parks and Water Security (DEPWS 2019), now known as the Department of Lands, Planning and Environment (DLPE).

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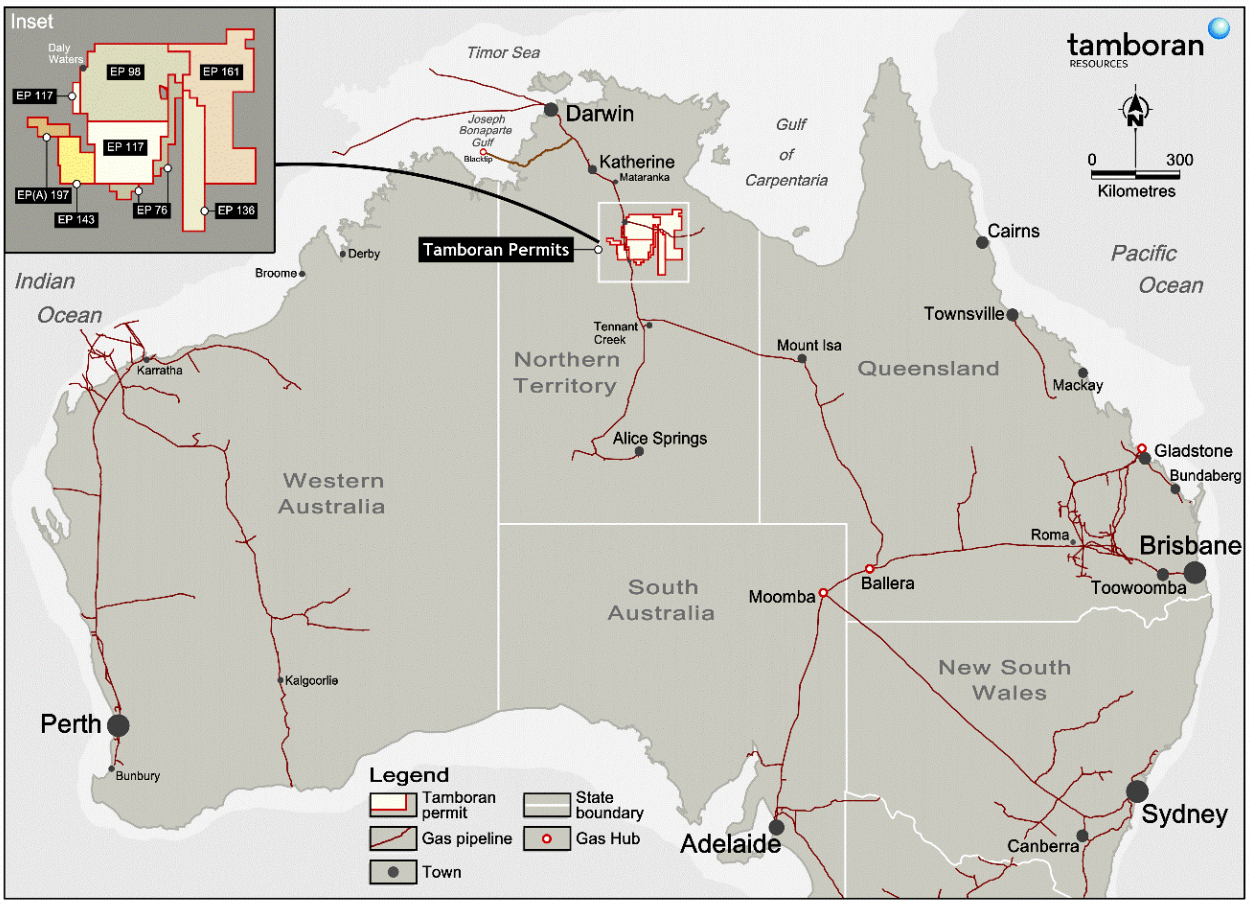

Figure 1 Location of Tamboran exploration permit areas (EPs)

2 Project Context

This plan covers all civil, seismic, drilling, stimulation, rehabilitation and routine maintenance/monitoring activities undertaken by Tamboran within its permit areas (Figure 1).

The primary activities subject to this WMP include but are not limited to:

- Access track construction, use and maintenance
- Gathering line construction, use and maintenance
- Seismic acquisition and line rehabilitation
- Exploration lease pad construction, use and maintenance
- Gravel pit construction and maintenance
- Drilling, stimulating, completing and maintaining petroleum exploration wells
- Routine access, maintenance and monitoring of all exploration areas subject to this plan.

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3 Legal Requirements

The following section presents the relevant legislation and statutory obligations for the project.

3.1 Petroleum Act and subordinate legal instruments

Petroleum Act 1984, Petroleum (Environment) Regulations 2016 and ***Code of Practice for Petroleum Activities within the Northern Territory***

The *Petroleum Act 1984* provides the legal framework within which persons are encouraged to undertake effective exploration for petroleum and to develop petroleum production so that the optimum value of the resource is returned to the NT. It regulates the exploration for, and production of petroleum, including environmental protection measures which should be employed during exploration and production activities, including protection of parks and reserves and rehabilitation.

In addition, the Act is supported by the Petroleum (Environment) Regulations 2016 (the Regulations). The Regulations require that regulated activities are carried out in a manner consistent with the principles of ecologically sustainable development, and by which the environmental impacts and environmental risks of the activities are identified and reduced to as low as reasonably practical (ALARP) and acceptable levels.

The *Code of Practice for Petroleum Activities in the Northern Territory* (the Code) is a mandatory code of practice for the petroleum industry to ensure that petroleum activities in the NT are managed according to minimum acceptable standards to ensure that risks to the environment can be managed to a level that is ALARP and acceptable.

Under this legal framework, Tamboran is required to submit an EMP prior to any petroleum exploration or production activity.

EMPs must include:

- potential environmental risks or impacts (in this instance relating to the introduction and spread of weeds)
- appropriate environmental outcomes, environmental performance standards and measurement criteria
- appropriate implementation strategy and monitoring, recording and reporting arrangements, and
- demonstrate that there has been an appropriate level of engagement with directly affected stakeholders in developing the plan.

This WMP is designed to support and implement the requirements of Tamboran's project specific environment management plans.

3.2 NT Weeds Management Act

The aim of the *Weeds Management Act 2001* is *"to protect the Territory's economy, community, industry and environment from the adverse impact of weeds"*.

The purpose of the Act, as defined in section 3, is:

- To prevent the spread of weeds in, into and out of the Territory and to ensure that the management of weeds is an integral component of land management in accordance with the NT Weeds Management Strategy 1996 – 2005 or any other strategy adopted to control weeds in the Territory.

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- To ensure there is community consultation in the creation of weed management plans.
- To ensure that there is community responsibility in implementing weed management plans.

As of the 8 July 2024, the Act[1] identifies declared weeds (those which must be controlled) and provides a framework for weed management. Weeds may be classified according to any of the following purposes:

Class A	it is necessary to eradicate the plant
Class B	it is necessary to prevent the growing and spreading of the plant
Class C	it is necessary to prevent the introduction of the plant into the Territory or a part of the Territory
Class D	it is necessary to prevent the plant being spread by the actions of persons.
Unclassified	Declared but not classified as A, B, C or D.

* All Class A and B weeds are also Class C.

The Act enables the relevant Minister to approve statutory weed management plans. Management obligations in these plans must be adhered to.

There are statutory management plans for 10 high priority weed species in the NT. The WMP must address weeds in accordance with their declaration status and the statutory requirements of any relevant weed management plans.

3.3 Regional Weed Management Strategies

Regional Weed Strategies (RWS) have been developed for areas of the NT, with the Tennant Creek regional weeds strategy 2021 – 2026 and the Katherine regional weeds strategy 2021 – 2026, overlapping Tamboran's Beetaloo exploration tenure. The aim of these regional plans is to assist in prioritising weed management by:

- identifying the region's priority weeds and associated pathways of spread to inform management priorities
- identifying landscapes that may need prioritised protection from weed impacts like river corridors or sacred Aboriginal sites
- containing information on alert weeds that are not yet found in the region, but could become major issues if they establish.

3.4 Commonwealth Environment Protection Biodiversity Conservation Act

The objectives of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are, among other things to:

- provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and

[1] Refer Part 2, section 7(4).

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- promote the conservation of biodiversity; and
- promote a co-operative approach to the protection and management of the environment involving governments, the community, land holders and indigenous peoples; and
- assist in the co-operative implementation of Australia's international environmental responsibilities.

The EPBC Act provides for the identification and listing of key threatening processes on matters of national environmental significance (MNES). A threatening process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. Key threatening processes include invasive species, such as weeds, which have a major impact on Australia's environment, threatening our unique biodiversity and reducing overall species abundance and diversity (DCCEEW, 2018).

Threat abatement plans (TAP) are developed to address key threatening processes. A TAP has been developed covering 5 listed grass species present within the Northern Territory (DCCEEW, 2012). The TAP covers grasses originally introduced to support pastoralism: gamba grass (*Andropogon gayanus*), para grass (*Urochloa mutica*), olive hymenachne (*Hymenachne amplexicaulis*), mission grass (*Pennisetum polystachion*) and annual mission grass (*Pennisetum pedicellatum*).

The controls in this WMP are designed to align with the Commonwealth TAP.

4 Dedicated Weed Officer

As per recommendation 8.3 of the Scientific Inquiry into Hydraulic Fracturing Stimulation there must be a dedicated Weed Officer for each gas field.

The Weed Officer must have relevant skills and experience and availability to successfully manage weed related issues for the project, including:

- Knowledge of the biology/ecology of local weeds.
- Knowledge of relevant weed management frameworks including NT legislation and plans, the EPBC Act.
- Understanding of existing weed management arrangements being undertaken by landholders.

The Weed Officer is responsible and accountable for delivery of all weed related requirements of the project in accordance with the WMP and the overarching EMP, including:

- Planning and execution of weed monitoring requirements, including baseline weed assessments and ongoing monitoring both during periods of gas related activities as well as during the target identification period of February to May.
- Facilitate training all workers (including contractors) in weed management requirements, with support from the NT Government Onshore Petroleum Weed Management Officer.
- Oversight of implementation of weed control mechanisms including but not limited to wash-downs and proactive weed control programs.
- Ensuring all reporting requirements are met.
- Act as the designated point of contact for and rapidly responding to any weed related complaints and incidents in accordance with the pre-determined strategies in this WMP and additional

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strategies as required developed in consultation with the Onshore Petroleum Weed Management Officer and affected landholders.

- Review and update of WMPs to remain effective in communication with relevant landholders and Onshore Petroleum Weed Management Officer in consideration of monitoring results and emerging weed issues for both gas and pastoral operations.

Tamboran has appointed the **Beetaloo Field Manager** as the dedicated Weed Officer of the Beetaloo exploration activities. This role is supported by Tamboran's Approvals and HSE personnel.

5 Baseline Weed Species Information

Baseline and annual weed surveys have been completed across the proposed and existing exploration areas. These surveys indicate the abundance of weeds within the proposed and existing project areas are low.

No weeds were detected within the Shenandoah South E&A program during the December 2022, April 2023 and May 2024 field survey. *Hyptis suaveolens* (Hyptis), has been identified at the Kalala S1 and Amungee NW site (access tracks, camp pad and lease pad). Hyptis has also recently been observed at the Velkerri 76 S2 site camp pad and irrigation area. Rubber Bush and *Parkinsonia aculeata* (Parkinsonia) have been previously identified along/in proximity to the Beetaloo W access track, with rubber bush also found along the Kyalla 117 N2 access track. Parkinsonia is considered a Weed of National Significance (WoNS), which are weed species that are the focus of national management programs for the purpose of restricting their spread and/or eradicating them from parts of Australia. These species are specifically presented in Table 1 and Section 9.

Gamba Grass (*Andropogon gayanus*) is a Declared Class A (to be eradicated) weed within the Beetaloo Sub-basin.[2] Gamba Grass is grown within the Class A zone on two pastoral leases under strict permit conditions. These pastoral leases are subject to annual audits and regular inspections to ensure it is not spread outside the permitted areas. An active compliance program is in place to ensure eradication is being achieved in Zone A, as per the requirements of the statutory weed management plan for gamba grass (DEPWS 2020).

One incursion of Gamba Grass was treated at Amungee NW1 (EP 98) in 2023 and another (single plant not in seed) in May 2024 at Kyalla 117 N2 (EP 117). No other incursions pf Gamba grass has been identified within the Tamboran's exploration permits (e.g. EP 117, EP 98 and EP 76). Tamboran is committed to preventing the spread of Gamba Grass into the project area from known Gamba locations. Gamba grass incursions will continue to be identified, recorded and treated in accordance with the Threat Abatement Advice released by the Commonwealth Government.

Figure 2 illustrates the weeds species confirmed in the region during field surveys, along with other weed species that are known to occur or likely to occur within the wider exploration permit areas. This information is based on.

- Tamboran exploration program weed survey data (2014 onwards – results).
- Mapping data provided by the Weed Management Branch, DLPE.
- Guidelines for the Management of the Weeds of Beetaloo 2018 (DLRM et al 2018).
- Tennant Creek weeds strategy 2021 – 2026 and Katherine weeds strategy 2021 – 2026.

[2] The Beetaloo lies within the NT Statutory Weed Management Zone Class A (for eradication).

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- Department of Climate Change, Energy, the Environment and Water (DCCEEW) EPBC Act Protected Matters Report database.

Table 1 has been separated into priority weeds, which are broken down into 5 distinct categories:

- Category 1: These species are present in the region and are widely considered feasible to eradicate. They are typically evaluated as very high risk and have isolated and restricted distributions.
- Category 2: These species warrant strategic control across the landscape due to the high impact they have on land managers and on broader economic and environmental values. The key for these species is that outlier populations are practical to eradicate, but there are core infestations that are subject to control and containment. They are typically covered by a statutory weed management plan, the target of a specific program or similar; often they are Weeds of National Significance.
- Category 3: These species have been assessed by the weed risk management system as a medium to high risk (or have not been assessed) and have been identified by stakeholders as posing a threat to the values of the Region. The list is not comprehensive. There are no plans or strategies to manage any one of them as a species across the landscape. They are typically managed on a site basis and to prevent further spread. In some cases there may be local strategies to manage these weeds.
- Category 4: These species are typically evaluated as low risk; however, they do still have local impacts. There are no strategies in place for managing these species at a landscape scale. However, it is important for landholders to implement weed hygiene and other biosecurity measures to prevent the spread of weeds into clean areas, and to control these species where the opportunity arises. Typically, these weeds may become problems around infrastructure, drains and other disturbed areas.
- Category 5: The Weed Management Branch uses a working definition of an ‘alert’ weed as a species:
    - not yet naturalised in a region
    - with the potential to have a high level of impact should it become established
    - having a reasonable likelihood of arriving in the Region (or of being present undetected).

It is noted that Parthenium (*Parthenium hysterophorus*) is a major problem in rangelands and cropping areas of Queensland and is estimated to cost farmers and graziers more than $22 million a year in reduced production and increased management costs. Vehicle, machinery and material movements from Queensland into the project area present a risk of spread of Parthenium if not managed correctly (Department of Primary Industry and Resources 2016).

Additional mapped locations of weeds within the Tennant Creek and Katherine RWMS are provided in Figure 3, Figure 4 and Figure 5.

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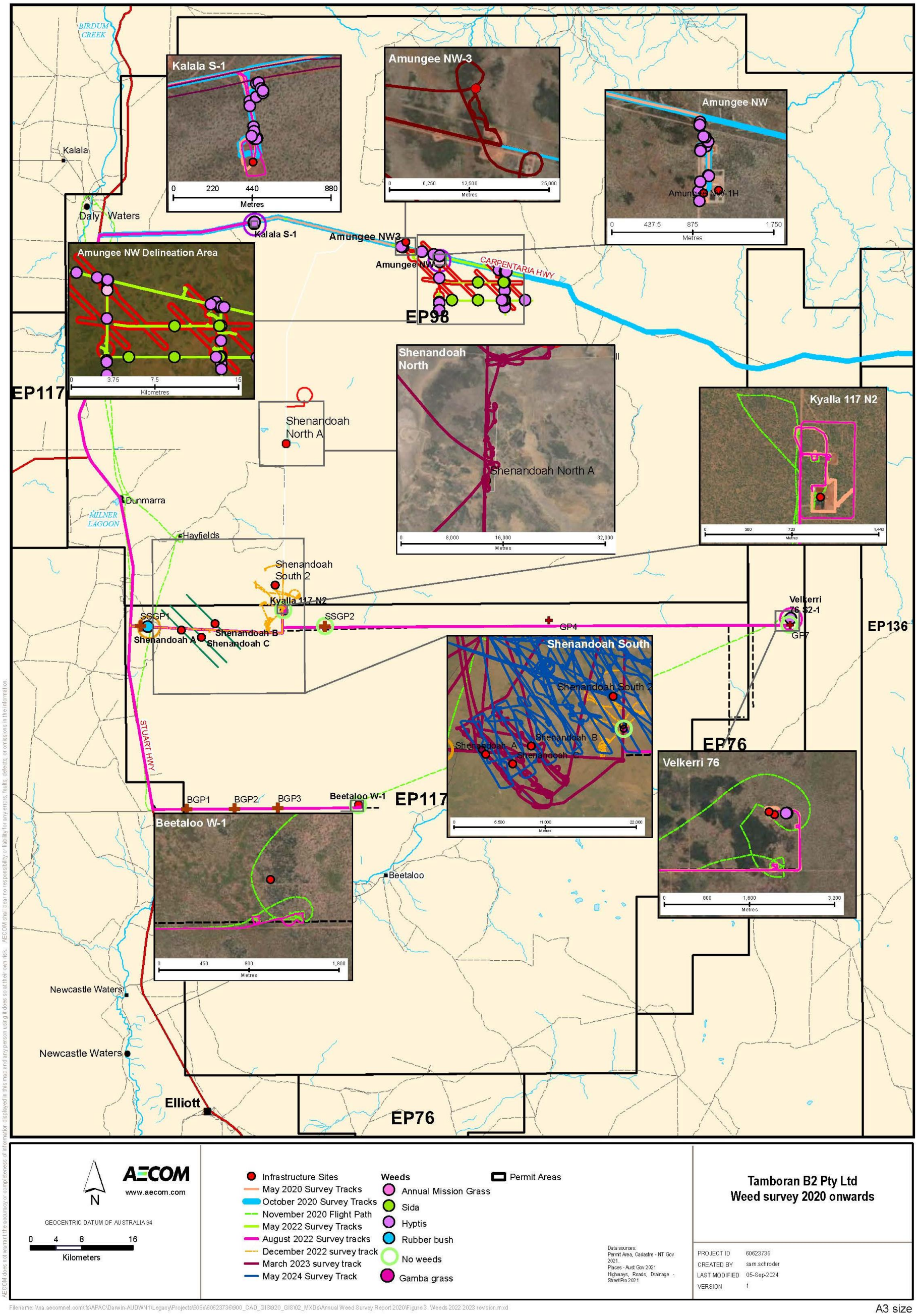

Figure 2 Location of weeds species in EPs

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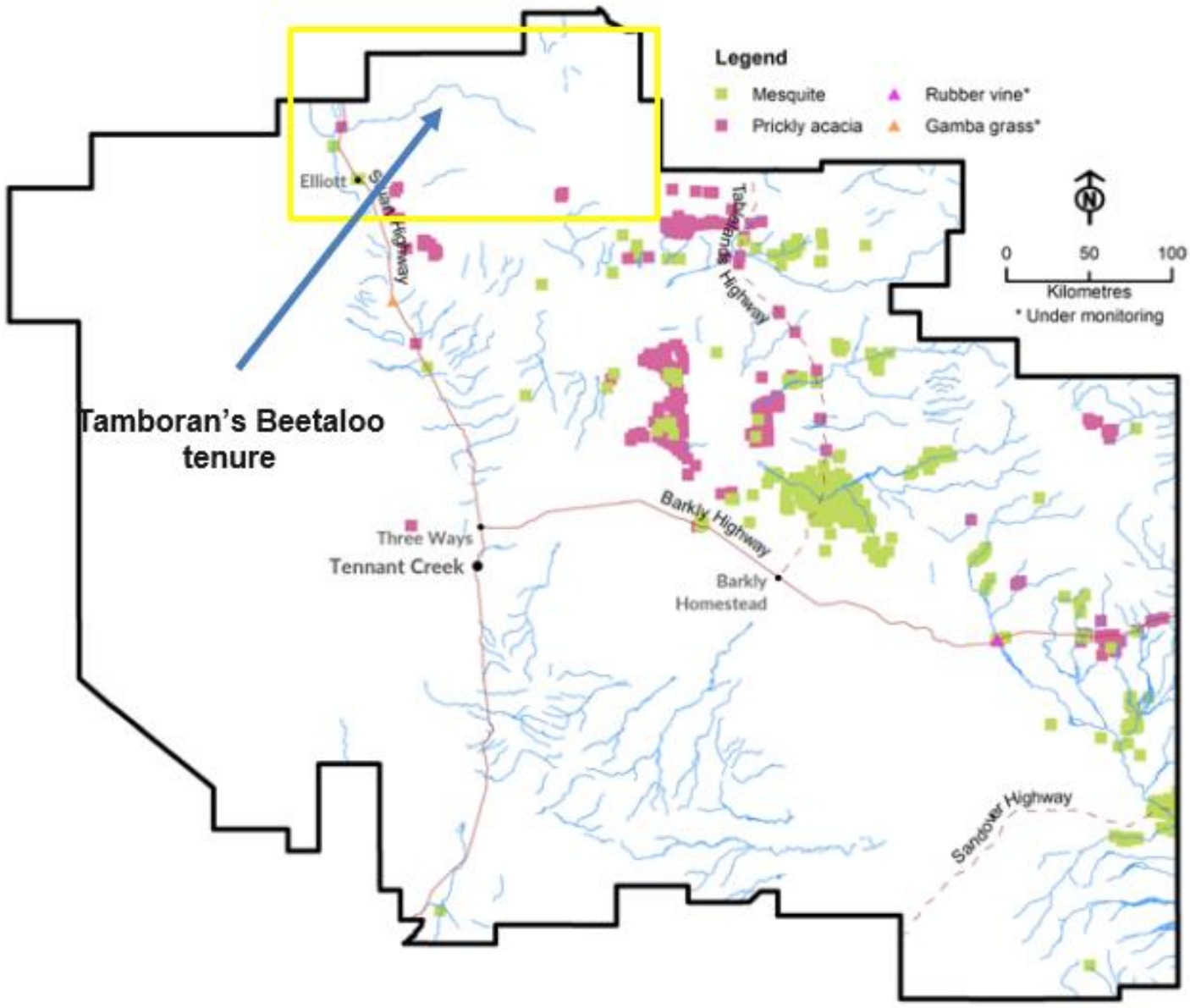

Figure 3 Tennant Creek RWS mapped priority weed for eradication locations (DEPWS 2021)

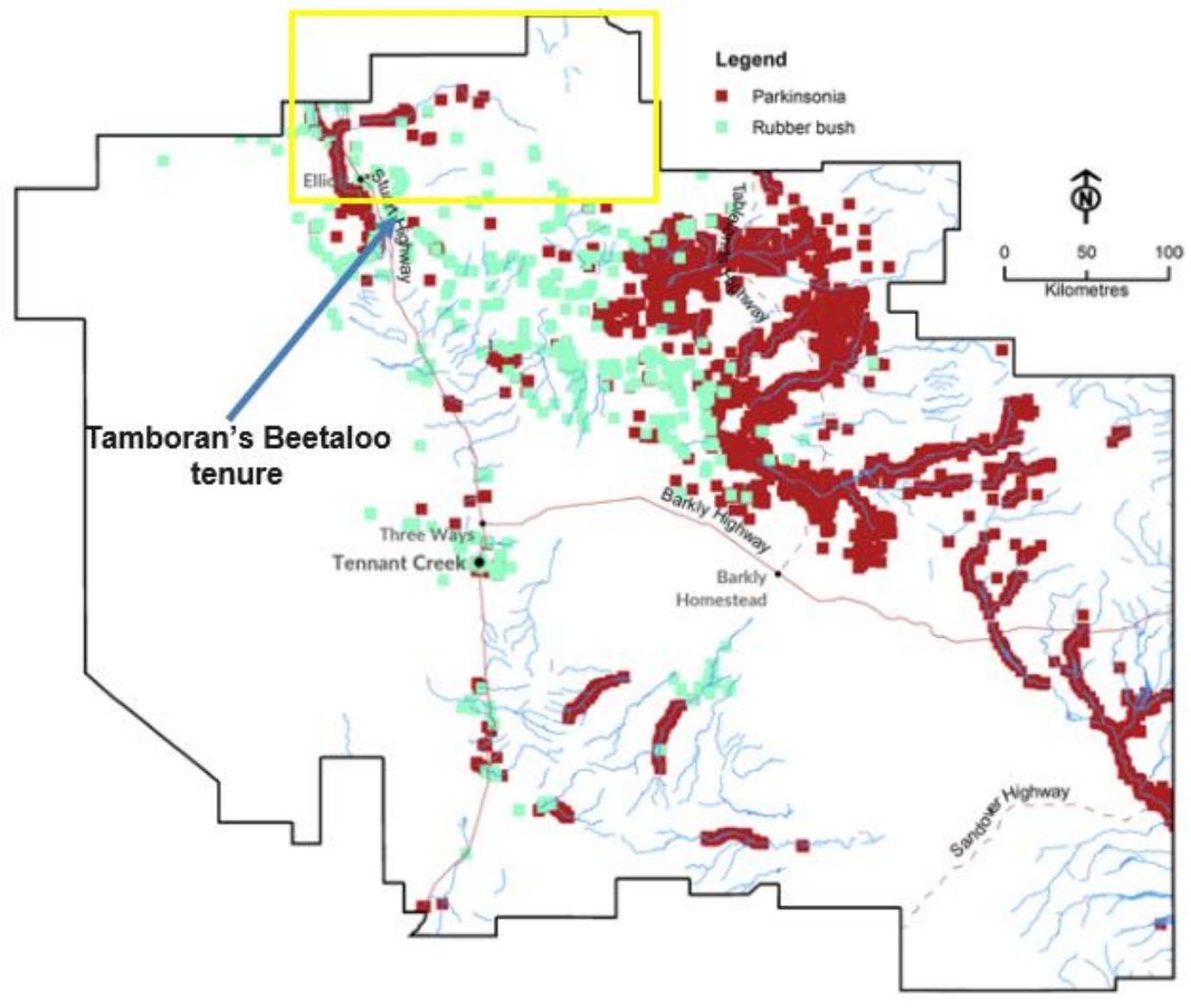

Figure 4 Tennant Creek RWS priority weeds for strategic control (DEPWS 2021)

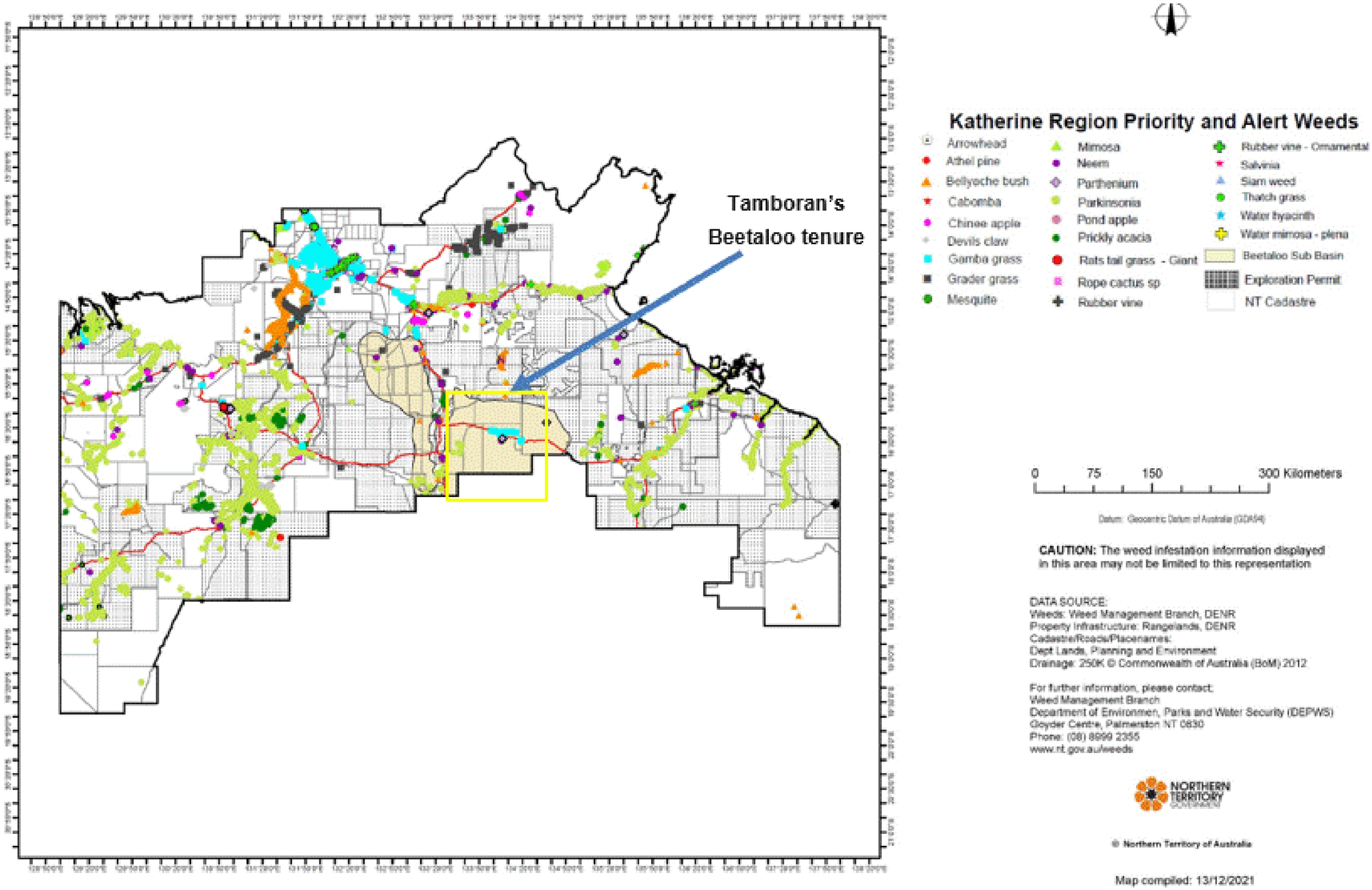

Figure 5 Katherine RWS mapped priority and alert weeds

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Table 1 NT listed weeds known or likely to occur within the EPs

Scientific name	Common name	Declaration Status*	Category	Data source
Alternanthera pungens	Khaki Weed	Class B & C	4	DCCEEW Protected Matters Report
Andropogon gayanus	Gamba Grass	Class A/B & C WoNS	1	Confirmed within exploration lease. High potential introduction through sourcing of equipment from Katherine and Darwin area.
Calotropis procera	Rubber Bush	Class B & C (south of 16°30' S latitude)	2	Mapped in the exploration lease within the Tennant RWS.
Cryptostegia grandiflora	Rubber Vine	Class A & C	1	Mapped in the exploration lease within the Katherine RWS.
Hyptis suaveolens	Hyptis	Class B & C	4	Confirmed within exploration lease during previous Tamboran weed surveys.
Jatropha gossypiifolia	Bellyache Bush	Class A/B & C WoNS	1	Mapped in the exploration lease within the Katherine RWS. Potential introduction through sourcing of equipment from Katherine area.
Parkinsonia aculeata	Parkinsonia	Class B & C, WoNS	2	Confirmed within exploration lease during previous weed Tamboran surveys and Mapped in the exploration lease within the Katherine RWS. Potential introduction through sourcing of equipment from Katherine area.
Prosopis pallida	Mesquite	Class A & C, WoNS	1	Mapped in the area surrounding exploration lease within the Katherine and Tennant Creek RWS.
Themeda quadrivalvis	Grader Grass	Class B & C, WoNs	5	Confirmed within the exploration lease and mapped in the area within the Katherine RWS. High potential introduction through sourcing of equipment from Katherine area.
Parthenium hysterophorus	Parthenium	Class A & C, WoNS	1/ 5	Confirmed by DLPE to occur within the exploration lease. Potential introduction through equipment sourced from QLD.
Cryptostegia grandiflora	Rubber vine	Class A & C, WoNS	1	Alert Species within the Tennant Creek and Katherine RWS.
Chromolaena odorata	Siam Weed	Class A & C	5	Alert Species Katherine RWS.
Azadirachta indica	Neem	Class B & C	2	Weed Management Branch – Mapping data
Cenchrus ciliaris	Buffel Grass	Declared, Unclassified	3	DCCEEW Protected Matters Report
Cenchrus echinatus	Mossman River Grass	Class B & C	3	DLRM databases (DLRM *et al* 2018)
Datura ferox	Fierce Thornapple	Class A & C	3	DLRM databases (DLRM *et al* 2018)

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Scientific name	Common name	Declaration Status*	Category	Data source
Sida acuta	Spinyhead sida	Class B & C	4	Weed Management Branch – Mapping data
Sida cordifolia	Flannel Weed	Class B & C	4	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018)
Sida rhombifolia	Paddy's Lucerne	Class B & C	4	DLRM databases (DLRM *et al* 2018)
Vachillia nilotica	Prickly Acacia	Class A & C, WoNS	1	Mapped in the exploration lease within the Katherine RWS.
Xanthium strumarium	Noogoora Burr	Class B	3	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018)
*All Class A and B weeds are also Class C weeds.				

6 Weed Management Mandatory Requirements

6.1 Weed hygiene declarations for vehicles and equipment

a) All vehicles, equipment and loads are to be clean (free of plant matter, seeds, dirt and mud) and have a valid weed hygiene declaration form prior to accessing any pastoralist property

b) Weed hygiene certificates are only to be issued by an authorised inspector that is satisfied that the vehicle is free of plant matter, seeds, dirt, mud animal wastes and any other time that could potentially represent a biosecurity or weeds risk.

c) An authorised inspector is someone who has successfully completed the nationally recognised "AHCBIO201- Inspect and clean machinery for plan, animal and soil material" training course

d) Weed hygiene declarations shall contain:

   a. The identification details of the vehicle or thing inspected.

   b. Odometer reading (where applicable)

   c. Date and location inspected

   d. Name and signature of the authorised inspector issuing the declaration

   e. The organisation with which the inspector issuing the declaration is affiliated

   f. Name and signature of the driver (where applicable)

e) A biosecurity hygiene declaration for a vehicle/equipment remains valid when the vehicle/equipment:

   a. does not travel off sealed/formed roads, or

   b. clean (i.e. free of biosecurity matter including weeds, pests and diseases, and biosecurity carriers) or

   c. is located on the same or adjacent property and has not encountered any areas with weeds. Areas where it is reasonably expected to encounter weeds include the unsealed shoulders of road corridors and known infestation areas as provided in Figure 2.

f) A biosecurity declaration becomes invalid when:

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a. The vehicle or equipment has encountered known areas of weed infestations.

b. The vehicle or equipment has come from a property that is not adjacent to the property to be accessed.

c. It is not known where the vehicle/ equipment has been previously used.

g) Where a vehicle or piece of equipment arrives at site dirty, they shall be refused entry. The vehicle/ equipment must be directed to the closest washdown facility (Tennant Creek or Katherine), recertified and inspected prior to accessing the site.

6.2 Weed Hygiene Declarations for Loads and Material

1. Weed hygiene declarations are to be utilised to satisfy that a load of materials (including hay, seed, sand, gravel, topsoil) is free of or containing a biosecurity matter and carriers. Anyone who is either the seller, supplier or the driver may issue a Weed Hygiene Declaration for a load providing they have direct knowledge of the product and the status as weed free or containing a biosecurity matter.
2. Weed declarations are not required for loads moved within areas within the same or adjacent properties that have been determined through baseline weed studies as being weed free.
3. Where loads of material cannot be determined to be weed free, they shall be returned to the supplier and an alternative clean source utilised.

6.3 Weed Washdown Facility Requirements

1. Cleaning activities should be undertaken at facilities with effective environmental controls to prevent the spread of biosecurity matter.
2. Wash water, mud/ silt, weed material and other contaminants must be bagged and disposed of at a licenced landfill.
3. Where possible, high pressure water spray should be used. This is the preferred method. If this is impractical, (such as at a site location) the minimum requirement is to use a suitable bar or shovel, brooms/ brushes and compressed air to remove contaminants (dry cleaning).

6.4 Equipment Sourcing and Selection

h) Equipment shall be sourced based on the following prioritisation:

a. Local equipment, particularly civil construction equipment, shall be sourced as a priority.

b. Regional equipment (NT) shale be sourced where no local equipment supplier exists

c. Interstate equipment should be sourced only where local/regional equipment is not available (due to availability or cost constraints). In such cases, additional inspections may be required to ensure vehicles/ equipment are free of weed containing material prior to accessing site.

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6.5 Interstate Transport

All vehicles, equipment and loads moved interstate/territory shall be free of weeds and weed containing material (vegetation, seed, grass, soil, mud etc.) prior to entry into the NT.

All vehicles, equipment and loads travelling from interstate shall have a further inspection prior to access to any pastoral property. If required, additional cleaning shall be undertaken to remove any weeds or weed carrying material.

Where a load/equipment/ vehicle is unclean and is suspected of not being washed prior to entry into the NT, a load must be refused entry into a pastoralist property. The vehicle will require a washdown at an appropriate facility within the state/territory the equipment/vehicle/load originated from.

6.6 Weed Management Awareness

All staff and contractors shall be made aware of their weed management obligations. This shall be undertaken through:

- Building weed prevention and management requirements into contracts and assessed as a part of work readiness reviews and ongoing assurance activities.
- Inclusion of weed management requirements within site inductions and toolbox talks.

7 Weed Introduction and Spread Risk Assessments

As part of the development of their EMP's, Tamboran undertakes an assessment of the risk of introducing or spreading weeds in the project area. This assessment and the corresponding proposed mitigation measures and management objectives are presented in Table 2. Due to the low abundance of weeds within the EPs, management controls will primarily focus on preventing the introduction of weed species through appropriate equipment sourcing cleaning and inspection.

Table 2 Risk of weed introductions and spread, including management controls

Environmental Values	Maintain the integrity of significant ecosystems and agricultural productivity		
Management Objectives	Avoid the introduction of weeds Avoid the spread of existing weeds		
Measures Criteria	No introduction or spread of declared weeds resulting from Tamboran's activities.		
Activity	**Potential Risks**		**Management controls**
	Introduction of new weeds	**Spread of existing weeds**	
Vehicle and equipment movements	Vehicles and equipment sourced from other locations infested with weed species not found in or around Project Area	Traversing of weed infested areas with machinery	• Code of Practice for Petroleum Activities in the NT, Part A Surface Activities. • Activities will adhere to the guidelines within the NT Weed Management Handbook. • Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. • All equipment will have certified equipment wash-down completed prior to entry to the field. Wash-down would occur at

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Environmental Values	Maintain the integrity of significant ecosystems and agricultural productivity		
Management Objectives	Avoid the introduction of weeds Avoid the spread of existing weeds		
Measures Criteria	No introduction or spread of declared weeds resulting from Tamboran's activities.		
Activity	**Potential Risks**		**Management controls**
	Introduction of new weeds	**Spread of existing weeds**	
			Contractors deport or a commercial wash facility prior to mobilisation in a manner that prevents pollution of the surrounding environment. • Machinery to be preferentially sourced locally, with machinery sourced from surrounding areas or Queensland being the 2nd and 3rd preferred option respectively. • Weeds will be actively controlled in cleared/ hardstand areas. • Major equipment moves will be planned from weed-free areas to infested areas and not the other way around. • Ensuring all material imported to or between sites is free of weeds.
Construction of access tracks, monitoring bore pads and seismic lines	Importing materials from areas where weeds are present and creating opportunities for weed species to colonise disturbed areas	Traversing of weed infested areas and creating opportunities for weed species to colonise disturbed areas	• Code of Practice for Petroleum Activities in the NT, Part A Surface Activities. • Activities will adhere to the guidelines within the NT Weed Management Handbook. • Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. • All equipment will have certified equipment wash-down completed prior to entry to the field. • Ensure field staff, contractors and machinery operators are familiar with hygiene protocols and weed identification. • Machinery to be preferentially sourced locally, with machinery sourced from surrounding areas or Queensland being the 2nd and 3rd preferred option respectively. • Weeds will be actively controlled in cleared/ hardstand areas. • Stabilise disturbed areas.

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Environmental Values	Maintain the integrity of significant ecosystems and agricultural productivity		
Management Objectives	Avoid the introduction of weeds Avoid the spread of existing weeds		
Measures Criteria	No introduction or spread of declared weeds resulting from Tamboran's activities.		
Activity	**Potential Risks**		**Management controls**
	Introduction of new weeds	**Spread of existing weeds**	
Drilling, stimulation and well testing	Introduction of weed species not found in or around EP area.	Traversing of weed infested areas with machinery	• Code of Practice for Petroleum Activities in the NT, Part A Surface Activities. • Activities will adhere to the guidelines within the NT Weed Management Handbook. • Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. • All equipment will have certified equipment wash-down completed prior to entry to the field. Wash-down would occur at Contractors deport or a commercial wash facility prior to mobilisation in a manner that prevents pollution of the surrounding environment. • Ensure field staff, contractors and machinery operators are familiar with hygiene protocols and weed identification. • Weeds will be actively controlled in cleared/ hardstand areas. • Major equipment moves will be planned from weed-free areas to infested areas and not the other way around. • Drilling and stimulation equipment will be restricted to cleared lease areas. • Ensuring all material imported to or between sites is free of weeds.
Operational / site management	Personnel unable to identify weeds or unaware of weed species present in areas where machinery and equipment is sourced from	Existing weed distribution not known due to insufficient survey effort, surveys conducted at wrong time of year, surveyors not familiar with / unable to identify	• Code of Practice for Petroleum Activities in the NT, Part A Surface Activities. • Staff members responsible for preventing, identifying and managing weeds to be appropriately trained. • Weed desktop and field-based surveys to be provided to identify existing weed areas. • Pre-and post-wet (February to May) inspections and periodic audits will be

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Environmental Values	Maintain the integrity of significant ecosystems and agricultural productivity		
Management Objectives	Avoid the introduction of weeds Avoid the spread of existing weeds		
Measures Criteria	No introduction or spread of declared weeds resulting from Tamboran's activities.		
Activity	**Potential Risks**		**Management controls**
	Introduction of new weeds	**Spread of existing weeds**	
		declared weed species	conducted to identify and report weed outbreaks.
	Insufficient management control to prevent the introduction of weeds	Insufficient management control to prevent the spread of weeds	• Staff members responsible for preventing, identifying and managing weeds to be appropriately trained. • Ensure field staff, contractors and machinery operators are familiar with hygiene protocols and weed identification (Weed identification posters and the NTG Weed Deck will be made available) • Weeds will be actively controlled in cleared/ hardstand areas. • Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. • New activities will be planned to address prevention of weed or non-indigenous plant spread.

8 Statutory Weed Management Plans

No statutory weeds have been identified during surveys of the EPs, however the following plans apply to species that have been found / could be potential found in the broader region:

- Weed Management Plan for Athel pine (*Tamarix aphylla*)
- Weed Management Plan for Mesquite (*Prosopis* spp.)
- Weed Management Plan for Prickly Acacia (*Vachella nilotica*)
- Weed Management Plan for Bellyache Bush (*Jatropha gossypiifolia*)
- Weed Management Plan for Neem (*Azadirachta indica*)
- Weed Management Plan for Gamba Grass (*Andropogon gayanus*)
- Weed Management Plan for Grader Grass (*Themeda quadrivalvis*).

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The weed management plans establish the legal requirements and management actions to be undertaken by all owners and occupiers of the land on which the declared weed is present in the NT. The aim of each plan is to mitigate the damage caused by the each weed species within specific management areas and zones, through eradication and avoidance of further spread. Conducting land management practices in accordance with the weed management plans will secure compliance with the requirements of the Act.

9 Annual Action Plan

An action plan for each of the weed species identified in the Project Area is presented in Table 3. Treatment options as contained in the NT Weed Management Handbook are presented in Section 9.1 to Section 9.3.

This section will be undated if new weed species are discovered over the life of the program to ensure that statutory requirements with relation to declaration status and relevant weed management plans are addressed (refer to section 8).

As part of the Annual Weed Management Action Plan, Tamboran also commits to undertaking finer detailed weed mapping of all permit areas, lease pads, access tracks and gravel pits, as well as any other areas disturbed as part of the activity.

Table 3 Annual weed management action plan

Management objective	Avoid the introduction of weeds Avoid the spread of existing weeds			
Weed species	**Survey time(s)**	**Treatment time(s)**	**Control options**	**Where located**
Hyptis *Hyptis suaveolens*	6 monthly: pre and post-wet season	Preferred Dec – Mar Also Nov and April	Refer to section 9.1.	Beetaloo access track Access track to Amungee NW Kalala S1 site Velkerri 76 S2 camp pad
Parkinsonia *Parkinsonia aculeata*	6 monthly: pre and post wet season	Preferred Mar – May Also all year round	Refer to section 0.	Beetaloo access track
Rubber Bush *Calotropis procera*	6 monthly: pre and post wet season	Preferred October – March April - July	Refer to section 9.3.	Proximity to the Beetaloo access track Kyalla 117 N2 access track and Stuart Highway intersection
Gamba grass *Andropogon gayanus*	6 monthly: pre and post wet season	• Preferred December – March Also April and November	Refer to section 9.4	Amungee NW1 well site Kyalla 117 N2 well site
Annual Mission grass *Cenchrus pedicellatum*	6 monthly: pre and post wet season	• Preferred December – March Also April and November	Refer to section 9.5	Amungee NW1 well site Kyalla 117 N2 well site

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9.1 Hyptis (*Hyptis suaveolens*) Treatment Options

Table 4 includes herbicide and non-chemical treatment options for Hyptis (*Hyptis suaveolens*) (NT Government 2015).

Table 4 Hyptis (*Hyptis suaveolens*) treatment options

Weed Species	Hyptis *(Hyptis suaveolens)*		
Control Methods	**Chemical and concentration**	**Rates**	**Weed growth stage, method and comments**
Herbicides	**2, 4-D amine 625 g/L** Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing.
	Glyphosate 360 g/L Various trade names and formulations	15 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing.
Non-chemical applications	• Manually remove all plant material; slash to encourage competition from desirable species.		

Source: Northern Territory Weed Management Handbook (NT Government 2021)

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9.2 Parkinsonia (*Parkinsonia aculeata*) Treatment Options

Table 5 includes herbicide and non-chemical treatment options for Parkinsonia (Parkinsonia aculeata) (NT Government 2015).

Table 5 Parkinsonia *(Parkinsonia aculeata)* treatment options

Weed Species	Parkinsonia *(Parkinsonia aculeata)*		
Control Methods	**Chemical and concentration**	**Rate**	**Weed growth stage, method and comments**
Herbicides	**Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L** Grazon™ Extra	350 mL / 100 L or 3 L / ha	**Seedling (individuals and infestation)** Foliar spray – avoid spraying if plants are stressed or bearing pods – Uptake Spraying Oil required Foliar spray – plants up to 2 m or 2 years old - Uptake Spraying Oil required.
	Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling or adult (individuals or infestation)** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter
	Tebuthiuron 200 g/kg	1.5 g / m^2	**Seedling or adult (individuals or infestation)** Granulated herbicide - ground applied Do not use within 30 m of desirable trees or apply to continuous area > 0.5 ha. Do not use if fire is eminent. Apply when there is soil moisture or prior to rain.
Non-chemical applications	• Blade-ploughing, stick-raking, bulldozing and chaining can be effective if the root layer is removed from the soil. • Cultivation of pasture or native vegetation after mechanical control will help to prevent re-sprouting and seedling establishment. • Fire destroys seed in the soil surface and can be used as a follow-up to remove seedlings after other control efforts. • Fire may also be used to manage mature trees. Hand grubbing for single plants or small outbreaks, ensure removal of the root system. • Biocontrol options are available with establishing slowly in some areas.		
Source: Northern Territory Weed Management Handbook (Northern Territory Government 2021).			

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9.3 Rubber bush (*Calotropis procera*) Treatment Options

Table 6 includes herbicide and non-chemical treatment options for rubber bush *(Calotropis procera)* (NT Government, 2015).

Table 6 Rubber bush (*Calotropis procera*) treatment options

Weed Species	Rubber bush *(Calotropis procera)*		
Control Methods	**Chemical and concentration**	**Rate**	**Weed growth stage, method and comments**
Herbicides	**Triclopyr 300 g/L + Picloram 100 g/L Conqueror®** **+ Aminopyralid 8 g/L** Grazon™ Extra	750 mL / 100 L (water) 500-750mL / 100 L (water)	**Seedling (individuals or infestation):** Foliar spray. Check label for recommended adjuvant product. More effective on plants <2m as thorough coverage on all leaves is required
	Triclopyr 240 g/L + Picloram 120 g/L Access™	 1 L / 60 L (diesel) 1 L / 10 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals and infestation):** Basal bark < 5cm stem diameter. Spray all stems. Spray to point of runoff. Thin Line up to 5cm stem diameter. Cut stump > 5cm stem diameter.
	Tebuthiuron (200g/kg) Graslan Pending registration. Please check with Weed Management Branch for status confirmation.	1.5 – 2 g/m^2	**Seedling or adult:** Application to black clay soils in conjunction with seasonal rainfall. Spread granules according to density of the infestation.
	Fluroxypyr (333g/L) Starane™ Advanced	3 L / 100 L (diesel)	**Adult:** Cut stump method for plants up to 10cm diameter and 3m high.
Non-chemical applications	This plant is difficult to eradicate as the deep roots survive almost any treatment. Maintenance of a dense pasture sward will assist in preventing invasion.		
Source: Northern Territory Weed Management Handbook (NT Government, 2021)			

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9.4 Gamba grass (*Andropogon gayanus*) Treatment Options

Table 7 includes herbicide and non-chemical treatment options for Gamba grass (*Andropogon gayanus*) (NT Government, 2021).

Table 7 Gamba grass (*Andropogon gayanus*) treatment options

Weed Species	Gamba grass (*Andropogon gayanus*)		
Control Methods	**Chemical and concentration**	**Rate**	**Weed growth stage, method and comments**
Herbicides	**Glysophate 360 g/L** Various trade names and formulations	10 mL / 1 L (water)	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing. Effective chemical control relies on spraying entire plant. For optimal uptake and high mortality rates gamba grass should be sprayed when actively growing and young (leaves should be at least 40 cm long). Spraying plants prior to reaching full height will reduce time and herbicide requirements. Gamba grass is still sensitive to herbicide when flowering. Once gamba grass is seeding and the leaves are drying out herbicide will not be effective.
Non-chemical applications	**Physical:** Individual plants can be removed by hand or by using a mattock. Ensure the entire root mat is removed. Excess soil should be shaken or kicked off root system to ensure regrowth does not occur from the root mat. **Burning:** Burning will not kill gamba grass, low intensity fires, undertaken in the Wet season, can remove rank growth improving access for slashing or spraying. Plants may need to be treated with herbicide prior to burning to create enough dry matter to carry a fire. Avoid using fire as a control method while plants are seeding. Bushfires NT permit would be required to light fire. **Slashing:** Slashing will not eradicate gamba grass, but can reduce the biomass, prevent seeding, create an opportunity for more desirable species to establish and provide improved access to control by other means. Slash young plants prior to seed production from January to March. Ensure equipment and machinery is cleaned prior to moving to new sites.		
Source: Northern Territory Weed Management Handbook (NT Government, 2021)			

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9.5 Annual Mission grass (*Cenchrus pedicellatum*) Treatment Options

Table 8 includes herbicide and non-chemical treatment options for Annual Mission grass (*Cenchrus pedicellatum*) (NT Government, 2021).

Table 8 Annual Mission grass (*Cenchrus pedicellatum*) treatment options

Weed Species	Annual Mission grass (*Cenchrus pedicellatum*)		
Control Methods	**Chemical and concentration**	**Rate**	**Weed growth stage, method and comments**
Herbicides	**Glysophate 360 g/L** Various trade names and formulations	10 mL / 1 L (water)	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing.
Non-chemical applications	Annual mission grass can be controlled by slashing prior to seeding (repeated slashing may be required). Adult plants will not persist to the following year.		
Source: Northern Territory Weed Management Handbook (NT Government, 2021)			

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10 Notification Procedure

The Onshore Petroleum Weed Management Officer at the Weeds Unit of DLPE should be notified within 48 hours of the discovery of a new weed species in the EP.

Initial notification may be verbal, with follow-up written notification provided within seven working days. The notification should include a preliminary species identification and location information. The Regional Weed Officer will advise what further action is required.

It is noted that some species spread rapidly so immediate action may be required to control spread. For example, as stated above Parthenium (*Parthenium hysterophorus*) is a Class A (to be eradicated) and Class C (not to be introduced) weed in the Northern Territory as well as being classified as a Weed of National Significance. Early detection is crucial in not allowing this species to spread in the Northern Territory (Department of Primary Industry and Resources 2016).

In addition, it is noted that under the Weeds Management Act that:

> *'The owner and occupier of land must… within 14 days after becoming aware of a declared weed that has not previously been, or known to have been, present on the land, notify an officer of the presence of the declared weed'.*

All weed outbreak incidents will be reported in Tamboran's incident reporting system and corrective action initiated.

11 Recording

Records of weed inspections will be maintained by Tamboran.

Data on weed distribution will be maintained within Tamboran's GIS and provided to the Weeds Officer at Weeds Unit at DLPE as part of the annual report on performance against the Weed Management Plan, or as requested. Data will be collected as per the requirements of the NT *Weed Data Collection Manual - Section One Technical Data Description* (Weed Management Branch, 2015). Data will be recorded as per the guidelines provided in Appendix A, using the data sheet provided in Appendix B (Weed Management Branch, 2015).

The NT *Weed ID Deck* (NT Government, 2021) will be referenced to assist with identification of species that have been identified as likely or known to occur in the EP.

Field data will be submitted directly to the Weeds Unit at DLPE in a shapefile format or as an Excel spreadsheet, including incidental identification of weeds and following completion of field surveys.

12 Reporting

All weed outbreak incidents will be reported in Tamboran's incident reporting system and corrective action initiated.

A report on the performance against this Weed Management Plan will be submitted to DLPE on an annual basis. At a minimum, this should include:

a. Details of activities implemented to address weed spread and introduction risks (e.g. vehicle wash down/ blow down locations, examples of track construction from working from weed free areas into weed infested areas to reduce spread).

b. Details of survey and monitoring events, including dates, personnel, maps and track data.

c. Submission of all weed data collected.

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d. Overview of weed control events and success rates (weed control should be captured in detail through the data collection process and submitted as a component of (a)).

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APPENDIX A Weed Data Collection Methodology

Field data collection for weed infestations: The following is a guide to efficiently evaluating and recording a weed site in the field. Each record must identify the person or organisation taking the record, as well as the details explained below.

How to record weed area as a point record

1. Record the species

When a weed is sighted, move to the area and confirm identification of the weed. If you cannot positively identify the weed record it as "Unknown weed" and take a sample or photograph, do not try to guess. If more than one weed species is present, then repeat the process with separate records for each species.

2. Assess the size of the weed patch

Look across the area of weeds to the furthest weed plant and decide the diameter. Decide if the area is best fits in a circle of either 20, 50 or 100 m. If it is a single plant or small patch you would choose 20 m. The size 100 m extends about as far as you can see on the ground, if the weeds extend out of sight you will need to make another point further on. You may place overlapping circle areas to reflect different densities.

3. Assess the density of weeds within the circle

Decide how much of the area is covered by weeds. Assign a score from 2 to 5 based on the percentage table below. It will be useful (if possible) to move into the centre of the weed circle. Consider the whole circle size chosen in step 2 deciding on the density score. Area covered should be determined by a 'projected canopy' method.

Density categories

1 = Absent, no weeds of this species in this area.

2 = < 1%, Very few, not many weeds – e.g. single plant, perhaps with seedlings.

3 = 1 -10%, More than one or two isolated plants but not a lot – e.g. a few small plants.

4 = 11-50%, A lot, up to half the area covered – e.g. a tree, dense patches of weeds.

5 = > 50%, Dominant cover is weed, more than half covered – e.g. thickets, monocultures.

4. Record the location

Take the GPS location (ideally) from the centre of the circle. If weed seeds may be spread or it is difficult to access the centre, it is acceptable to take the reading from the location as close to the centre as practical.

5. Record the treatment

Record the method you apply a treatment to the weeds, or record 'No Treatment'. Choose from the list of treatment methods – e.g. no treatment, unknown, treated, foliar spray etc.

How to record weed area as a line (polyline) record

1. Record the species

When a weed is sighted, move to the area and confirm identification of the weed. If you cannot positively identify the weed record it as “Unknown weed” and take a sample or photograph, do not try to guess. If more than one weed species is present, then repeat the process with separate records for each species.

2. Assess the ‘best fit’ width in metres of the linear weed area

Look along the area of weeds to the furthest weed plant and decide a width that best sums up the width of the infestation from values of 5, 20, 50 or 100 m. If the width is too variable, you may need to make more than one line or consider recording as points or as a polygon.

3. Assess the density of weeds within the line

For the area of the line, being from start to finish at the designated width, decide the area covered by weeds. Assign a score from 2 to 5 based on the percentage table below. Consider the whole line area when deciding on the density score. Area covered should be determined by a ‘projected canopy’ method.

Density categories

1 = Absent, no weeds of this species in this area.

2 = < 1%, Very few, not many weeds – e.g. single plant, perhaps with seedlings.

3 = 1 -10%, More than one or two isolated plants but not a lot – e.g. a few small plants.

4 = 11-50%, A lot, up to half the area covered – e.g. a tree, dense patches of weeds.

5 = > 50%, Dominant cover is weed, more than half covered – e.g. thickets, monocultures.

4. Record the location

Start the GPS track, or line sketch from one end of the linear weed area. Walk or sketch a line as best fit through the middle of the linear weed area and finish at the end point.

5. Record the treatment

Record the method you apply a treatment to the weeds, or record ‘No Treatment’. Choose from the list of treatment methods – e.g. no treatment, unknown, treated, foliar spray etc.

How to record weed area as a polygon record

1. Record the species

When a weed is sighted, move to the area and confirm identification of the weed. If you cannot positively identify the weed record it as “Unknown weed” and take a sample or photograph, do not try to guess. If more than one weed species is present, then repeat the process with separate records for each species.

2. Assess the extent of the weed area an ensure it can be practically enclosed

Polygons are good for clearly delineated areas of weeds; you should be able to walk around the edge of the weed area with confidence. Ensure the defined area of weed at a similar density can be delineated before attempting to create the area, you may need more than one polygon. If the area is poorly defined, then the point method may be a more useful.

3. Assess the density of weeds within the polygon

Assess the area covered by weeds for density, you may need to move to several vantage points to get a clear picture. Assign a score from 2 to 5 based on the percentage table below. Consider the whole area within the polygon when deciding on the density score. Area covered should be determined by a ‘projected canopy’ method.

Density categories

1 = Absent, no weeds of this species in this area.

2 = < 1%, Very few, not many weeds – e.g. single plant, perhaps with seedlings.

3 = 1 -10%, More than one or two isolated plants but not a lot – e.g. a few small plants.

4 = 11-50%, A lot, up to half the area covered – e.g. a tree, dense patches of weeds.

5 = > 50%, Dominant cover is weed, more than half covered – e.g. thickets, monocultures.

4. Record the location

Start the GPS track, or polygon sketch from one point of the polygon weed area. It is useful to start from a landmark or flagging tape. Create the polygon edge line by walk a path or sketching along the outer edge of the weed area until you return to the start point. If using a GPS track to create the polygon, ensure that you cross your start point so as to close the polygon.

5. Record the treatment

Record the method you apply a treatment to the weeds in the area, or record ‘No Treatment’. Choose from the list of treatment methods– e.g. no treatment, unknown, treated, foliar spray etc.

Appendix B Example Weed Data Collection Sheet

Weed Management Plan

TB2-HSE-MP-11

RECORDER:					PROJECT:							LOCALITY:		
ORG_NAME:					GPS NAME/MODEL:							RECORDING METHOD:		
SITE_ID	DATE_REC	LAT_G94	LONG_G94	WEED_NAME	SIZE_DIA_M	DENS_CAT	SEEDLINGS	JUVENILES	ADULTS	SEED_PRES	PAST_TREAT	TREATMENT	HERBICIDE	COMMENTS

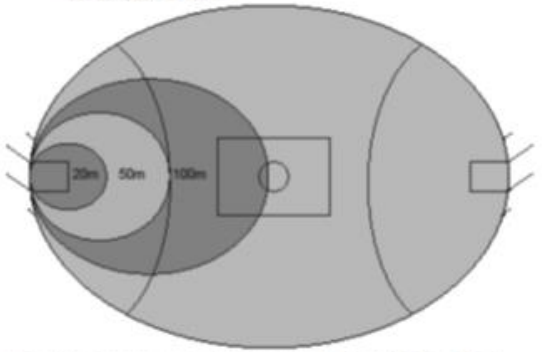
Notes:

Treatment method
Control method applied today as per below.
If none, record 'No treatment'

- Foliar spray
- Residual application
- Basal bark
- Cut stump
- Stem injection
- Aerial spray
- Slashed or cut
- Hand pull

Herbicide The active ingredient(s) of the herbicide applied today (if any)
GPS waypt Waypoint ID as entered in the GPS
Weed name Common name or scientific name for the weed recorded
S (y/n) Seedlings: Are seedlings visible?
J (y/n) Juveniles: Are juvenile plants visible?
A (y/n) Adults: Are there adult plants, or seeds, or evidence of past seeding present?
Seed (y/n) Seeds: Are seeds visible today? Or plants with seeds or pods?
Treat (y/n) Treatment: Did you apply treatment to this site?
Comment Record any notes for yourself here.

Size dia m Size/diameter of the area you are recording information about (in metres). Use 20m, 50m or 100m.

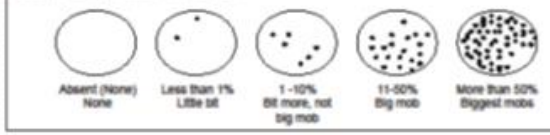


Example of size/diameter compared to a football oval. (Sizes 20m, 50m, 100m)

Dens cat Density of weeds in the assessed area using categories described below

1 = No weeds (absent)	2 = Single plant or very few (<1%)	3 = A few plants (1-10%)
4 = Many weeds, up to half (11 – 50%)	5 = Mostly weeds, more than 50%	6 = Density not assessed

Density category (Dens cat) examples

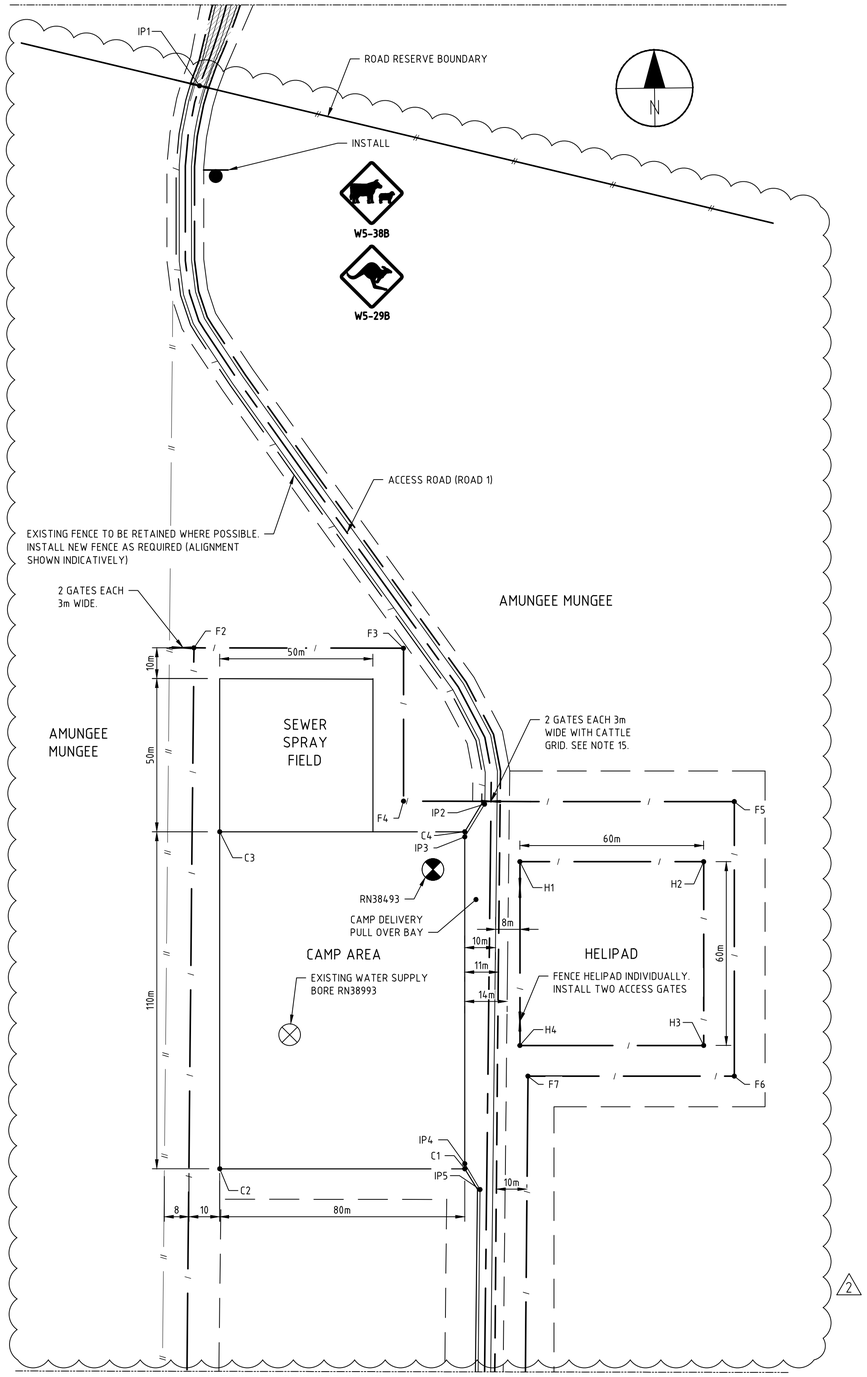


(Source: Northern Territory Weed Data Collection Manual - Section One Technical Data Description)

APPENDIX D

Engineering Drawing Layout and Specifications

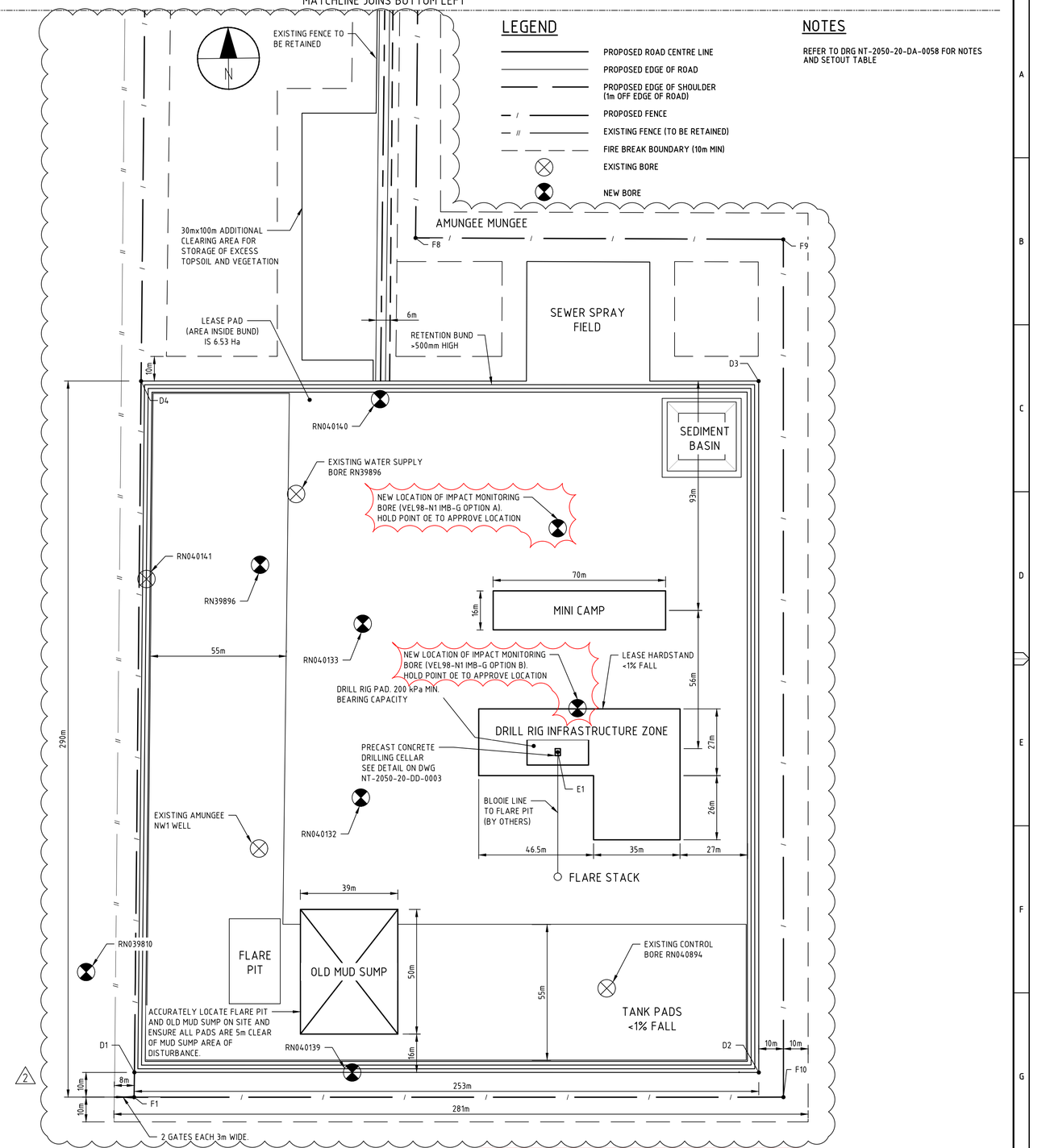
MATCHLINE JOINS DRG. No. NT-2050-20-DD-0001



PLAN
Scale 1:1000

MATCHLINE JOINS TOP RIGHT

MATCHLINE JOINS BOTTOM LEFT



PLAN
Scale 1:1000

ISSUED FOR CONSTRUCTION

LEGEND

- PROPOSED ROAD CENTRE LINE
- PROPOSED EDGE OF ROAD
- PROPOSED EDGE OF SHOULDER (1m OFF EDGE OF ROAD)
- PROPOSED FENCE
- EXISTING FENCE (TO BE RETAINED)
- FIRE BREAK BOUNDARY (10m MIN)
- EXISTING BORE
- NEW BORE

NOTES

REFER TO DRG NT-2050-20-DA-0058 FOR NOTES AND SETOUT TABLE

0 25 50 m

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	D&C ENGINEER	PROJECT ENGINEER	D&C PROJECT MANAGER	GA FIELD MANAGER	GA APPROVALS LEAD	GA OPS & PROJECT MANAGER
NT-2050-20-DD-0003	TURKEY'S NEST AND CELLAR DETAILS	2	07/06/2022	FENCING REVISED AND IMB OPTION ADDED	BM	AB	AB						
NT-2050-20-DD-0002	ROAD, MUD SUMP AND FLARE PIT DETAILS	1	23/03/2022	REVISED FOR REMOVAL OF DRILLING CELLAR E2	BM	AB	AB						
NT-2050-20-DA-0057	INTERSECTION DETAIL	0	18/02/2022	ISSUED FOR CONSTRUCTION	AN	AB	AB						

APPROVALS

PREPARED FOR ORIGIN BY:
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RPEQ No. 5583
JOB No. 60623736
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ORIGIN	BY	DATE
DRAWN	AN	11/02/2022
DWG CHECK	AB	11/02/2022
DESIGN	AB	11/02/2022
ENG DES CHECK	JJ	18/02/2022
DRAFT. SUPER.		
PROJECT APPROVAL		

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
AMUNGEE MUNGEE WELL 2
DRILL PAD, ACCOMODATION CAMP AND WATER TANK
GENERAL ARRANGEMENT

PROJECT NO.	DRAWING NO.	REVISION
	NT-2050-20-DA-0056	2
MOD NO.		
SCALE N.T.S.	CADFILE 60330225-NT-2050-20-DA-0056.dwg	A1

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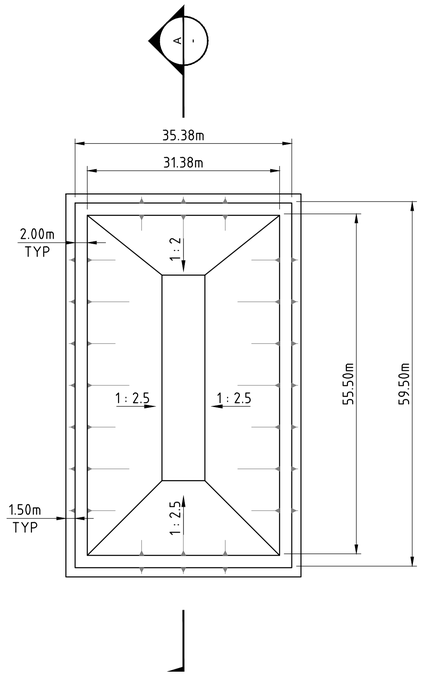
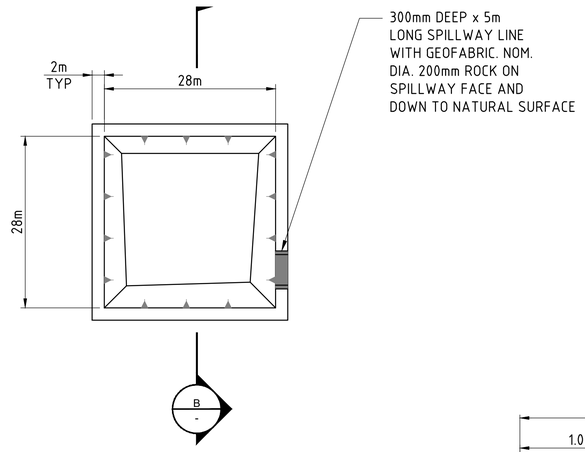


PLAN - MUD SUMP

Scale N.T.S.



PLAN - SECONDARY CONTAINMENT

Scale N.T.S.

NOTES:

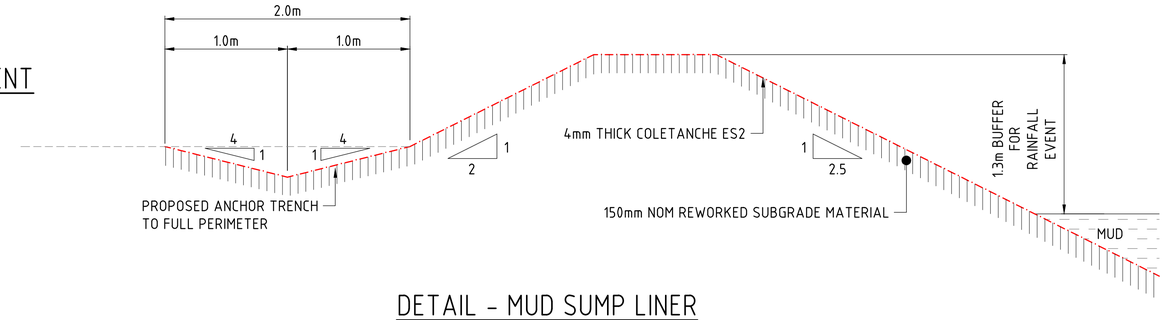
1. ALL UNITS ARE IN METRES (m) UNLESS NOTED OTHERWISE.
2. GROUND CONDITIONS AND SUITABLE MATERIALS TO BE CONFIRMED ON SITE BY SUPERINTENDENT.
3. REFER TO SPECIFICATION FOR COMPACTION REQUIREMENTS.
4. REFER TO SPECIFICATION FOR GENERAL REQUIREMENTS.
5. THE CONTRACTOR IS TO NOTIFY THE ORIGIN SUPERVISOR IF AREAS OF SOFT GROUND ARE ENCOUNTERED OR IF THE SPECIFICATION CANNOT BE ACHIEVED.
6. REFER TO DRAWING NT-2050-20-DA-0022 FOR SETOUT DETAILS OF MUD SUMP.
7. FAUNA LADDERS TO BE INSTALLED TO MUD SUMP.
8. CONTRACTOR TO PROVIDE CATTLE PANELS FOR FENCING AROUND SUMP WHERE DEPTH IS GREATER THAN 1.5m.
9. CATTLE PANEL FENCING TO BE INSTALLED AROUND MUD SUMP AND SEDIMENT BASIN INCLUDING CRITTER FENCING.
10. MUD SUMP VEHICLE OFFLOAD AREA TO BE COMPACTED TO 200 KPa

CERTIFICATION

DISCIPLINE	CERTIFIER	RPEQ No.
CIVIL	J.JENTZ	5583

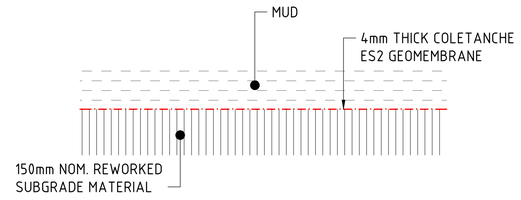
NOTES:

1. GEOSYNTHETICS ARE DRAWN EXAGGERATED FOR CLARITY.



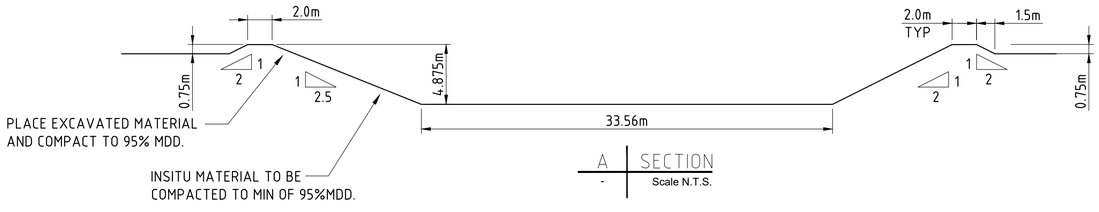
DETAIL - MUD SUMP LINER

Scale N.T.S.

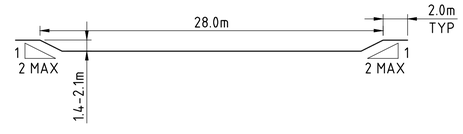


DETAIL - BASE LINER

Scale N.T.S.



A SECTION
-
Scale N.T.S.



B SECTION
-
Scale N.T.S.

ISSUED FOR CONSTRUCTION

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	QE DRAFT SUPER	QE PROJECT APPROVAL
		3	04.10.19	REISSUED FOR CONSTRUCTION	CD	PM	CD	JJ		
		2	25.09.19	LAYOUT UPDATES FOR REVIEW	CD	PM	CD	JJ		
		1	24.05.19	REISSUED FOR CONSTRUCTION	CD	PM	CD	JJ	MR	MR
NT-2050-20-DA-0023	GENERAL ARRANGEMENT PLAN	0	24.04.19	ISSUED FOR CONSTRUCTION	CRD	PCM	PCM	JMJ		

APPROVALS

PREPARED FOR ORIGIN BY:

AECOM

AECOM Australia Pty Ltd
A.B.N 20 093 846 925
www.aecom.com

PROJECT 60480548 BEETALOO EXPLORATION

DRAWING OFFICE DARWIN

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	BY	DATE
DRAWN	CD	23.04.2019
DWG CHECK	PM	23.04.2019
DESIGN	CD	23.04.2019
ENG DES CHECK	JJ	23.04.2019
DRAFT. SUPER.	MR	30.05.2019
PROJECT APPROVAL	MR	30.05.2019

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
MUD SUMP DETAILS

PROJECT NO.

DRAWING NO. NT-2050-20-DD-0031

REVISION 3

MOD NO.

SCALE 1:1000 @ A1

CADFILE NT-2050-20-DD-0031.dwg

A1

Mon, 28 Oct 2019 - 10:47am P:\604X\604805&815 CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DD-0031.DWG Dudley, Calvin

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. REFER TO NORTHERN TERRITORY STANDARD DRAWING C(S)1306 FOR TYPICAL STOCK FENCE DETAILS.
3. SEWER SPRAY FIELD AREA IS NOT TO BE CLEARED. SPRAY PIPES LAID ON EXISTING VEGETATION BY OTHERS.
4. DRILL RIG INFRASTRUCTURE ZONE AND CAMP PAD TO BE COMPACTED TO 100KPA BEARING CAPACITY UNLESS OTHERWISE NOTED.
5. DRILL RIG PAD TO BE COMPACTED TO 200 KPA BEARING CAPACITY.
6. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED MANAGEMENT PLAN REQUIREMENTS.
7. NO CONSTRUCTION WORKS ARE TO BE CARRIED OUT OUTSIDE THE APPROVED WORK CORRIDOR BOUNDARIES.
8. CONSTRUCTION FACILITY AREA LOCATIONS TO BE APPROVED BY THE SUPERINTENDENT PRIOR TO WORKS COMMENCING.
9. 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.
10. 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.
11. THE CONTRACTOR IS TO CARRY OUT A DBYD AND LOCATE AND MARK SERVICES ON SITE. ANY DAMAGE TO EXISTING SERVICES IS TO BE RE-INSTATED AT THE CONTRACTORS EXPENSE.
12. SIGNAGE TO BE INSTALLED PRIOR TO ROAD USE.
13. REFER TO DRAWING NT-2050-20-DD-0002 FOR MUD SUMP DETAILS AND DRAWING NT-2050-20-DD-0003 FOR PRECAST CELLAR PIT DETAILS .
14. THE NOMINATED AREA BOUND BY SETOUT POINTS D1 TO D4 IS TO BE A UNIFORMLY GRADED PAD.
15. FOR CATTLE GRID DETAILS REFER TO APRILLA GRIDS. PROPOSED GRID TYPE 5RQT TO BE INSTALLED IN ACCORDANCE WITH SUPPLIERS SPECIFICATIONS. ALTERNATE GRID SUPPLY TO BE APPROVED BY SUPERINTENDENT. THE NEED FOR GRIDS TO BE DETERMINED AS PART OF THE LAND ACCESS AGREEMENTS AND MAY NOT BE REQUIRED. TO BE CONFIRMED BY SUPERINTENDENT PRIOR INSTALL.
16. NEW WATER BORE TO BE PROVIDED BY THE CONTRACTOR AND TO DISCHARGE TO ABOVE GROUND TANK.
17. EXISTING FENCE ON THE WESTERN SIDE OF THE ACCESS ROAD IS TO BE RETAINED UP TO THE GATES AT THE INTERSECTION OF ROAD 2. NEW FENCING IS TO BE INSTALLED AROUND THE DRILL PAD AS INDICATED, HOWEVER EXISTING FENCE MAY BE REUSED FOR A SECTION OF THIS.
18. DRILLING CONTRACTOR TO PROVIDE ALL AMENITIES INCLUDING ACCOMMODATION, ABLUTIONS, WATER SUPPLY, WASTE MANAGEMENT AND SEWAGE TREATMENT FOR THE CAMP AREA. AMENITIES TO COMPLY WITH NORTHERN TERRITORY REQUIREMENTS FOR FACILITIES OF THIS NATURE.
19. FINISH SURFACE LEVELS ARE TO FOLLOW EXISTING SURFACE LEVELS AS NEAR AS POSSIBLE AND TO THE GRADES SPECIFIED ON THE DRAWINGS.
20. FIREBREAK CLEARINGS AROUND DRILLING LEASE AND CAMP PAD ARE TO BE USED FOR STORAGE OF TOPSOIL AND VEGETATION AS REQUIRED. IF ADDITIONAL STORAGE SPACE IS REQUIRED THE CONTRACTOR IS TO PROVIDE ADDITIONAL STORAGE AREA AS INDICATED ON THIS DRAWING.

LEGEND

- EXISTING CONTOUR
- L=10m (MB) (MB) — FILTER BERM/LENGTH (DIRTY WATER)
- L=10m (MB) (MB) — FILTER BERM/LENGTH (CLEAN WATER)
- FLOW DIRECTION (DIRTY WATER)
- FLOW DIRECTION (CLEAN WATER)

NEW BORE SETOUT

Pt	Easting	Northing
RN040894	380999.74	8192241.42
RN39896	380859.42	8192412.876
RN38493	380893	8192798
RN039810	380789	8192248
RN039811	381009	8192961
RN040132	380900.23	8192318.59
RN040133	380900.98	8192389.01
RN040139	380896.72	8192207.31
RN040140	380908	8192479.92
RN040141	380813.42	8192407.12
VEL98-N1 IMB-G(A)	380979.929	8192427.682
VEL98-N1 IMB-G (B)	380987.929	8192354. 832

HELICOPTER PAD SETOUT

Pt	Easting	Northing
H1	380921.378	8192800.576
H2	380981.378	8192800.576
H3	380981.378	8192740.576
H4	380921.378	8192740.576

ACCESS ROAD SETOUT

Pt	Easting	Northing
IP1	380816.790	8193053.828
IP2	380909.929	8192819.492
IP3	380903.381	8192808.671
IP4	380903.381	8192702.004
IP5	380908.345	8192693.566

CAMP PAD SETOUT

Pt	Easting	Northing
C1	380903.381	8192700.338
C2	380823.381	8192700.338
C3	380823.381	8192810.338
C4	380903.381	8192810.338

DRILLING LEASE PAD SETOUT

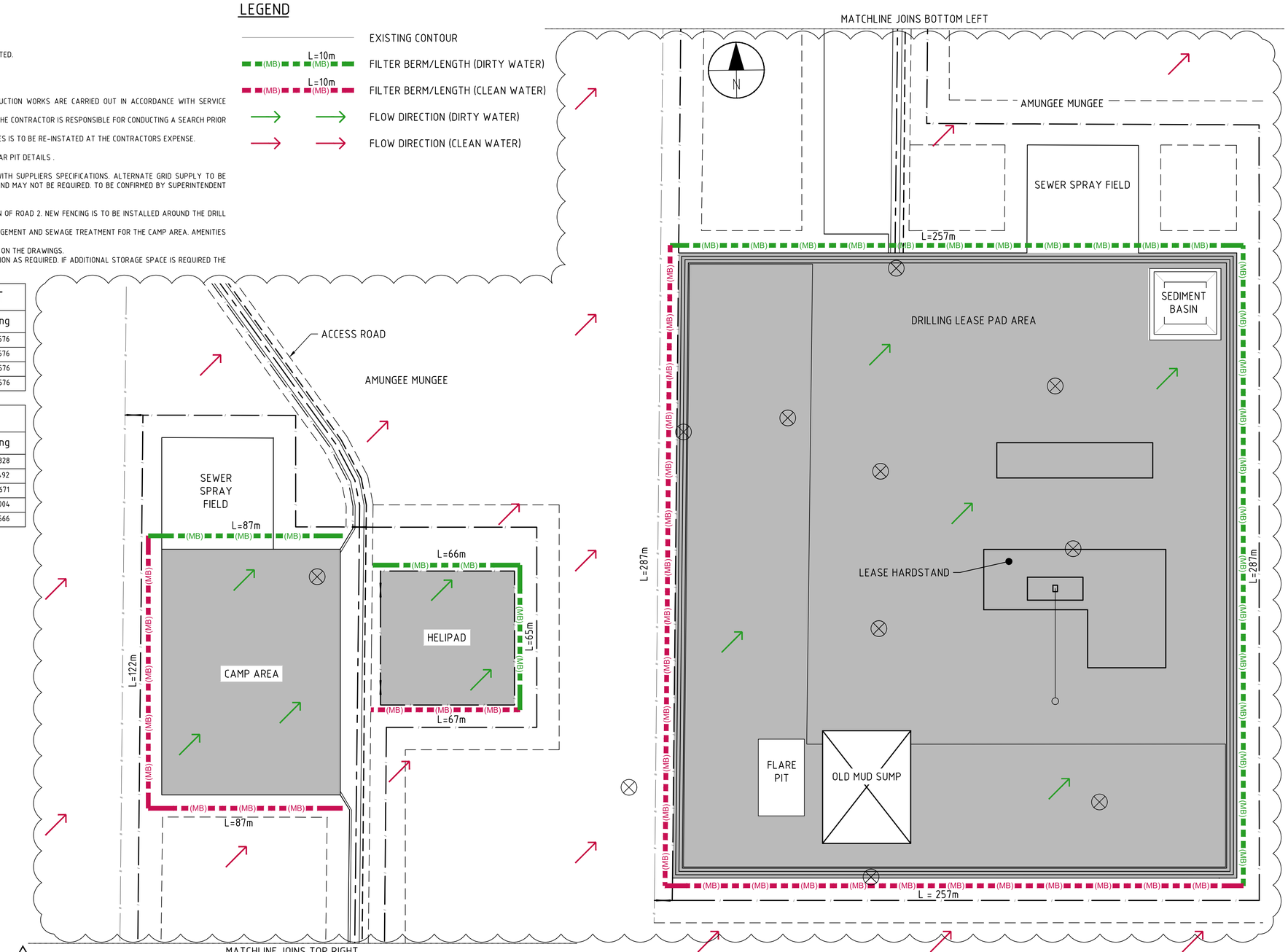
Pt	Easting	Northing
D1	380808.537	8192207.391
D2	381061.293	8192207.358
D3	381061.251	8192487.284
D4	380811.250	8192487.284

EXPLORATION WELL LOCATION

Pt	Easting	Northing
E1	380979.929	8192337.049

FENCELINE SETOUT

Pt	Easting	Northing
F1	380808.419	8192197.346
F2	380814.966	8192870.375
F3	380883.381	8192870.244
F4	380883.381	8192820.338
F5	380991.378	8192820.186
F6	380991.378	8192730.576
F7	380924.015	8192730.576
F8	380922.375	8192545.241
F9	381071.243	8192544.630
F10	381071.295	8192197.357



EROSION AND SEDIMENT CONTROL PLAN
Scale 1:1000

EROSION AND SEDIMENT CONTROL PLAN
Scale 1:1000

ISSUED FOR CONSTRUCTION

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN
		3	07/06/2022	DRILL PAD LAYOUT AND COORDINATES REVISED	BM	AB	AB
NT-2050-20-DD-0003	TURKEY'S NEST AND CELLAR DETAILS	2	19/04/2022	EROSION AND SEDIMENT CONTROL PLAN ADDED	BM	AB	AB
NT-2050-20-DD-0002	ROAD, MUD SUMP AND FLARE PIT DETAILS	1	23/03/2022	REVISED FOR REMOVAL OF DRILLING CELLAR E2	BM	AB	AB
NT-2050-20-DA-0057	INTERSECTION DETAIL	0	18/02/2022	ISSUED FOR CONSTRUCTION	AN	AB	AB

APPROVALS: D&C ENGINEER | PROJECT ENGINEER | D&C PROJECT MANAGER | GA FIELD MANAGER | GA APPROVALS LEAD | GA OPS & PROJECT MANAGER

PROJECT APPROVALS - OTHERS: PROJECT | DRAWING OFFICE

PREPARED FOR ORIGIN BY:
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AECOM Australia Pty Ltd A.B.N. 20 093 846 925

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	BY	DATE
DRAWN	AN	11/02/2022
DWG CHECK	AB	11/02/2022
DESIGN	AB	11/02/2022
ENG DES CHECK	JJ	18/02/2022
ORIGIN DRAFT. SUPER.		
ORIGIN PROJECT APPROVAL		

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
AMUNGEE MUNGEE WELL 2
DRILL PAD, ACCOMODATION CAMP AND WATER TANK
NOTES, SETOUT TABLES AND EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.
MOD NO.
SCALE N.T.S.
DRAWING NO. NT-2050-20-DA-0058
REVISION 3
CADFILE 60330225--NT-2050-20-DA-0058.dwg
A1

Tue, 07 Jun 2022 - 6:36pm L:\LEGACY\PROJECTS\606X\60623736_ORIGIN_STAGE_3\900_CAD_GIS\10_CAD\20_SHEETS\AMUNGEE N1\60330225--NT-2050-20-DA-0058.DWG Borzi, Alfio

Signature: Kaycee Verghese

Email: kaycee.verghese@origin.com.au

Signature: PThomas

Email: Peter.Thomas@origin.com.au

Signature: James Boorman

Email: james.boorman1@upstream.originenergy.com.

Signature:

Email: robert.wear@origin.com.au

Signature:

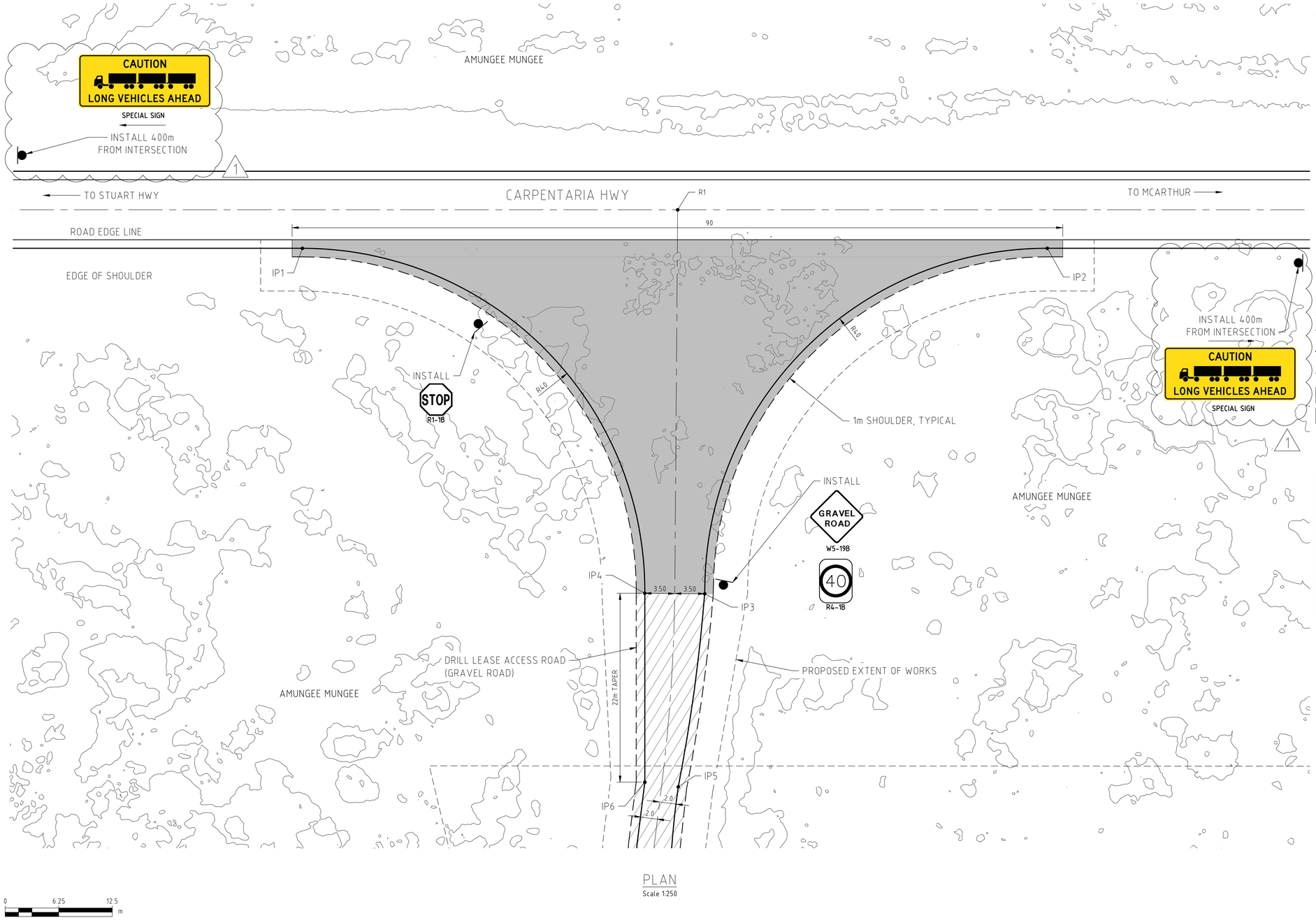
Email: Matt.Kernke@origin.com.au

Signature:

Matthew Hanson (Nov 23, 2022 21:27 GMT+10)

Email: matthew.hanson@origin.com.au

AMUNGEE NW1 INTERSECTION



PLAN
Scale 1:250

0 6.25 12.5 m

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTES OTHERWISE.
2. TRAFFIC ROAD SIGNAGE TO COMPLY WITH AS1743 AND NORTHERN TERRITORY GUIDELINES.
3. PAVEMENT SEAL WORKS TO BE CONSTRUCTED TO MEET PERFORMANCE AND DESIGN STANDARDS FOR NORTHERN TERRITORY GOVERNMENT ROADS AND STANDARD SPECIFICATION ROADWORKS v4.2.
4. INTERSECTION DESIGNED WITH 40m TURNING RADII TO ACCOMMODATE ALL HEAVY VEHICLE MOVEMENTS INCLUDING A-TRIPLE ROAD TRAINS.
5. LOCATION OF INTERSECTION IS TO BE CONFIRMED BY CONTRACTOR ON SITE.
6. THE CONTRACTOR IS RESPONSIBLE FOR PERMITS REQUIRED FOR CONSTRUCTION IN ROAD RESERVE AND TIE-IN TO EXISTING HIGHWAY.
7. ROAD AREA BETWEEN CARPENTARIA HIGHWAY AND ROAD RESERVE BOUNDARY TO BE RE-INSTATED/COVERED WHILE ACCESS TRACK NOT IN USE.
8. CONTRACTOR IS RESPONSIBLE TO FIND/LOCATE EXISTING SERVICES. ANY DAMAGE TO EXISTING SERVICES TO BE RE-INSTATED AT THE CONTRACTORS EXPENSE.
9. SIGNAGE TO BE INSTALLED PRIOR TO ROAD USE.
10. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED MANAGEMENT PLAN REQUIREMENTS.
11. NO CONSTRUCTION WORKS ARE TO BE CARRIED OUT OUTSIDE THE APPROVED WORK CORRIDOR BOUNDARIES.
12. CONSTRUCTION FACILITY AREA LOCATIONS TO BE APPROVED BY THE SUPERINTENDENT PRIOR TO WORKS COMMENCING.
13. NO SERVICES WERE PRESENT OR PROVIDED BY DBYD AT THE TIME OF DESIGN AND ARE THEREFOR NOT SHOWN, HOWEVER THE CONTRACTOR IS RESPONSIBLE FOR CONDUCTING A SEARCH PRIOR TO WORKS BEING CARRIED OUT.
14. 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.
15. THIS DRAWING MAY BE USED FOR TEMPORARY ACCESS APPLICATION TO NT ROADS.
16. FINISH SURFACE LEVELS ARE TO FOLLOW EXISTING SURFACE LEVELS AS NEAR AS POSSIBLE AND TO THE GRADES SPECIFIED ON THE DRAWINGS.
17. 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 DWG. NT-2050-20-DD-0002.
18. FENCELINE TO BE MAINTAINED AT ALL TIMES.

LEGEND

- PROPOSED ROAD CENTRE LINE
- PROPOSED EDGE OF ROAD
- PROPSED EDGE OF SHOULDER (1m OFF EDGE OF ROAD)
- PROPOSED GRAVEL ROAD PAVEMENT
- PROPOSED SEALED SHOULDER
  PRIME AND SEAL **S20E**, 14/7mm AGGREGATE.
  TYPE 2 OR 3 GRAVEL BASE COMPACTED
  THICKNESS 200mm TO 100% MMDD.

ROAD SETOUT

Pt	Easting	Northing
R1	380836.955	8193126.080
IP1	380793.277	8193131.916
IP2	380877.885	8193111.647
IP3	380829.571	8193081.718
IP4	380822.786	8193083.405
IP5	380821.311	8193060.500
IP6	380817.644	8193061.942

No.	DESCRIPTION	DATE	INIT.	DEPT/COMPANY
1	LONG VEHICLE AHEAD SIGNAGE ADDED	24.05.22	J.JENTZ	AECOM
0	CONTRACT DRAWING	10.05.22	J.JENTZ	AECOM

AMENDMENTS — Plot Date: 24/05/2022

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

DRAWN: B.MOOREHEAD, DATE: 10.05.2022	CHECKED: A.BORZI, DATE: 10.05.2022
DESIGNED: A.BORZI, DATE: 10.05.2022	CHECKED: J.JENTZ, DATE: 10.05.2022
DESIGN PROJECT LEADER: P.THOMAS, DATE: 10.05.2022	NTG PROJECT MANAGER: N.PERERA, DATE: 10.05.2022

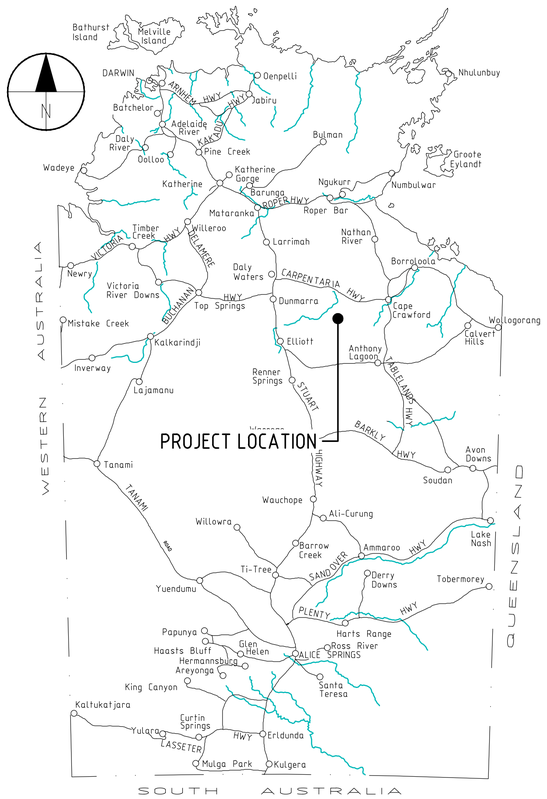
Northern Territory Government

KATHERINE - NEAR NT PORTION 7027 - 4500 CARPENTERIA HIGHWAY
ACCESS TO BEETALOO EXPLORATION DRILLING CAMPAIGN
AECOM - ORIGIN ENERGY

NTG PROJECT No.	NTG ASSET No.	SHEET No.	NTG DRAWING No.	AMENDMENT	SHEET SIZE
2018-0186	R0025	1 OF 1	R22-1725	1	A1

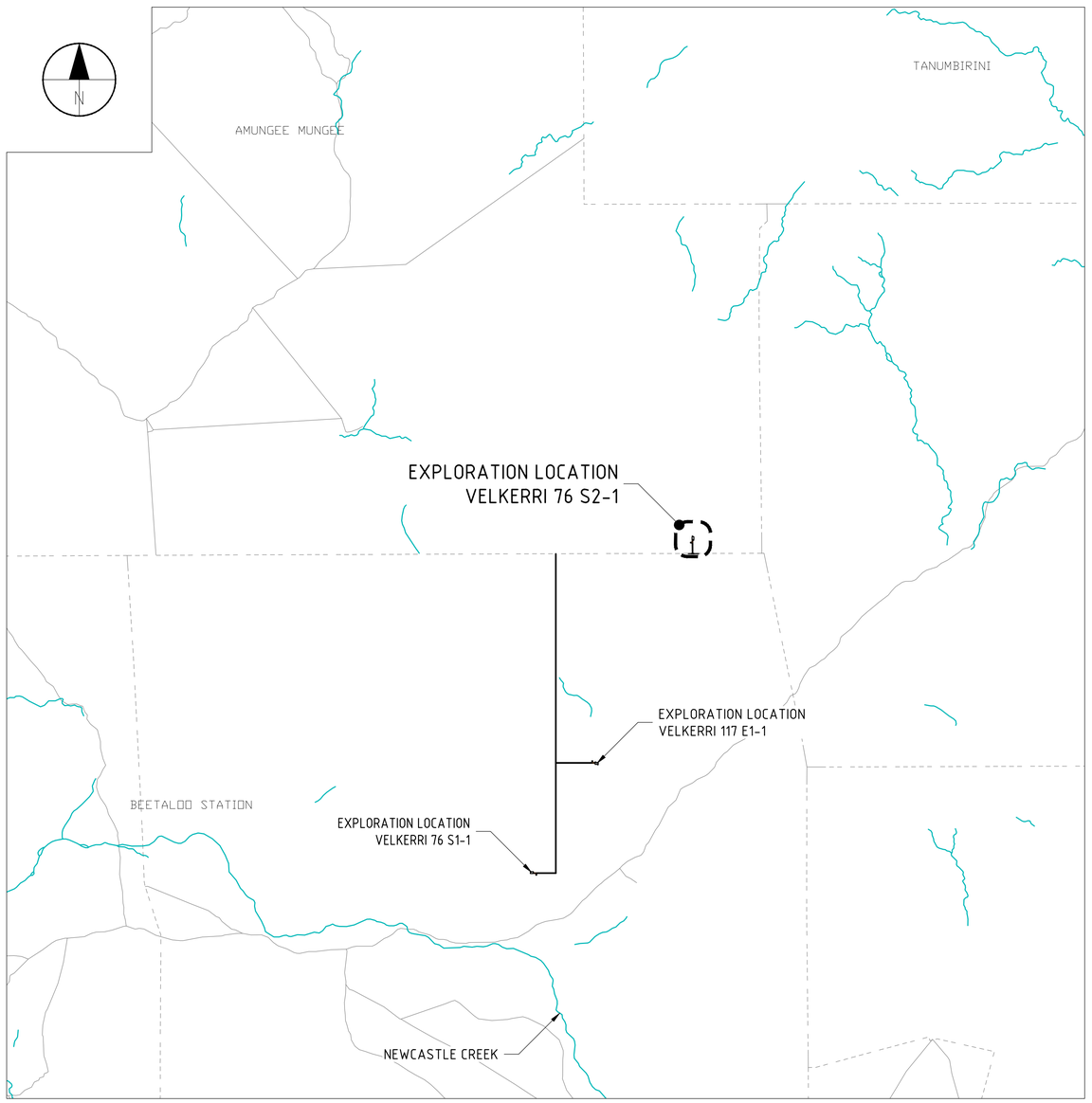
Ver. Jan' 2020

PLOTTED ON: 24/May/2022 1:48 PM
USER: MOOREHEAD, BAILEY
FILE LOCATION: L:\Legacy\Projects\606x\60623736_Origin_Stage_3\500_Deliverables\501_Deliverable_Amungee\2022-05-24 - Amungee DIPL REV\R22-1725 - R22-1726\IR22-1725 - R22-1726\DIPL\R22-1725.dwg



LOCALITY MAP

SCALE 0 100 150 200 250 300 Kilometers



LOCALITY PLAN

SCALE (km) 0 2 4 6 8 10 1:200,000 (A1)

DRAWING SCHEDULE

CIVIL	
DRAWING NUMBER	DESCRIPTION
NT-2050-20-DH-0007	LOCALITY MAP, LOCALITY PLAN, DRAWING SCHEDULE, GENERAL NOTES
NT-2050-20-DA-0023	DRILL PAD, ACCOMODATION CAMP AND WATER TANK GENERAL ARRANGEMENT PLAN
NT-2050-20-DA-0026	DRILL PAD, ACCOMODATION CAMP AND WATER TANK EARTHWORKS GENERAL ARRANGEMENT PLAN
NT-2050-20-DD-0023	DESIGN DETAILS
NT-2050-20-DD-0031	MUD SUMP DETAILS
NT-2050-20-DD-0025	PAD ACCESS ROAD
NT-2050-20-DD-0032	PAD INTERSECTION DETAIL
NT-2050-20-DD-0027	DRILLING CELLAR DETAILS
NT-2050-15-MP-0022	DRILL PAD, ACCOMODATION CAMP AND WATER TANK EROSION AND SEDIMENT CONTROL PLAN
STANDARD DRAWINGS	
C(S)3310	STOCK FENCE DESIGN AND DETAILS

LEGEND

EXISTING

- PIPELINE
- FENCE
- PRINCIPAL ROAD
- UNSEALED TRACK
- WATERCOURSE

GENERAL 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 SUPERINTENDENT 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. THIS DRAWING MAY BE USED FOR TEMPORARY ACCESS APPLICATION TO NT ROADS.

PRELIMINARY

NOT FOR CONSTRUCTION

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
-	-	A	21.03.2019	PRELIMINARY ISSUE	CD	-	-	-	-	-

PREPARED FOR ORIGIN BY:

AECOM Australia Pty Ltd
A.B.N 20 093 846 925
www.aecom.com

PROJECT 60480548 BEETALOO EXPLORATION
DRAWING OFFICE DARWIN
APPROVALS
PROJECT APPROVALS - OTHERS

Origin Energy Ltd
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GPO Box 148
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DESIGN	-	— . — . —
ENG DES CHECK	-	— . — . —
DRAFT. SUPER.	-	— . — . —
PROJECT APPROVAL	-	— . — . —

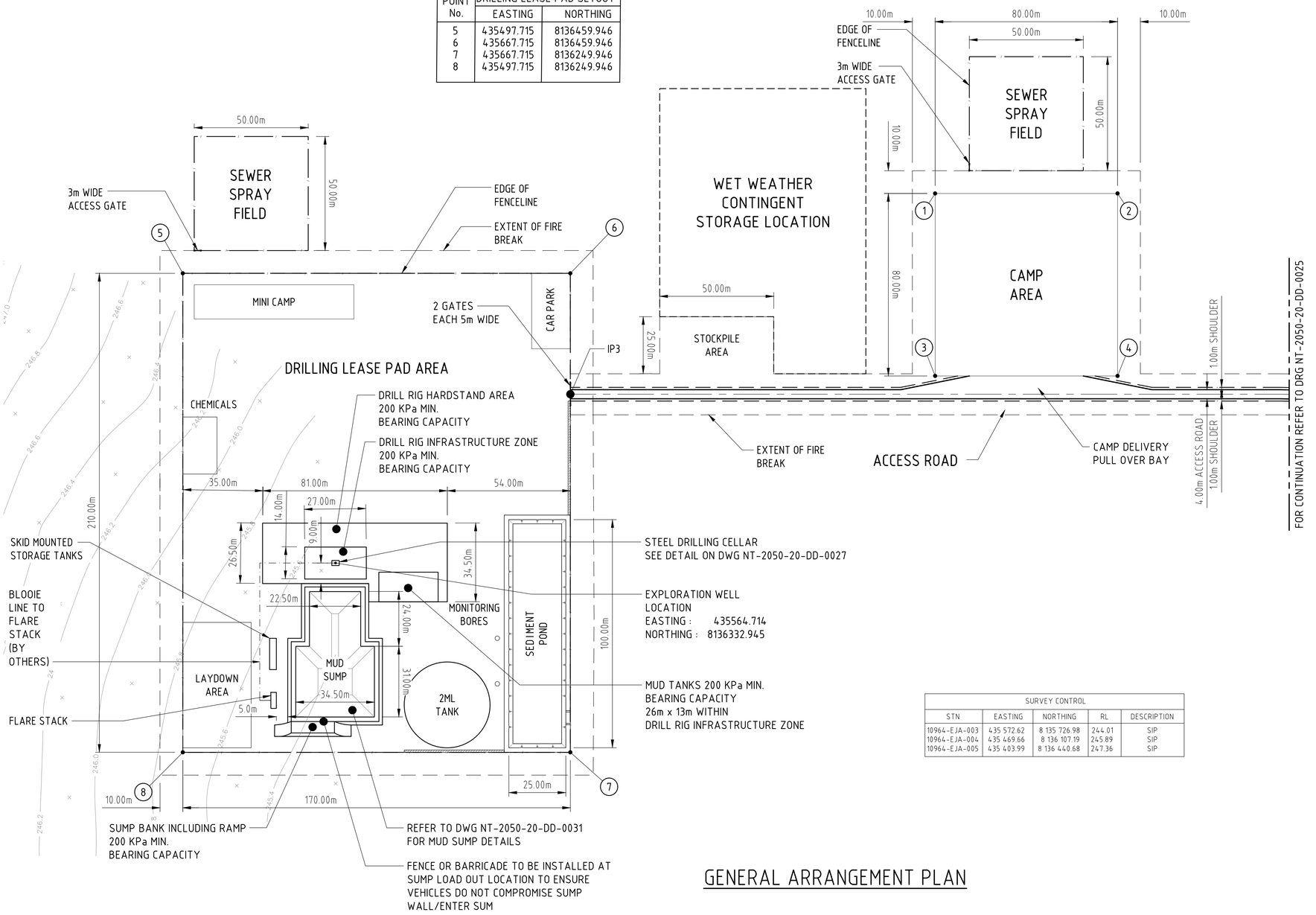
TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
LOCALITY MAP, LOCALITY PLAN, DRAWING SCHEDULE, GENERAL NOTES

PROJECT NO.
MOD NO.
SCALE AS NOTED
DRAWING NO. NT-2050-20-DH-0007
REVISION A
CADFILE NT-2050-20-DH-0007.dwg
A1

Thu, 18 Apr 2019 - 14:9pm P:\60\XX\60480548\5. CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DH-0007.DWG Dudley, Calvin

POINT No.	CAMP PAD SETOUT	
	EASTING	NORTHING
1	435827.715	8136494.945
2	435907.715	8136494.945
3	435827.715	8136414.945
4	435907.715	8136414.945

POINT No.	DRILLING LEASE PAD SETOUT	
	EASTING	NORTHING
5	435497.715	8136459.946
6	435667.715	8136459.946
7	435667.715	8136249.946
8	435497.715	8136249.946



LEGEND

EXISTING

CONTOURS

PROPOSED

ACCESS ROAD CENTERLINE

EDGE OF PAVEMENT

EDGE OF SHOULDER

EDGE OF FOOTPATH

EXTENT OF CLEARING - (EXTENT OF FIRE BREAK)

EDGE OF FENCELINE

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. REFER TO NORTHERN TERRITORY STANDARD DRAWING C(S)3310 FOR TYPICAL STOCK FENCE DETAILS.
3. SEWER SPRAY FIELD AREA IS NOT TO BE CLEARED. SPRAY PIPES LAID ON EXISTING VEGETATION BY OTHERS.
4. LEASE AND CAMP PAD TO BE COMPACTED TO 120KPA BEARING CAPACITY UNLESS OTHERWISE NOTED.
5. LEASE HARDSTAND PAD TO BE COMPACTED TO 200 KPA BEARING CAPACITY.
6. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED MANAGEMENT PLAN REQUIREMENTS.
7. NO CONSTRUCTION WORKS ARE TO BE CARRIED OUT OUTSIDE THE APPROVED WORK CORRIDOR BOUNDARIES.
8. CONSTRUCTION FACILITY AREA LOCATIONS TO BE APPROVED BY THE SUPERINTENDENT PRIOR TO WORKS COMMENCING.
9. 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.
10. THE CONTRACTOR IS TO CARRY OUT A DBYD AND LOCATE AND MARK SERVICES ON SITE. ANY DAMAGE TO EXISTING SERVICES IS TO BE RE-INSTATED AT THE CONTRACTORS EXPENSE.
11. SIGNAGE TO BE INSTALLED PRIOR TO ROAD USE.
12. REFER TO DRAWING NT-2050-20-DD-0031 FOR MUD SUMP DETAILS AND DRAWING NT-2050-20-DD-0027 FOR STEEL DRILLING CELLAR DETAILS.
13. THE NOMINATED AREA BOUND BY SETOUT POINTS D1 TO D4 IS TO BE A UNIFORMLY GRADED PAD.
14. FINISH SURFACE LEVELS ARE TO FOLLOW EXISTING SURFACE LEVELS AS NEAR AS POSSIBLE AND TO THE GRADES SPECIFIED ON THE DRAWINGS.
15. FIREBREAK CLEARINGS AROUND DRILLING LEASE AND CAMP PAD ARE TO BE USED FOR STORAGE OF TOPSOIL AND VEGETATION AS REQUIRED.
16. FOR ROAD SETOUT TABLE REFER TO DRG. NT-2050-20-DD-0025.
17. HARDSTAND AND LEASE PAD FINISHED SURFACE LEVELS TO BE EQUAL OR SMOOTH TRANSITION TO AVOID BATTERS OF STEPS.
18. CAMP PAD AREA CROSSFALL TO BE NO GREATER THAN 1%.
19. NO ESC DEVICE CAN BE INSTALLED IN CRITICAL RIG AREA WITHOUT APPROVAL BY WELLSITE REP.
20. CATTLE PANEL FENCING TO BE INSTALLED AROUND MUD SUMP.

SURVEY CONTROL				
STN	EASTING	NORTHING	RL	DESCRIPTION
10964-EJA-003	435 572.62	8 135 726.98	244.01	SIP
10964-EJA-004	435 469.66	8 136 107.19	245.89	SIP
10964-EJA-005	435 403.99	8 136 440.68	247.36	SIP

GENERAL ARRANGEMENT PLAN

PRELIMINARY

NOT FOR CONSTRUCTION

SCALE (m) 0 10 20 30 40 50 1:1000 (A1)

DRAWING NO.	REFERENCE DRAWING TITLE
NT-2050-20-DD-0027	DRILLING CELLAR DETAILS
NT-2050-20-DD-0023	DESIGN DETAILS

REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
A	21.03.2019	PRELIMINARY ISSUE	CD	-	-	-	-	-

APPROVALS

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PROJECT 60480548 BEETALOO EXPLORATION

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DESIGN	-	— . — . —
ENG DES CHECK	-	— . — . —
DRAFT. SUPER.	-	— . — . —
PROJECT APPROVAL	-	— . — . —

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DRILL PAD, ACCOMODATION CAMP AND WATER TANK
GENERAL ARRANGEMENT PLAN

PROJECT NO.

DRAWING NO. NT-2050-20-DA-0023

REVISION A

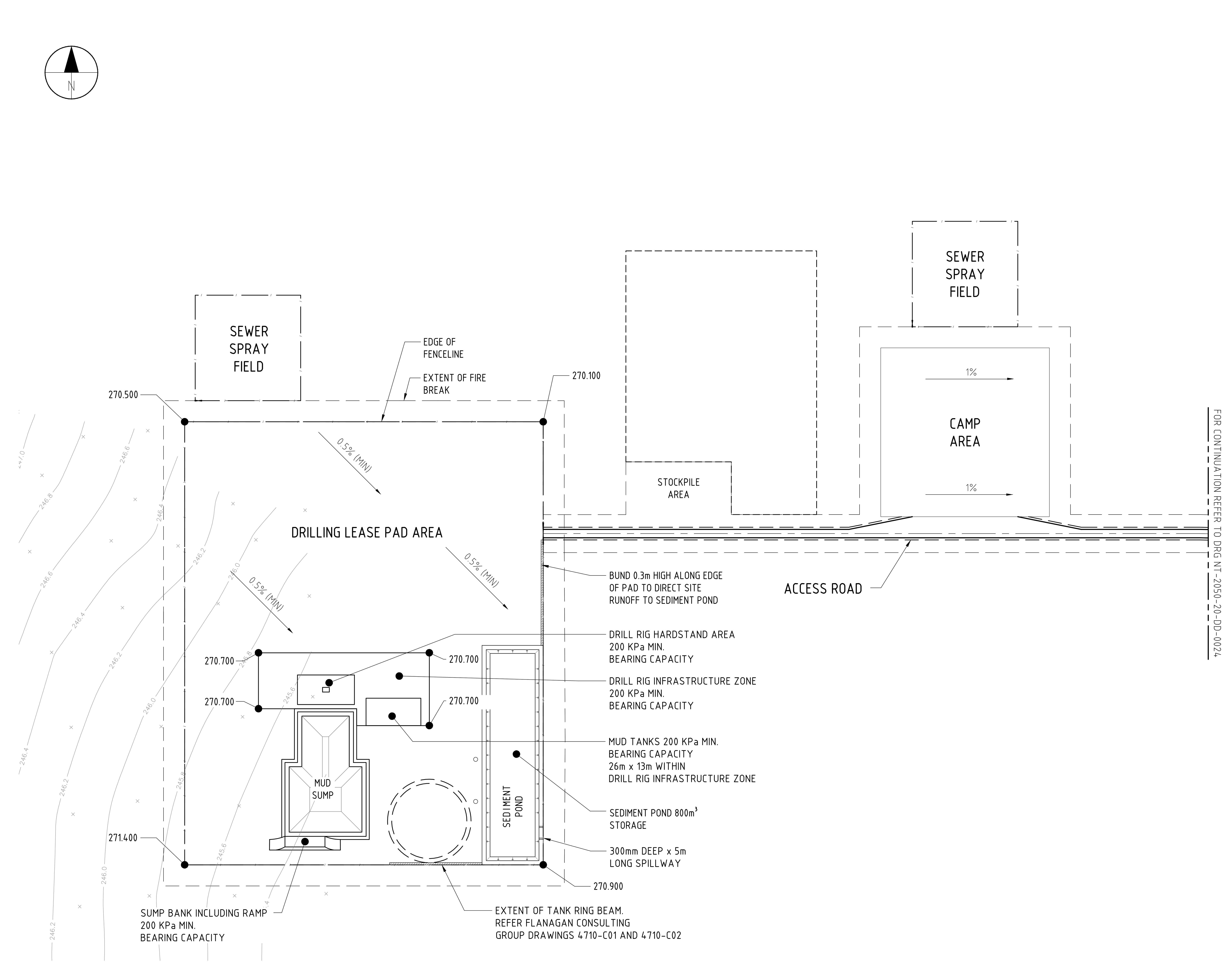
MOD NO.

SCALE 1:1000 @ A1

CADFILE NT-2050-20-DA-0023.dwg

A1

Thu, 18 Apr 2019 - 1:50pm P:\604X\604805&815 CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DA-0023.DWG Dudley, Calvin



GENERAL ARRANGEMENT PLAN

LEGEND

EXISTING

(line)	CONTOURS

PROPOSED

(line)	ACCESS ROAD CENTERLINE
(line)	EDGE OF PAVEMENT
(line)	EDGE OF SHOULDER
(line)	EDGE OF FOOTPATH
(line)	EXTENT OF CLEARING - (EXTENT OF FIRE BREAK)
(line)	EDGE OF FENCELINE

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. LEASE AND CAMP PAD TO BE COMPACTED TO 120KPA BEARING CAPACITY UNLESS OTHERWISE NOTED.
3. LEASE HARDSTAND TO BE COMPACTED TO 200 KPA BEARING CAPACITY.
4. BULK EARTHWORKS ARE TO BE MINIMISED WHERE POSSIBLE.
5. ROAD AND PAD PAVEMENTS ARE TO BE CONSTRUCTED TO FOLLOW EXISTING SURFACE LEVELS AS NEAR AS POSSIBLE AND TO THE GRADES SPECIFIED ON THE DRAWINGS.
6. CONTRACTOR IS RESPONSIBLE TO FIND/LOCATE EXISTING SERVICES. ANY DAMAGE TO EXISTING SERVICES TO BE RE-INSTATED AT THE CONTRACTORS EXPENSE.
7. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED MANAGEMENT PLAN REQUIREMENTS.
8. NO CONSTRUCTION WORKS ARE TO BE CARRIED OUT OUTSIDE THE APPROVED WORK CORRIDOR BOUNDARIES.
9. CONSTRUCTION FACILITY AREA LOCATIONS TO BE APPROVED BY THE SUPERINTENDENT PRIOR TO WORKS COMMENCING.
10. 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 DWG. NT-2050-20-DD-0023.
11. REFER TO DWG NT-2050-20-DD-0023 FOR ROAD PAVEMENT DETAILS. LAYDOWN AND VEHICLE AREA, LEASE PAD AND ACCOMMODATION PAD ARE TO BE STRIPPED OF 150mm AND THEN RIPPED AND RE-COMPACTED TO 95%MMDD. DRILL PAD IS TO BE TESTED FOR REQUIRED BEARING CAPACITIES AND THE ORIGIN SITE SUPERVISOR NOTIFIED IF THIS CAN NOT BE ACHIEVED.
12. REFER TO DRAWING NT-2050-20-DD-0031 FOR MUD SUMP DETAILS AND DRAWING NT-2050-20-DD-0027 FOR STEEL DRILLING CELLAR DETAILS.
13. FOR TANK RING BEAM DETAIL REFER FLANAGAN CONSULTING GROUP DRAWINGS 4710-C01 AND 4710-C02.
14. FINAL DRILLING LEASE PAD AREA GRADE TO BE CONFIRMED ON SITE BY ORIGIN SITE SUPERVISOR.

PRELIMINARY

NOT FOR CONSTRUCTION

SCALE (m) 0 10 20 30 40 50 1:1000 (A1)

DRAWING NO.	REFERENCE DRAWING TITLE
NT-2050-20-DD-0027	DRILLING CELLAR DETAILS
NT-2050-20-DD-0023	DESIGN DETAILS

REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
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DRAWING OFFICE DARWIN
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DESIGN	-	- . - . -
ENG DES CHECK	-	- . - . -
ORIGIN DRAFT. SUPER.	-	- . - . -
ORIGIN PROJECT APPROVAL	-	- . - . -

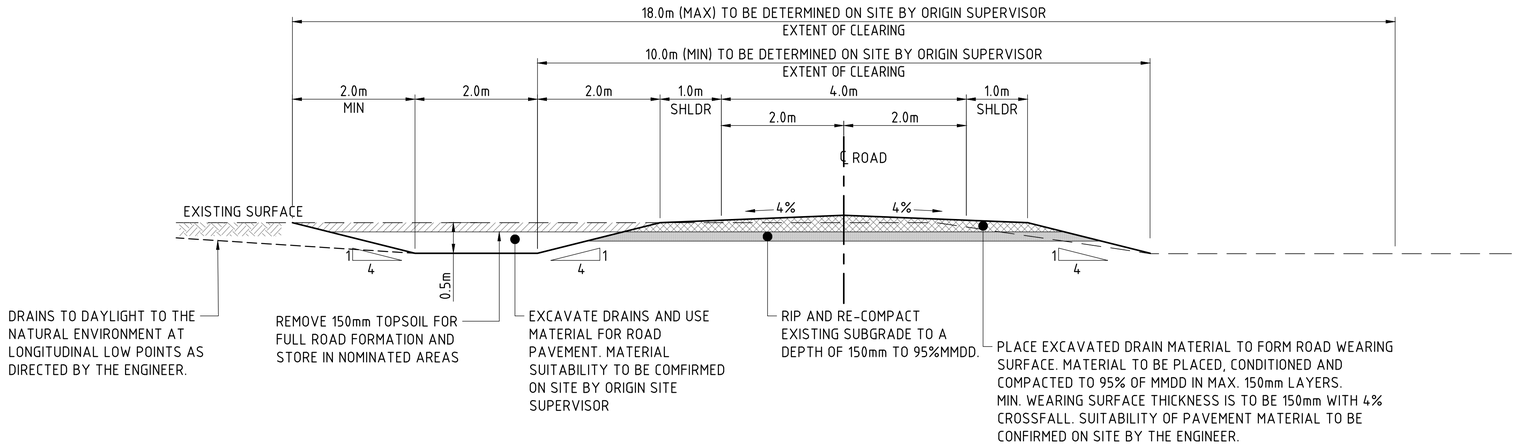
TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DRILL PAD, ACCOMODATION CAMP AND WATER TANK EARTHWORKS
GENERAL ARRANGEMENT PLAN

PROJECT NO. | DRAWING NO. NT-2050-20-DA-0026 | REVISION A

MOD NO.

SCALE 1:1000 @ A1 | CADFILE NT-2050-20-DA-0026.dwg | A1

Thu, 18 Apr 2019 - 1:50pm P:\604X\60480548\5. CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DA-0026.DWG Dudley, Calvin



TYPICAL CROSS SECTION - ACCESS ROAD

SCALE (m) 0 0.2 0.4 0.6 0.8 1.0 — 1:20 (A1)

NOTES:

1. ALL UNITS ARE IN MILLIMETRES (mm) UNLESS NOTED OTHERWISE.
2. ENSURE THAT TABLE DRAINS ARE FREE DRAINING.
3. GROUND CONDITIONS AND SUITABLE MATERIALS TO BE CONFIRMED ON SITE BY SUPERINTENDENT.
4. CLEARED VEGETATION TO BE STORED ALONGSIDE NEW ROAD FOR FUTURE REHABILITATION.
5. REFER TO SPECIFICATION FOR COMPACTION REQUIREMENTS.
6. STRIPPED TOPSOIL TO BE STORED IN BERMS ALONGSIDE ROAD.
7. REFER TO SPECIFICATION FOR GENERAL REQUIREMENTS.
8. THE CONTRACTOR IS TO NOTIFY THE ORIGIN SUPERVISOR IF AREAS OF SOFT GROUND ARE ENCOUNTERED OR IF THE SPECIFICATION CANNOT BE ACHIEVED.
9. CLEAR, STRIP 150mm TOPSOIL AND STOCKPILE IN NOMINATED BUFFER ZONE TO ESTABLISH BORROW PITS.
10. THIS DRAWING MAY BE USED FOR TEMPORARY ACCESS APPLICATION TO NT ROADS.
11. TYPICAL CROSS SECTION DESIGNED IN ACCORDANCE WITH NORTHERN TERRITORY STANDARD DRAWING C(S)3003.

ISSUED FOR CONSTRUCTION

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
		2	16.04.19	REISSUED FOR CONSTRUCTION	CRD	PCM	PCM	JMJ		
		1	11.04.19	REISSUED FOR CONSTRUCTION	CRD	PCM	PCM	JMJ		
NT-2050-20-DA-0023	GENERAL ARRANGEMENT PLAN	0	20.03.19	ISSUED FOR CONSTRUCTION	CRD	PCM	PCM	JMJ		

APPROVALS

PREPARED FOR ORIGIN BY:

AECOM Australia Pty Ltd
A.B.N 20 093 846 925
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PROJECT: 60480548 BEETALOO EXPLORATION
DRAWING OFFICE: DARWIN
PROJECT APPROVALS - OTHERS

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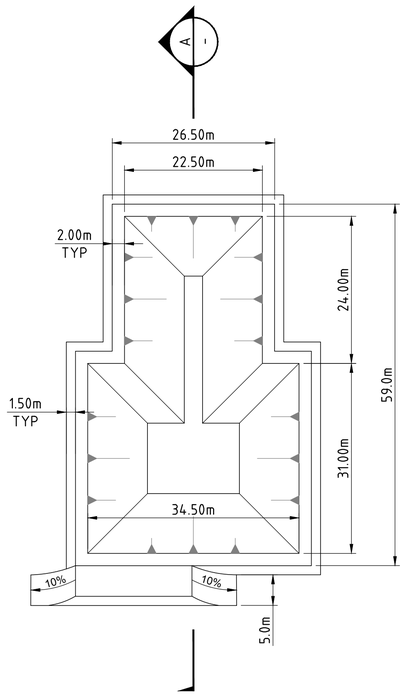
DWG CHECK	PCM	20.03.2019
DESIGN	PCM	20.03.2019
ENG DES CHECK	JMJ	20.03.2019
DRAFT. SUPER.		
PROJECT APPROVAL		

TITLE: BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DESIGN DETAILS

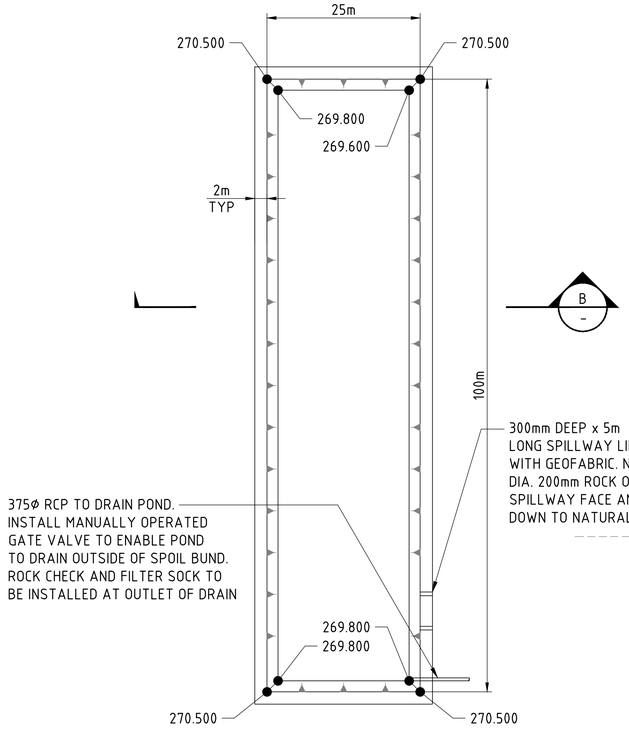
PROJECT NO.
MOD NO.
SCALE: 1:1000 @ A1
DRAWING NO.: NT-2050-20-DD-0023
REVISION: 0
CADFILE: NT-2050-20-DD-0023.dwg
A1

Thu, 18 Apr 2019 - 1:50pm P:\604-XX\604-805\8\5 CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DD-0023.DWG Dudley, Calvin



PLAN - MUD SUMP

Scale N.T.S.



PLAN - SECONDARY CONTAINMENT

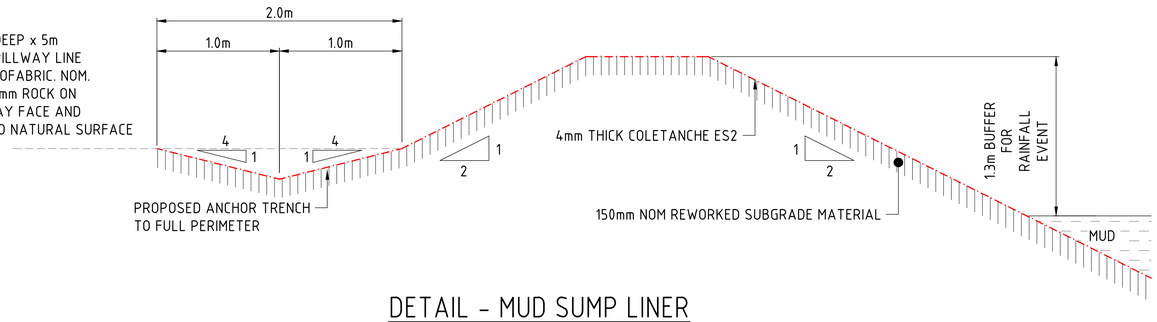
Scale N.T.S.

NOTES:

1. ALL UNITS ARE IN MILLIMETRES (mm) UNLESS NOTED OTHERWISE.
2. GROUND CONDITIONS AND SUITABLE MATERIALS TO BE CONFIRMED ON SITE BY SUPERINTENDENT.
3. REFER TO SPECIFICATION FOR COMPACTION REQUIREMENTS.
4. REFER TO SPECIFICATION FOR GENERAL REQUIREMENTS.
5. THE CONTRACTOR IS TO NOTIFY THE ORIGIN SUPERVISOR IF AREAS OF SOFT GROUND ARE ENCOUNTERED OR IF THE SPECIFICATION CANNOT BE ACHIEVED.
6. REFER TO DRAWING NT-2050-20-DA-0023 FOR SETOUT DETAILS OF MUD SUMP.
7. FAUNA LADDERS TO BE INSTALLED TO MUD SUMP.
8. CONTRACTOR TO PROVIDE CATTLE PANELS FOR FENCING AROUND SUMP WHERE DEPTH IS GREATER THAN 1.5m.
9. FENCE OR BARRICADE TO BE INSTALLED AT SUMP LOAD OUT LOCATION TO ENSURE VEHICLES DO NOT COMPROMISE SUMP WALL/ENTER SUM.
10. MUD SUMP VEHICLE OFFLOAD AREA TO BE COMPACTED TO 200 KPa

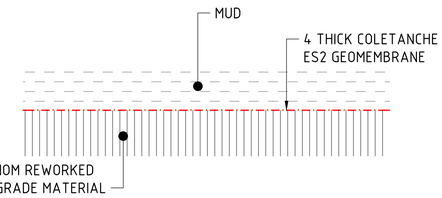
NOTES:

1. GEOSYNTHETICS ARE DRAWN EXAGGERATED FOR CLARITY.



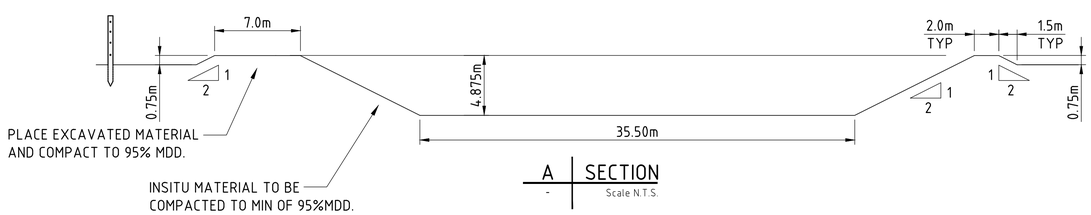
DETAIL - MUD SUMP LINER

Scale N.T.S.



DETAIL - BASE LINER

Scale N.T.S.



A | SECTION
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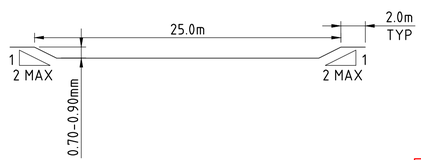
Scale N.T.S.



B | SECTION
-
Scale N.T.S.

ISSUED FOR CONSTRUCTION

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
		1	16.04.19	REISSUED FOR CONSTRUCTION	CRD	PCM	PCM	JMJ		
NT-2050-20-DA-0022	GENERAL ARRANGEMENT PLAN	0	11.04.19	ISSUED FOR CONSTRUCTION	CRD	PCM	PCM	JMJ		

APPROVALS

PREPARED FOR ORIGIN BY:

AECOM

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A.B.N 20 093 846 925
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PROJECT 60480548 BEETALOO EXPLORATION
DRAWING OFFICE DARWIN

PROJECT APPROVALS - OTHERS

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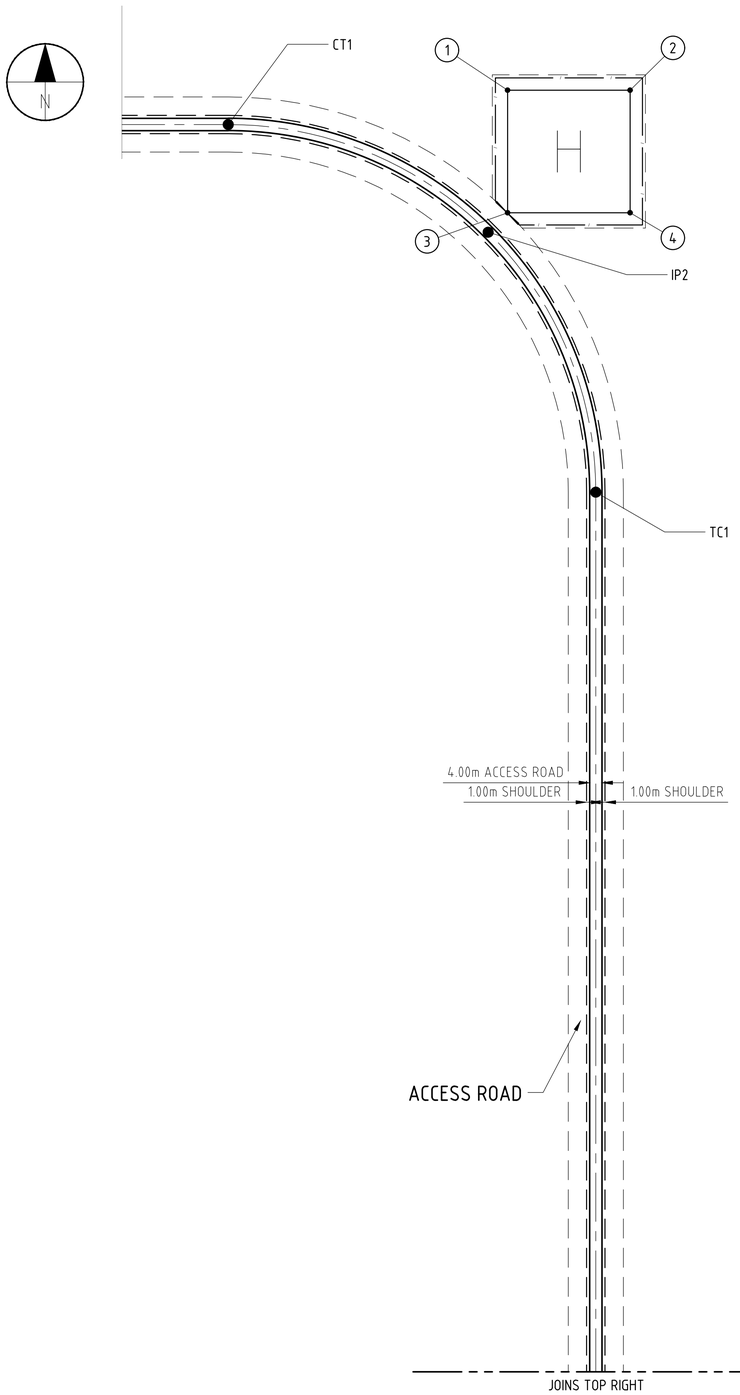
DWG CHECK	PCM	20.03.2019
DESIGN	PCM	20.03.2019
ENG DES CHECK	JMJ	20.03.2019
DRAFT SUPER		
PROJECT APPROVAL		

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
MUD SUMP DETAILS

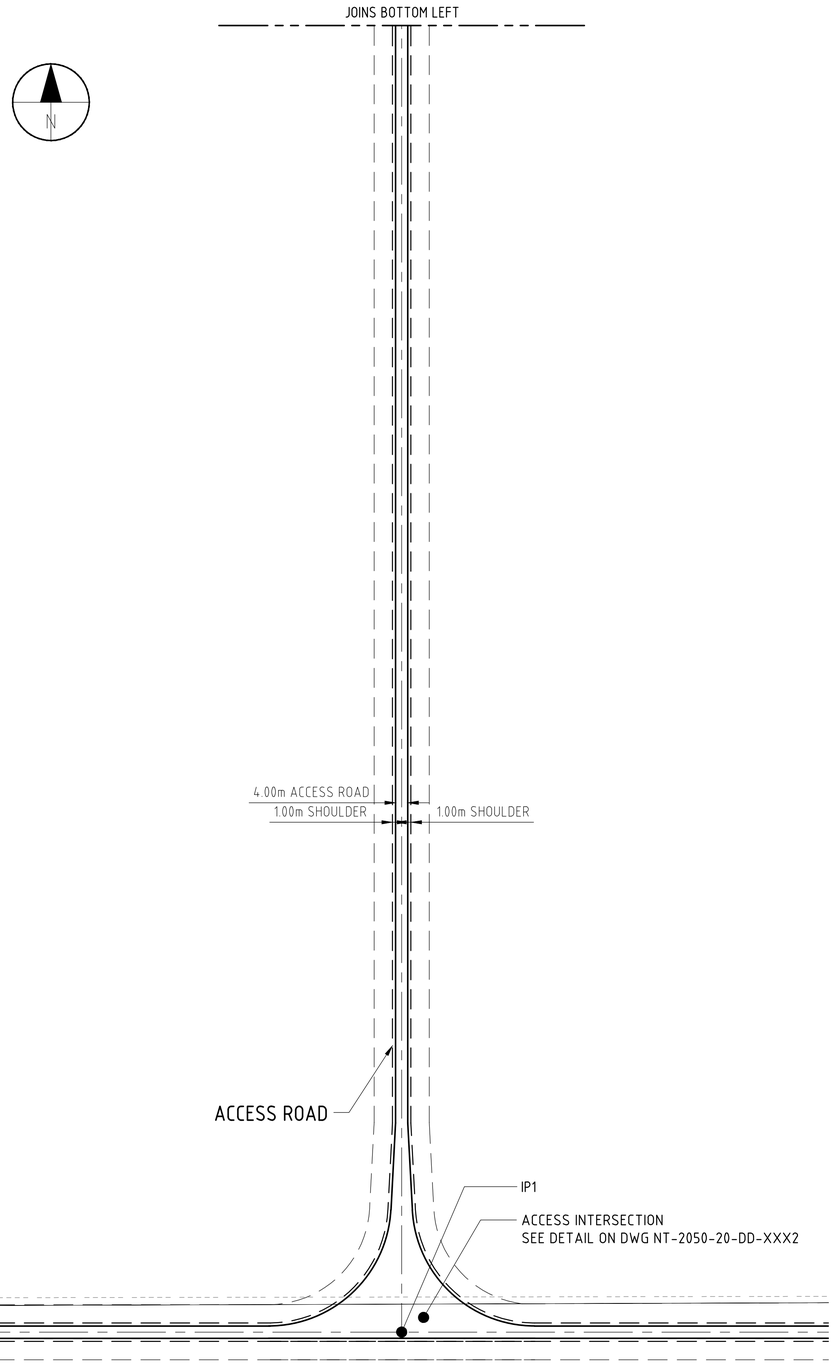
PROJECT NO.	DRAWING NO.	REVISION
MOD NO.	NT-2050-20-DD-0031	1
SCALE 1:1000 @ A1	CADFILE NT-2050-20-DD-0031.dwg	A1

Thu, 18 Apr 2019 - 1:51pm P:\60AX\60480SAR15 CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DD-0031.DWG Dudley, Calvin

FOR CONTINUATION REFER TO DRG NT-2050-20-DA-0023



ACCESS ROAD



LEGEND

EXISTING

- CONTOURS

PROPOSED

- ACCESS ROAD CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF SHOULDER
- EDGE OF FOOTPATH
- 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.

PRELIMINARY

NOT FOR CONSTRUCTION

SCALE (m) 0 10 20 30 40 50 1:1000 (A1)

DRAWING NO.	REFERENCE DRAWING TITLE
NT-2050-20-DA-XXX2	PAD INTERSECTION DETAIL
NT-2050-20-DA-0023	GENERAL ARRANGEMENT PLAN

REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
A	21.03.2019	PRELIMINARY ISSUE	CD	-	-	-	-	-

APPROVALS

PREPARED FOR ORIGIN BY:

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PROJECT 60480548 BEETALOO EXPLORATION
DRAWING OFFICE DARWIN
PROJECT APPROVALS - OTHERS

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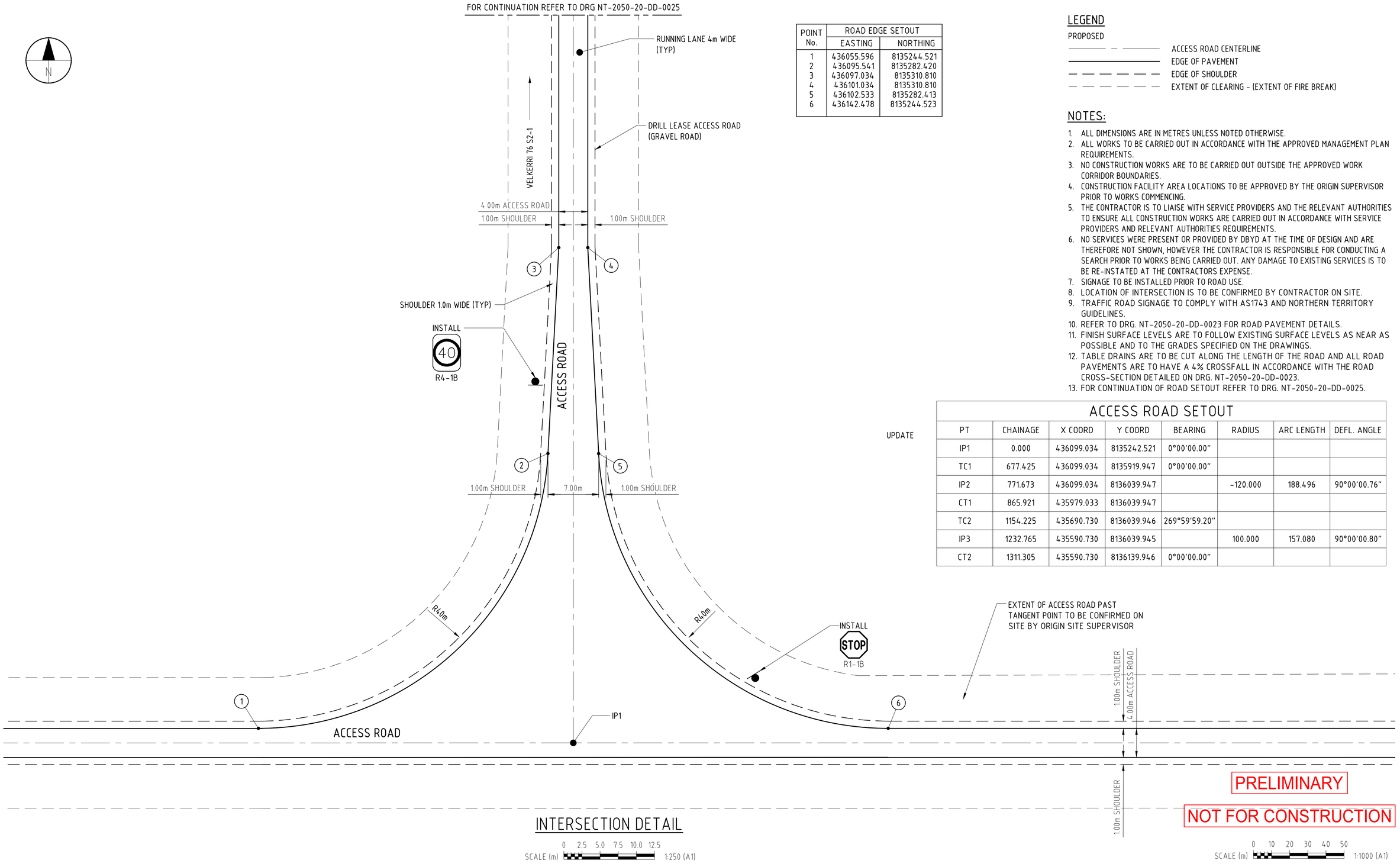
ENG DES CHECK	-	- . - . -
O&G DRAFT SUPER.	-	- . - . -
O&G PROJECT APPROVAL	-	- . - . -

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DRILL PAD, ACCOMODATION CAMP AND WATER TANK
ACCESS ROAD

PROJECT NO.
MOD NO.
SCALE 1:1000 @ A1
DRAWING NO. NT-2050-20-DD-0025
REVISION A
CADFILE NT-2050-20-DD-0025.dwg
A1

Thu, 18 Apr 2019 - 1:51pm P:\60LX\60480548\5 CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DD-0025.DWG Dudley, Calvin



POINT No.	ROAD EDGE SETOUT	
	EASTING	NORTHING
1	436055.596	8135244.521
2	436095.541	8135282.420
3	436097.034	8135310.810
4	436101.034	8135310.810
5	436102.533	8135282.413
6	436142.478	8135244.523

LEGEND

PROPOSED

- ACCESS ROAD CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF SHOULDER
- EXTENT OF CLEARING - (EXTENT OF FIRE BREAK)

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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-DD-0025.

UPDATE

ACCESS ROAD SETOUT

PT	CHAINAGE	X COORD	Y COORD	BEARING	RADIUS	ARC LENGTH	DEFL. ANGLE
IP1	0.000	436099.034	8135242.521	0°00'00.00"			
TC1	677.425	436099.034	8135919.947	0°00'00.00"			
IP2	771.673	436099.034	8136039.947		-120.000	188.496	90°00'00.76"
CT1	865.921	435979.033	8136039.947				
TC2	1154.225	435690.730	8136039.946	269°59'59.20"			
IP3	1232.765	435590.730	8136039.945		100.000	157.080	90°00'00.80"
CT2	1311.305	435590.730	8136139.946	0°00'00.00"			

INTERSECTION DETAIL

SCALE (m) 0 2.5 5.0 7.5 10.0 12.5 1:250 (A1)

SCALE (m) 0 10 20 30 40 50 1:1000 (A1)

DRAWING NO.	REFERENCE DRAWING TITLE
NT-2050-20-DD-0023	DESIGN DETAILS
NT-2050-20-DD-0025	ACCESS ROAD

REV	DATE	REVISION DESCRIPTION
A	21.03.2019	PRELIMINARY ISSUE

DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER APPROVALS	OE PROJECT APPROVAL
CD	-	-	-	-	-

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DWG CHECK	-	
DESIGN	-	
ENG DES CHECK	-	
DRAFT. SUPER.	-	
PROJECT APPROVAL	-	

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DRILL PAD, ACCOMODATION CAMP AND WATER TANK
PAD INTERSECTION DETAIL

PROJECT NO.

DRAWING NO. NT-2050-20-DD-0032

REVISION A

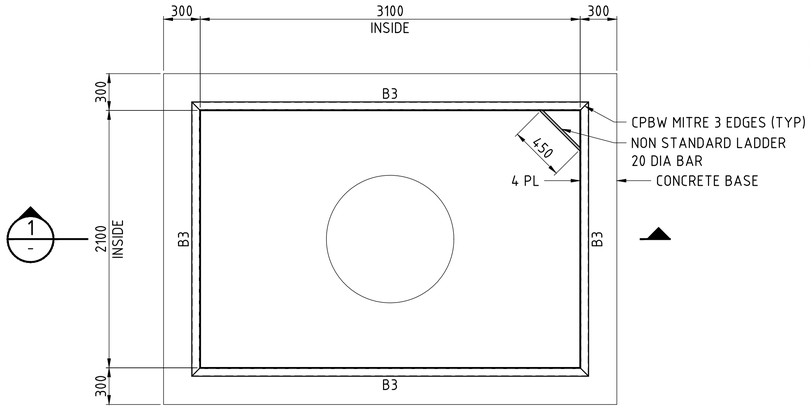
MOD NO.

SCALE 1:1000 @ A1

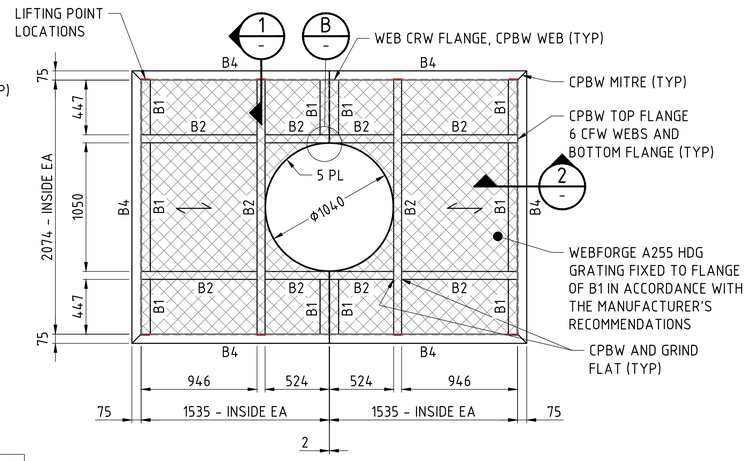
CADFILE NT-2050-20-DD-0032.dwg

A1

Thu, 18 Apr 2019 - 1:51pm P:\60LX\60480548\5. CAD\20-SHEETS\VELKERRI 76 S2-1\NT-2050-20-DD-0032.DWG Dudley, Calvin

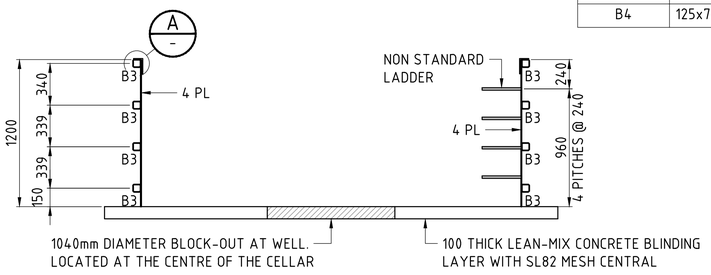


CELLAR PLAN
SCALE 1:25



CELLAR COVER PLAN
SCALE 1:25
GRATING SPAN DIRECTION

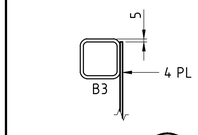
MEMBER SCHEDULE	
MARK	SIZE
B1	75x8 EA
B2	65x4 SHS
B3	65x4 SHS
B4	125x75x8 UA



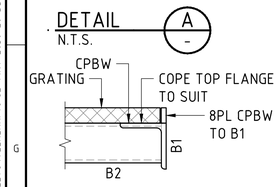
1040mm DIAMETER BLOCK-OUT AT WELL. LOCATED AT THE CENTRE OF THE CELLAR

100 THICK LEAN-MIX CONCRETE BLINDING LAYER WITH SL82 MESH CENTRAL

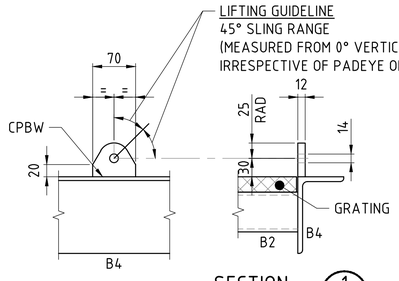
SECTION 1
SCALE 1:25



DETAIL A
N.T.S.

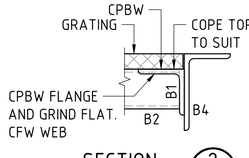


DETAIL B
N.T.S.

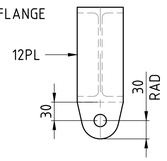


LIFTING POINT
N.T.S.

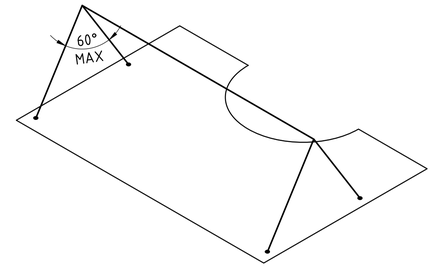
SECTION 1
N.T.S.



SECTION 2
N.T.S.

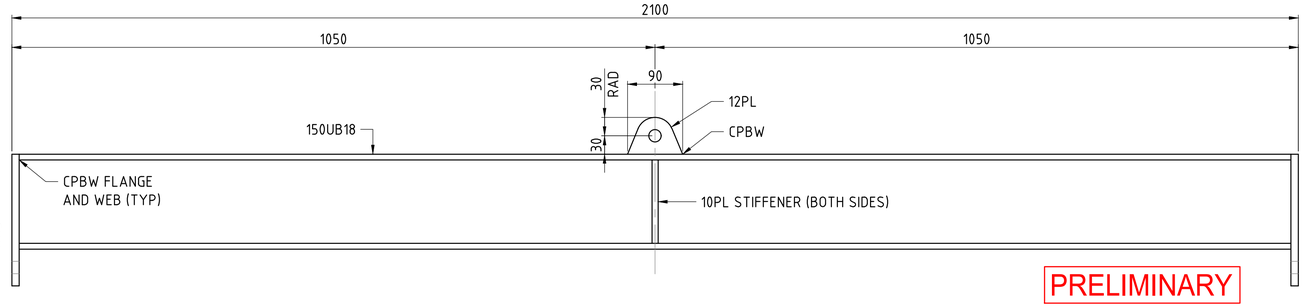


END ELEVATION LIFTING BEAM
N.T.S.



LIFTING DIAGRAM

LIFTING NOTES
- DESIGN ASSUMES A DYNAMIC IMPACT FACTOR Kd=1.2 AND FACTOR OF SAFETY (FOS) OF 3.0
- SLING ANGLE MUST BE 60 DEGREES MAXIMUM AT THE HOOK.
- LIFTING BEAM SHALL HAVE WWL200kg STAMPED INTO FLANGE



LIFTING BEAM
N.T.S.

GENERAL NOTES
- THE FOOTINGS HAVE BEEN DESIGNED FOR A SAFE BEARING PRESSURE OF 50 kPa.
- THE FOOTING DEPTH SHALL BE CHECKED BY THE SUPERINTENDENT AFTER EXCAVATION, AND THE DEPTH MAY BE VARIED FROM THAT DETAILED ON THE DRAWINGS DEPENDING ON THE EXACT LOCATION OF THE LOAD BEARING STRATA.
- FILL UNDER BUILDING FLOOR SLABS: GRANULAR MATERIAL COMPACTED TO A DRY DENSITY RATIO NOT LESS THAN 98% (STANDARD COMPACTION).
- FILL UNDER PAVEMENT SLABS: GRANULAR MATERIAL TO A MIN. THICKNESS OF 50mm UNO ALL FILL AND TOP 150mm OF SUBGRADE COMPACTED TO A DRY DENSITY RATIO NOT LESS THAN 98% (STANDARD COMPACTION).
- DESIGN LIVE LOADS HAVE BEEN CALCULATED IN ACCORDANCE WITH A.S. 1170 PART 1 & A.S. 1657.
- DESIGN LIVE LOAD SURCHARGE ON SOIL 5 kPa
- THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE ARCHITECTS AND OTHER ENGINEERS DRAWINGS, AND ALL DIMENSIONS AND DETAILS SHALL BE CHECKED WITH THEIR DRAWINGS AND ON SITE.
- TRADE NAMES HAVE BEEN USED ONLY TO ESTABLISH A BASIC REQUIREMENT AND ANY SATISFACTORY EQUIVALENT MAY BE SUBMITTED FOR REVIEW.
- ALL DIMENSIONS OF EXISTING STRUCTURES SHALL BE CHECKED PRIOR TO FABRICATION AND ERECTION.
- DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE STRUCTURE AND EXCAVATIONS IN A STABLE CONDITION, AND ENSURING NO PART SHALL BE OVERSTRESSED UNDER CONSTRUCTION ACTIVITY.

CONCRETE NOTES
- CONCRETE, CONCRETE WORK, AND STEEL REINFORCEMENT SHALL CONFORM TO A.S. 3600, CONCRETE STRUCTURES.
- THE PROPORTION OF FLY ASH SHALL BE 25% BY WEIGHT OF THE TOTAL COMBINED WEIGHT OF FLY ASH AND CEMENT.
- MAXIMUM SLUMP OF CONCRETE = 80±15mm UNO.
- MAXIMUM NOMINAL SIZE OF AGGREGATE = 20mm.
- PLACE 2.N12 REINFORCING BARS X 1000 LONG IN TOP REINF. LAYER DIAGONALLY ACROSS ALL RE-ENTRANT CORNERS AND OPENINGS.
- REINFORCEMENT SHOWN ON DRAWINGS IS REPRESENTED DIAGRAMMATICALLY AND NOT NECESSARILY IN TRUE PROJECTION.
- ALL REINFORCEMENT HOOKS AND COGS SHALL BE STANDARD UNLESS SHOWN OR NOTED OTHERWISE ON THE DRAWINGS.
- ALL REINFORCING STEEL SHALL BE ACRS (AUSTRALIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEEL) CERTIFIED.

STEELWORK NOTES
- ALL STEELWORK SHALL CONFORM TO A.S. 4100, STEEL STRUCTURES.
- STEEL GRADES: 300 UNO. SHS - 350. PLATES - 250.
- FABRICATION SHALL BE CARRIED OUT BY WELDERS WHO ARE QUALIFIED IN ACCORDANCE WITH THE REQUIREMENTS OF A.S./NZS 1554.1.
- THE BOLTING PROCEDURE ADOPTED UNLESS NOTED OTHERWISE IS 8.8/S IN ACCORDANCE WITH THE AUSTRALIAN INSTITUTE OF STEEL CONSTRUCTION - MANUAL OF STANDARDISED STRUCTURAL CONNECTIONS.
- ALL BOLTS OR FASTENERS SHALL BE MARKED WITH THE MANUFACTURERS BRAND, AND COMPLY WITH THE FOLLOWING :
  - BOLTS DENOTED 4.6/S ARE COMMERCIAL BOLTS OF STRENGTH GRADE 4.6 TO A.S. 1111 - SNUG TIGHT.
  - BOLTS DENOTED 8.8/S, 8.8/TF, OR 8.8/TB ARE HIGH STRENGTH STRUCTURAL BOLTS OF STRENGTH GRADE 8.8 TO A.S. 1252.
- BOLTS SHALL BE M20 8.8/S UNO.
- GRADE 8.8 BOLTS SHALL NOT BE WELDED, INCLUDING TACK WELDS FOR CAGING.
- PLATES IN STRUCTURAL STEEL CONNECTIONS SHALL BE 10mm THICK UNO
- MINIMUM CONNECTIONS SHALL BE 10Pl. 2/M20 8.8/S BOLTS UNO.
- ALL BOLTS (INCLUDING MASONRY ANCHORS) SHALL BE HOT DIPPED GALVANISED.
- ALL WELDS SHALL BE 6 CFW UNLESS NOTED OTHERWISE.
- ALL WELDS SHALL BE CATEGORY S.P. AS SPECIFIED IN A.S. 1554, UNO.
- ELECTRODES SHALL BE B-G49X OR B-T49X UNO.
- ALL RHS AND CHS MEMBERS SHALL HAVE 5 PL. SEAL PLATES AT ENDS UNO.
- PROTECTIVE COATING SHALL BE EITHER
  - ALL STEELWORK SSHALL BE BLAST CLEANED TO CLASS 2½ AS SPECIFIED IN AS 1627.4 WITH SURFACE ROUGHNESS OF 75 MICRONS
  - 2 COATS OF IMMERSION GRADE EPOXY TO DRY FILM THICKNESS 400 MICRONS (EACH COAT).

  OR
  - HOT DIP GALVANISED TO AS4680
- SHOP DRAWINGS SHALL BE SUBMITTED BEFORE COMMENCEMENT OF FABRICATION. GRADE OF SANDBLASTING, PAINT BRAND, TYPE, FILM THICKNESS AND WELD CATEGORY SHALL BE NOTED ON THESE DRAWINGS.
- ALL MEMBER CENTROIDS AT CONNECTIONS SHALL INTERSECT AT A POINT UNO GAUGE LINES MAY BE USED IN LIEU OF CENTROIDS FOR BOLTED END CONNECTIONS OF ANGLES.
- ALL STRUCTURAL STEEL SHALL BE ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEEL) CERTIFIED.

PRELIMINARY

NOT FOR CONSTRUCTION

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
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-	-									
-	-									

APPROVALS

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DRAFT. SUPER.	-	- . - . -
PROJECT APPROVAL	-	- . - . -

TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DRILLING CELLAR DETAILS

PROJECT NO.

DRAWING NO. NT-2050-20-DD-0027

REVISION A

MOD NO.

SCALE 1:25 @ A1

CADFILE NT-2050-20-DD-0027.dwg

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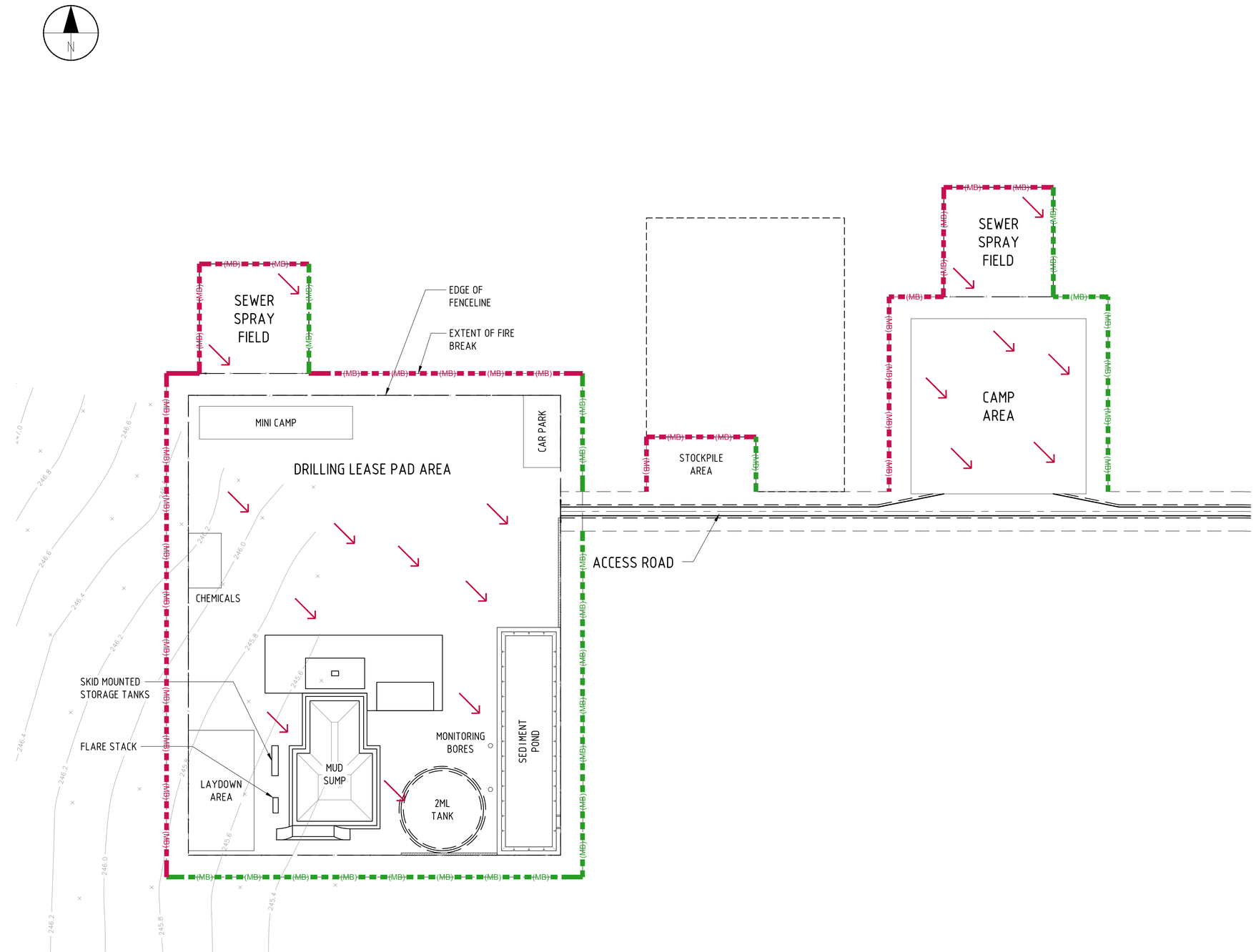
Thu, 18 Apr 2019 - 1:51pm



LEGEND

EXISTING

CONTOURS

PROPOSED

TOPSOIL BERM (DIRTY WATER)

TOPSOIL BERM (CLEAN WATER)

FLOW DIRETION

U-SHAPED SEDIMENT TRAP

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. TOPSOIL BERM DIMENSIONS IN ACCORDANCE WITH IECA FIGURE 1 ON STANDARD DRAWING MB-01.
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.

EROSION AND SEDIMENT CONTROL PLAN

PRELIMINARY

NOT FOR CONSTRUCTION

SCALE (m) 0 10 20 30 40 50 1:1000 (A1)

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
-	-	A	21.03.2019	PRELIMINARY ISSUE	CD	-	-	-	-	-

APPROVALS

PREPARED FOR ORIGIN BY:

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PROJECT 60480548 BEETALOO EXPLORATION

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TITLE
BEETALOO EXPLORATION DRILL CAMPAIGN
VELKERRI 76 S2-1
DRILL PAD, ACCOMODATION CAMP AND WATER TANK
EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	DRAWING NO.	REVISION
MOD NO.	NT-2050-15-MP-0022	A
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GENERAL

1. ALL WORK EXCLUDING WORK ASSOCIATED WITH LINER SUPPLY AND INSTALLATION SHALL BE COMPLETED IN ACCORDANCE WITH 'ORIGIN' TECHNICAL SPECIFICATION Q-4522-20-TS-0001: POND EARTHWORKS AND WITH PROJECT SPECIFIC DRAWINGS, PROJECT STANDARD DRAWINGS AND OTHER CONTRACT DOCUMENTATION AS APPLICABLE.
2. ALL WORK ASSOCIATED WITH LINER SUPPLY AND INSTALLATION SHALL BE COMPLETED IN ACCORDANCE WITH 'ORIGIN' TECHNICAL SPECIFICATION Q-4522-20-TS-0002 AND Q-4522-20-TS-0003.
3. THE CONTRACTOR SHALL TAKE OUT ALL APPROPRIATE LOCAL GOVERNMENT AND OTHER AUTHORITY PERMITS PRIOR TO COMMENCING WORK.
4. THE CONTRACTOR SHALL ASCERTAIN THE EXACT LOCATION OF ALL EXISTING SERVICES ON AND ADJACENT TO THE SITE OF THE WORK PRIOR TO COMMENCING THE WORK AND SHALL BE RESPONSIBLE FOR THE COST OF RECTIFICATION OF ANY DAMAGES TO THE EXISTING SERVICES OCCASIONED DURING THE WORK. LOCATIONS OF EXISTING SERVICES IF AND WHERE SHOWN ON THE DRAWINGS ARE APPROXIMATE ONLY. DRAWINGS MAY NOT INDICATE ALL EXISTING SERVICES.
5. THE CONTRACTOR SHALL PROGRAMME WORK AND INCORPORATE APPROPRIATE MEASURES TO MINIMISE DISTURBANCE TO OTHERS BY DUST, NOISE, FLOODING, SERVICES DISCONNECTIONS AND THE LIKE.
6. NOTWITHSTANDING THE EXTENT OF FILLING AND EXCAVATION WORK SHOWN ON THE DRAWINGS, NOTED IN THE SPECIFICATION OR NOTED IN OTHER CONTRACT DOCUMENTS, THE EXTENT OF THE WORK SHALL BE CONFIRMED WITH THE SUPERINTENDENT PRIOR TO COMMENCEMENT OF THE WORK.
7. THE CONTRACTOR SHALL MAINTAIN THE SITE FREE OF RUBBISH AND EXCESS MATERIALS AND SHALL STACK AND/OR STOCKPILE CONSTRUCTION MATERIALS IN A SUITABLE MANNER AS APPLICABLE FOR EACH OF THE INDIVIDUAL MATERIALS.

ENVIRONMENTAL AND SEDIMENT CONTROL NOTES

1. THE CONTRACTOR SHALL AVOID DISTURBANCE OF ENVIRONMENTALLY SENSITIVE AREAS. UNLESS NOTED OTHERWISE IN THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL INSTALL TEMPORARY FENCING (STAR PICKETS WITH 2 STRANDS OF PLAIN WIRE AND FLAGGING TO SUIT) ALONG THE BOUNDS OF ENVIRONMENTAL BUFFERS. THERE SHALL BE NO ENTRY INTO ENVIRONMENTAL BUFFER AREAS (BEYOND THE FENCED BOUNDS) UNLESS OTHERWISE APPROVED FOR BY THE SUPERINTENDENT.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, INSTALLATION AND MAINTENANCE OF ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES/MEASURES INCLUDING CUT OFF DRAINS AND BUNDS, REQUIRED DURING THE COURSE OF THE WORK AND UP UNTIL THE WORK IS TAKEN OFF MAINTENANCE.
3. A COPY OF THE PROPOSED EROSION AND SEDIMENT CONTROL PLAN, PREPARED IN ACCORDANCE WITH OTHER CONTRACT DOCUMENTATION, SHALL BE SUBMITTED TO THE SUPERINTENDENT PRIOR TO THE COMMENCEMENT OF WORK ON THE SITE.
4. THE CONTRACTOR SHALL INSTALL ALL SEDIMENT CONTROL DEVICES/MEASURES PRIOR TO COMMENCEMENT OF THE WORK PROPER. DURING THE COURSE OF THE WORK, THE CONTRACTOR SHALL INSTALL FURTHER SEDIMENT CONTROL DEVICES/MEASURES INCLUDING CUT OFF DRAINS AND BUNDS, DEEMED NECESSARY TO CONTROL SEDIMENT RUNOFF.
5. THE CONTRACTOR SHALL INSPECT ALL EROSION AND SEDIMENT CONTROL DEVICES/MEASURES FOR DAMAGE FOLLOWING EACH RAINFALL EVENT. DAMAGED DEVICES/MEASURES SHALL BE REMOVED AND REPLACED, SEDIMENT SHALL BE REMOVED AND ALL ERODED AREAS MADE GOOD.
6. ALL EROSION AND SEDIMENT CONTROL DEVICES/MEASURES SHALL BE CLEANED OUT PRIOR TO SEDIMENT VOLUME REACHING 50% OF THE CONTROL DEVICE/MEASURE CAPACITY.

POND EARTHWORKS

1. EARTHWORKS SHALL GENERALLY BE COMPLETED IN ACCORDANCE WITH 'ORIGIN' TECHNICAL SPECIFICATION Q-4522-20-TS-0001: POND EARTHWORKS AND WITH PROJECT SPECIFIC DRAWINGS, PROJECT STANDARD DRAWINGS AND OTHER CONTRACT DOCUMENTATION AS APPLICABLE.
2. TOPSOIL SHALL BE STRIPPED TO A DEPTH OF 150mm ACROSS THE EXTENTS OF THE WORK AND STOCKPILED FOR REUSE WHERE DIRECTED BY THE SUPERINTENDENT.
3. COMPACTION TESTING SHALL BE COMPLETED IN ACCORDANCE WITH THE SPECIFICATION.
4. THE PREPARED SURFACE/SURFACES TO BE LINED SHALL BE MAINTAINED (MOISTURE CONTENT AND LEVEL OF COMPACTION) UNTIL IMMEDIATELY PRIOR TO LINER INSTALLATION. WHERE INSTALLATION OF THE LINER IS DELAYED DUE TO ANY CAUSE WHATSOEVER AND/OR THE PREPARED SURFACE/SURFACES ARE SUBJECT TO ELEMENTS OF THE WEATHER WHICH RESULTS IN CHANGES IN THE MOISTURE CONTENT, COMPACTION AND INTEGRITY OF THE SURFACE/SURFACES, THE SURFACE/SURFACES SHALL BE REWORKED IMMEDIATELY PRIOR TO THE INSTALLATION OF THE LINER TO ACHIEVE THE SPECIFIED REQUIREMENTS FOR MOISTURE CONTENT, LEVEL OF COMPACTION AND SURFACE INTEGRITY.

TOPSOIL REINSTATEMENT AND AMENDMENT

1. TOPSOIL SHALL BE PLACED TO ALL DISTURBED AREAS EXCLUDING AREAS OCCUPIED BY PAVEMENTS, SPILLWAYS AND CAPPING MATERIAL OR AS DIRECTED BY THE SUPERINTENDENT.
2. FINISHED EARTHWORKS SURFACES TO RECEIVE TOPSOIL SHALL BE PREPARED IN ACCORDANCE WITH REQUIREMENTS STATED HEREIN.
   - 2.1. FINISHED EARTHWORKS SURFACES (SUBGRADE) TO BE TOPSOILED SHALL BE RIPPED/TYNED TO DEPTHS OF 150mm.
   - 2.2. GYPSUM SHALL BE SPREAD AT THE RATE OF 50 t/Ha (5 kg/m2) AND SHALL BE THOROUGHLY WORKED AND MIXED INTO THE LOOSENED MATERIAL/MATERIALS VIA TWO (2) PASSES OF A TWO (2) WAY DISC PLOW MINIMUM OR VIA ROTARY HOE.
   - 2.3. FOLLOWING MIXING, THE MATERIAL SHALL BE RESHAPED TO THE PROFILES REQUIRED OF THE FINISHED EARTHWORKS AND SHALL BE COMPACTED TO 95% MINIMUM OF THE MAXIMUM DRY DENSITY FOR THE MATERIAL – STANDARD COMPACTIVE EFFORT.
3. TOPSOIL WORK AND ASSOCIATED SUBGRADE AMENDMENT SHALL BE COMPLETED IMMEDIATELY FOLLOWING THE TRIMMING OF EARTHWORKS.
4. TOPSOIL SHALL BE PLACED TO A DEPTH OF 150mm.
5. TOPSOIL SHALL BE AMENDED BY THE INCLUSION OF 10 t/ha FEEDLOT MANURE, 100 kg/ha UREA AND 2 t/ha GYPSUM OR AS DIRECTED BY THE SUPERINTENDENT BASED ON SOIL ASSESSMENT.
6. GRASS SEED OF THE SPECIES AND MIX COMPOSITION AS DETERMINED BY ORIGIN ENERGY SHALL BE SOWN INTO THE TOPSOIL.

BITUMINOUS GEOMEMBRANE LINER PRODUCT DATA

1. DESCRIPTION – BGM IS AN SBS ELASTOMERIC MODIFIED BITUMINOUS GEOMEMBRANE.
2. USE – EXTREME LEVEL OF MECHANICAL RESISTANCE, FOR USE AS ENVIRONMENTAL PROTECTION AND GROUNDWORKS WATERPROOFING (AGGRESSIVE MATERIALS, REINFORCED PRECAUTIONS)

   -RAILWAYS, DIRECTLY UNDER BALLAST
   -DAMS

3. PRODUCT USE MUST BE VALIDATED BY THE MANUFACTURER.
4. APPLICATION METHOD – TORCHED.
5. STORAGE – ROLLS MUST NOT BE STORED DIRECTLY ON THE GROUND. THEY MUST BE LAID SUPPORTED ON CONCRETE BLOCKS, TRESTLES OR TIMBER BEAMS, MIN 35cm HEIGHT, PLACED UNDER MANDREL ENDS.

COMPOSITION

GLASS MAT	50 g/m^2
NON-WOVEN GEOTEXTILE	400 g/m^2
ELASTOMERIC SBS	5400 g/m^2
SAND	200 g/m^2
POLYESTER ANTIROOT FILM	15 g/m^2

CHARACTERISTICS

					TOLERANCE	
		STANDARD	UNITS	VALUES	MIN	MAX
	LENGTH		m	54	≥	
DIMENSIONS	WIDTH	-	m	5.01	≥	
THICKNESS (ON FINISHED PRODUCT)		ASTM D 5199	mm	5.60	5.32	6.16
SURFACE MASS		ASTM D 3776	kg/m^2	6.40	6.10	7
	LONGITUDINAL			1225	919	
RESISTANCE TO TEARING	CROSS DIRECTION	ASTM D 4073	N	1025	769	
TENSILE PROPERTIES : MAXIMUM TENSILE STRENGTH	LONGITUDINAL			39	29	
	CROSS DIRECTION		kN/m	31	23	
TENSILE PROPERTIES : ELONGATION	LONGITUDINAL	ASTM D 7275		60	48	
	CROSS DIRECTION		%	60	48	
TENSILE PROPERTIES : MAXIMUM TENSILE STRENGTH	LONGITUDINAL			32	24	
	CROSS DIRECTION		kN/m	28	21	
TENSILE PROPERTIES : ELONGATION	LONGITUDINAL	ASTM D 4595		90	60	
	CROSS DIRECTION		%	90	60	
STATIC PUNCTURE		ASTM D 4833	N	650	585	
FLEXIBILITY AT LOW TEMPERATURE	SURFACE			-20		
	UNDER SURFACE	ASTM D 5147	°C	-20		
WATER PERMEABILITY (LIQUID TIGHTNESS)		ASTM E 96	m/s	6.10^{-14}		
GAS PERMEABILITY (GAS TIGHTNESS)		ASTM D 1434-82	$m^3/(m^2.j.atm)$	$< 2,3.10^{-14}$		

BITUMINOUS GEOMEMBRANE LINER INSTALLATION

1. BITUMINOUS GEOMEMBRANE INSTALLATION SHALL BE PERFORMED IN ACCORDANCE TO THE MANUFACTURER'S RECOMMENDATION. IF RECOMMENDATIONS ARE IN CONFLICT WITH DESIGN, THE CONTRACTOR TO NOTIFY THE PRINCIPAL IN WRITING FOR CLARIFICATION.
2. THE CONTRACTOR SHALL MONITOR AND ACCEPT RESPONSIBILITY FOR THE QUALITY OF MATERIALS PLACED INTO THE WORK. THE PRINCIPAL WILL REJECT MATERIALS INCORPORATED INTO WORK THAT FAIL TO COMPLY WITH SPECIFIED REQUIREMENTS. THE CONTRACTOR SHALL REMOVE REJECTED MATERIALS FROM THE WORK AND REPLACE WITH MATERIALS OF THE SPECIFIED QUALITY.
3. MEASUREMENT SHALL BE MADE OF THE TOTAL SURFACE AREA IN SQUARE METRES COVERED BY BITUMINOUS GEOMEMBRANE. FINAL QUANTITIES WILL BE BASED ON AS-BUILT CONDITIONS. CONTRACTOR SHOULD MAKE ALLOWANCE FOR BITUMINOUS GEOMEMBRANE IN ANCHOR TRENCHES, DRAINAGE TRENCHES, AND OVERLAPS; HOWEVER, NO ALLOWANCE WILL BE MADE FOR WASTE OR MATERIALS USED FOR THE CONVENIENCE OF THE CONTRACTOR.
4. ROLLS SHALL NOT BE DRAGGED, LIFTED BY ONE END, OR DROPPED. A MANDREL OF SUFFICIENT STRENGTH TO SUPPORT THE FULL WEIGHT OF A ROLL WITHOUT SIGNIFICANT BENDING, SHALL BE USED FOR ALL HANDLING ACTIVITIES. THE DIAMETER OF THE MANDREL SHALL BE SMALL ENOUGH TO BE EASILY INSERTED THROUGH THE CORE OF THE ROLL. CHAINS SHALL BE USED TO LINK THE ENDS OF THE MANDREL TO THE ENDS OF A SPREADER BAR. THE SPREADER BAR SHALL BE WIDE ENOUGH TO PREVENT THE CHAINS FROM RUBBING AGAINST THE ENDS OF THE ROLL. ALTERNATIVELY, A STINGER BAR PROTRUDING FROM THE END OF A FORKLIFT OR OTHER EQUIPMENT MAY BE USED. THE STINGER BAR SHALL BE AT LEAST THREE-FOURTHS THE LENGTH OF THE CORE AND ALSO MUST BE CAPABLE OF SUPPORTING THE FULL WEIGHT OF THE ROLL WITHOUT SIGNIFICANT BENDING.
5. THE LINER SHALL BE PLACED IN A RELAXED STATE SUCH THAT THE MATERIAL CAN RESPOND TO THERMAL CHANGES WITHOUT EXCESSIVE BUCKLING, WRINKLING OR TENSIONING.
6. ONLY THE QUANTITY OF BITUMINOUS GEOMEMBRANE THAT WILL BE ANCHORED AND SEAMED TOGETHER IN ONE DAY SHALL BE DEPLOYED.

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Name: B-R Tc

BGM INSTALLATION (CONTINUED)

7. THE PROCEDURES AND EQUIPMENT USED SHALL NOT ELONGATE, WRINKLE, SCRATCH, OR OTHERWISE DAMAGE THE BITUMINOUS GEOMEMBRANE, OTHER GEOSYNTHETIC LAYERS, OR THE UNDERLYING SUBGRADE. BITUMINOUS GEOMEMBRANE DAMAGED DURING INSTALLATION SHALL BE REPLACED OR REPAIRED, AT THE CONTRACTORS EXPENSE AND AT THE PRINCIPAL'S DISCRETION. ADEQUATE BALLAST (I.E., SAND BAGS OR OTHER) SHALL BE PLACED ON THE BITUMINOUS GEOMEMBRANE, WITHOUT DAMAGING THE BITUMINOUS GEOMEMBRANE, TO PREVENT UPLIFT BY WIND. NO EQUIPMENT SHALL BE OPERATED ON THE TOP SURFACE OF THE BITUMINOUS GEOMEMBRANE WITHOUT PERMISSION FROM THE PRINCIPAL. THE METHODS USED TO DEPLOY, BACKFILL, AND BALLAST (TEMPORARY OR PERMANENT) OVER THE BITUMINOUS GEOMEMBRANE SHALL MINIMIZE WRINKLES AND TENSILE STRESSES IN THE BITUMINOUS GEOMEMBRANE. THE BITUMINOUS GEOMEMBRANE SHALL HAVE ADEQUATE SLACK TO PREVENT THE CREATION OF TENSILE STRESS.
8. IN GENERAL, SEAMS SHALL BE ORIENTATED PARALLEL TO THE LINE OF MAXIMUM SLOPE. NO HORIZONTAL WELDS ALONG SLOPES OR WITHIN 1 METRE OF SLOPE TRANSITIONS UNLESS APPROVED BY THE PRINCIPAL. IN CORNERS AND ODD SHAPED GEOMETRIC LOCATIONS, THE TOTAL LENGTH OF THE FIELD SEAM SHALL BE MINIMIZED. SEAMS SHALL NOT BE LOCATED AT LOW POINTS IN THE SUBGRADE UNLESS GEOMETRY REQUIRES SEAMING AT SUCH LOCATIONS AS APPROVED BY THE PRINCIPAL.
9. QUADRUPLE POINT LOCATIONS DUE TO ALIGNED STRIP ENDS ARE NOT ALLOWED. TRIPLE POINT LOCATIONS WILL BE COVERED WITH AN ADDITIONAL BITUMINOUS GEOMEMBRANE.
10. THE BITUMINOUS GEOMEMBRANE SHALL NOT BE ALLOWED TO "BRIDGE OVER" VOIDS OR LOW AREAS IN THE SUBGRADE. THE BITUMINOUS GEOMEMBRANE SHALL REST IN INTIMATE CONTACT WITH THE SUBGRADE.
11. THE SUBGRADE UNDER THE BITUMINOUS GEOMEMBRANE SHALL CONFORM THE TECHNICAL SPECIFICATIONS.
12. TEMPORARY BALLASTING SUCH AS SAND BAGS OR TYRES SHALL BE PLACED ON THE LINER TO PREVENT WIND DAMAGE OR BRIDGING DURING AND AFTER INSTALLATION. IT SHOULD BE NOTED THAT THIS TEMPORARY BALLASTING SHALL BE OF A SUITABLE CONSTRUCTION TO PREVENT AGAINST DAMAGE OF THE LINER. THE CONTRACTOR SHALL BE REQUIRED TO ENSURE THAT THE SPACING OF THESE SAND BAGS/TYRES ARE APPROPRIATELY DESIGNED (THIS COULD INCLUDE TYING THE SAND BAGS/TYRES TOGETHER IN A HORIZONTAL AND VERTICAL DIRECTION) TO PREVENT AGAINST UPLIFT AND ANY POTENTIAL DAMAGE OF THE LINER. ANY LINER MATERIAL THAT HAS BEEN DAMAGED AS THE RESULT OF WIND OR BRIDGING, IN THE OPINION OF THE PRINCIPAL, SHALL BE REMOVED AND REPLACED AT THE CONTRACTOR'S EXPENSE.
13. ALL PERSONNEL WORKING ON THE LINER SURFACE SHALL WEAR SOFT-SOLED SHOES, AND SHALL NOT ENGAGE IN ANY ACTIVITY WHICH MAY DAMAGE THE LINER.
14. BITUMINOUS GEOMEMBRANE SHALL NOT BE DEPLOYED OR FIELD-SEAMED IN THE PRESENCE OF SIGNIFICANT RAIN, IN AREAS OF PONDED WATER, OR IN THE PRESENCE OF WIND IN EXCESS OF 55 KM/HOUR. UNLESS AUTHORIZED BY THE PRINCIPAL, NO PLACEMENT OR SEAMING SHALL BE ATTEMPTED AT AMBIENT TEMPERATURES BELOW -25 DEGREES C (-13 DEGREES F) OR ABOVE 40 DEGREES C (104 DEGREES F). AMBIENT TEMPERATURE SHALL BE MEASURED AT A HEIGHT NO GREATER THAN 150 MM 6 INCHES ABOVE THE GROUND OR BITUMINOUS GEOMEMBRANE SURFACE. IN MARGINAL CONDITIONS, SEAMING SHALL CEASE UNLESS DESTRUCTIVE FIELD SEAM TESTS, CONDUCTED BY THE QC LABORATORY, CONFIRM THAT SEAM PROPERTIES MEET THE DESIGN REQUIREMENTS.
15. THE CONTRACTOR SHALL NOMINATE A MASTER WELDING SUPERVISOR BEFORE COMMENCING WORK AND SHALL DEMONSTRATE THAT THE MASTER WELDING SUPERVISOR HAS A PROVEN BACKGROUND IN INSTALLATION OF SIMILAR SYSTEMS AND MATERIALS SIMILAR TO THOSE SPECIFIED. ALL PERSONNEL EMPLOYED IN WELDING SHALL BE COMPETENT AND EXPERIENCED IN THE USE OF THE EQUIPMENT. THE CONTRACTOR SHALL ULTIMATELY BE RESPONSIBLE FOR ENSURING THE QUALITY ASSURANCE PROGRAMME IS FOLLOWED.
16. THE CONTRACTOR SHALL BE RESPONSIBLE AND SHALL PROVIDE SUFFICIENT RESOURCES FOR FIELD HANDLING, DEPLOYING, SEAMING, TEMPORARILY RESTRAINING (AGAINST WIND), AND OTHER ASPECTS OF THE DEPLOYMENT AND INSTALLATION OF THE BITUMINOUS GEOMEMBRANE. NO SEAMING SHALL BE PERFORMED UNLESS A MASTER WELDING SUPERVISOR IS PRESENT ON-SITE.
17. EVERY WORKER PERFORMING WELDING OF THE BITUMINOUS GEOMEMBRANE WILL NEED TO DEMONSTRATE A CONDABRI VERIFICATION OF COMPETENCE (VOC) PRIOR TO UNDERTAKING WORKS ON THE FIELD. THE CONDABRI VOC CERTIFICATION AND TESTING WILL BE ADMINISTERED BY THE LEVEL 1 CQC. TRIAL WELD TEST SAMPLES SHALL SUBMITTED TO A THIRD PARTY INDEPENDENT LABORATORY FOR DESTRUCTIVE TESTING.
18. DESTRUCTIVE TESTING SHALL BE COMPLETED IN ACCORDANCE TO ASTM D 7056 AND ASTM D 3019. NON-DESTRUCTIVE AIR LANCE TESTING SHALL BE COMPLETED IN ACCORDANCE TO ASTM D 4437.
19. CONNECTIONS TO ADJOINING STRUCTURES SHALL BE MADE IN ACCORDANCE WITH THE DETAILS SHOWN ON THE CONSTRUCTION DRAWINGS. CONNECTIONS SHALL BE AT LEAST EQUIVALENT IN STRENGTH TO THE NORMAL LAP JOINTS AND THE SECURITY OF CONTAINMENT SHALL NOT BE DIMINISHED. LOCAL STRESSES IN THE LINER AT CONNECTIONS SHALL BE MINIMISED.
20. ANCHOR TRENCHES SHALL BE EXCAVATED IN ACCORDANCE WITH THE DETAILS ON THE CONSTRUCTION DRAWINGS. THE ANCHOR TRENCHES SHALL BE KEPT WELL DRAINED TO AVOID SOFTENING DURING RAIN PERIODS AND MAINTAINED SO AS TO NOT DRY, DESICCATE AND CRACK.
21. IN ACCORDANCE WITH Q-4522-20-TS-0001, THE CONTRACTOR SHALL SEEK APPROVAL FROM THE PRINCIPAL PRIOR TO THE COMMENCEMENT OF ANCHOR TRENCH BACKFILLING. ONCE THE ANCHOR TRENCH IS READY TO BE BACKFILLED, IT SHALL BE BACKFILLED IN EARLY MORNING WHEN THE LINER IS AT MAXIMUM CONTRACTION. BACKFILLING SHALL BE CARRIED OUT IN A PLANNED, LOGICAL SEQUENCE TO AVOID OVERSTRESSING OF THE LINER AND MINIMIZE EXPOSURE WET WEATHER DAMAGE.
22. ANCHOR TRENCH SHALL BE BACKFILLED WITH FLOWABLE CONCRETE STABILIZED SAND (5% CEMENTICIOUS) AND MIX DESIGN SHALL BE SUBMITTED FOR APPROVAL.
23. A LEVEL 1 CQC IS REQUIRED DURING ALL LINER INSTALLATION, LINER REPAIRS, AND QUALITY/COMPLIANCE TESTING. MATERIAL TESTING SHALL BE CARRIED OUT AT RANDOMLY CHOSEN LOCATIONS, IN ACCORDANCE WITH SPECIFIED TESTING REQUIREMENTS AND FREQUENCIES, AND/OR AT LOCATIONS SELECTED BY THE PRINCIPAL.
24. ALL AREAS FOUND TO BE DEFECTIVE SHALL BE REPAIRED AT THE EXPENSE OF THE CONTRACTOR. THE PRINCIPAL SHALL BE NOTIFIED OF DEFECTIVE AREAS PRIOR TO THE REPAIR TAKING PLACE.
25. THE CONTRACTOR SHALL ENSURE A PLAN IS MARKED UP SHOWING THE LOCATIONS OF REPAIRS MADE AND THE TYPE OF REPAIR MADE. THE CONTRACTOR SHALL SUBMIT A MARKED UP DRAWING SHOWING THE LOCATIONS OF THE REPAIRS TO THE PRINCIPAL FOR REVIEW AND APPROVAL.
26. THE ENTIRE SURFACE OF EVERY SHEET OF LINER MATERIAL SHALL BE INSPECTED BY THE CONTRACTOR DURING PLACING TO IDENTIFY ANY TEARS, ABRASIONS, INDENTATIONS, CRACKS, THIN AREAS, OR OTHER DEFECTS.
27. ANY DEFECTS SUCH AS HOLES, TEARS, BLISTERS, LAMINATION, UNDISPERSED RAW MATERIALS OR VISIBLE NON-UNIFORMITY OR CONTAMINATION BY FOREIGN MATTER WHICH IN THE OPINION OF THE PRINCIPAL IS DETRIMENTAL TO THE LONG SERVICE LIFE REQUIRED OF THE LINER, SHALL BE GROUNDS FOR REJECTION OF THE LINER MATERIAL.
28. WHERE ADDITIONAL FAULTS ARE FOUND, THE PRINCIPAL RESERVES THE RIGHT TO REJECT THE ROLL. THE CONTRACTOR SHALL REPLACE ANY REJECTED ROLLS AND REPAIR ANY DEFECTS TO THE PRINCIPAL'S SATISFACTION AT THE CONTRACTOR'S EXPENSE.

BGM INSTALLATION (CONTINUED)

29. FOLLOWING INSTALLATION OF THE LINER, A DETAILED VISUAL INSPECTION OF THE PRIMARY LINER SURFACE SHALL BE PERFORMED BY THE PRINCIPAL (ACCOMPANIED BY THE CONTRACTOR), TO IDENTIFY ANY DEFECTS IN THE LINER SURFACE CAUSED DURING INSTALLATION. PRIOR TO PERFORMING THE SURVEY, A SURVEY GRID SHALL BE DETERMINED TO ENSURE THAT THE VISUAL SURVEY IS PERFORMED ACROSS 100-PERCENT OF THE LINER SURFACE.
30. ALL LINER WELD SEAMS SHALL BE SUBJECTED TO BOTH NON-DESTRUCTIVE AND DESTRUCTIVE TESTING. DESTRUCTIVE FIELD TESTING WILL BE AT THE INTERVALS LISTED AND ANY LOCATION CHOSEN BY THE PRINCIPAL. THE REPRESENTATIVE SAMPLES OF FIELD SEAMS SHALL BE TAKEN FOR LABORATORY TESTING BY AN INDEPENDENT, APPROPRIATELY QUALIFIED TESTING LABORATORY. WELD AND MATERIAL STRENGTH REQUIREMENTS TO COMPLY WITH MANUFACTURERS RECOMMENDATIONS.
31. NON-DESTRUCTIVE AND DESTRUCTIVE TESTING SHALL BE OBSERVED BY THE LEVEL 1 CQC/LIS.
32. TRIAL WELDS TESTING SHALL BE CARRIED OUT THE SAME AS DESTRUCTIVE TESTING TRIAL WELDS.
33. TRIAL WELDS TO BE COMPLETED AT BEGINNING OF PROJECT. WELD TO BE CONDUCTED BY MASTER WELDING SUPERVISOR AND SHALL BE SENT TO LABORATORY FOR TESTING.
34. JOINT MUST BE CENTERED IN THE SAMPLE. THE SAMPLE MUST BE AT LEAST 350mm FOR 5 TESTS TO BE CARRIED OUT ON THE SAME SAMPLE. EACH SAMPLE MUST BE CLEARLY IDENTIFIED.
35. NON-DESTRUCTIVE FIELD WELD TESTS SHALL BE CARRIED OUT ON ALL WELDED SEAMS. A FAILED TEST IS ANY LOCATION OF WELDED SEAM THAT HAS LESS THAN 150mm OF CROSS SECTIONAL WIDTH.
36. DESTRUCTIVE TESTS SHALL BE CARRIED OUT AT AN INTERVAL OF EVERY 1000 METRES OF WELDED SEAMS. A PASSING TEST IS EQUAL OR GREATER THAN 90% OF MATERIAL STRENGTH AND FAILURE OF SAMPLE OUTSIDE OF WELD.
37. THE CONTRACTOR SHALL DEPLOY THE BITUMINOUS GEOMEMBRANE PANELS IN GENERAL ACCORDANCE WITH THE LAYOUT DRAWING SPECIFIED. THE LAYOUT DRAWINGS MUST BE APPROVED BY THE PRINCIPAL OR LEVEL 1 CQA PRIOR TO INSTALLATION OF ANY LINER.
38. A BITUMINOUS GEOMEMBRANE FIELD PANEL IS A ROLL OR A PORTION OF ROLL CUT IN THE FIELD. EACH FIELD PANEL SHALL BE GIVEN A UNIQUE IDENTIFICATION CODE (NUMBER OR LETTER-NUMBER). THIS IDENTIFICATION CODE SHALL BE AGREED UPON BY THE LEVEL CQA AND CONTRACTOR.
39. FIELD PANELS SHALL BE INSTALLED IN ACCORDANCE TO THE PRINCIPAL APPROVED WORK METHOD STATEMENT.
40. PANELS SHALL BE SEAMED IN ACCORDANCE WITH THE BITUMINOUS GEOMEMBRANE MANUFACTURER'S RECOMMENDATIONS. IN CORNERS AND ODD-SHAPED GEOMETRIC LOCATIONS, THE NUMBER OF FIELD SEAMS SHALL BE MINIMIZED. SEAMING SHALL EXTEND TO THE OUTSIDE EDGE OF PANELS. THE SEAM AREA SHALL BE FREE OF MOISTURE, DUST, DIRT, AND FOREIGN MATERIAL AT THE TIME OF SEAMING. THE PANELS SHALL OVERLAP A MINIMUM 200mm FOR SEAMING. ENDS AND OVERLAPS MUST BE WELDED ON A HOMOGENEOUS AND CONTINUOUS BASIS, LEAVING A 6mm BITUMEN BEAD ALONG THE SEAM.
41. SEAMS SHALL BE WELDED USING PROPANE TORCHES. THE TORCH-WELDS MUST BE APPROVED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS AND PRINCIPAL.
42. BITUMINOUS GEOMEMBRANE TO BE WELDED TO CONCRETE AT INSTALLATION AREAS BY HEATING THE CONCRETE SURFACE AND THE BGM, THEN ROLLING WITH A SMALL ROLLER AND APPLYING HIGH PRESSURE. CONCRETE SURFACE SHALL BE PREPARED BY APPLYING 300 g/m^2 OF COLD PRIMER (SAMIPRIME KS-P OR APPROVED EQUAL) 24 HOURS PRIOR TO WELDING.
43. ONE QC SAMPLE, 500 MM IN LENGTH, FOR THE ENTIRE WIDTH OF A ROLL, SHALL BE OBTAINED FOR EVERY 9,000 SQUARE METERS 100,000 SQUARE FEET OF MATERIAL DELIVERED TO THE SITE. SAMPLES SHALL NOT BE OBTAINED FROM THE FIRST METRE OF THE ROLL. THE SAMPLES SHALL BE IDENTIFIED BY MANUFACTURER'S NAME, PRODUCT IDENTIFICATION, LOT AND ROLL/PANEL NUMBER. THE DATE, A UNIQUE SAMPLE NUMBER, AND THE MACHINE DIRECTION SHALL ALSO BE NOTED.
44. ANY PORTION OF THE LINER WITH A FLAW OR THAT FAILS A NON-DESTRUCTIVE OR DESTRUCTIVE TEST SHALL BE REPAIRED BY ONE OF THE FOLLOWING METHODS:
    - 44.1. PATCHING OR CAPPING FOR HOLES, DEFECTS OR TEARS USED TO REPAIR LARGE HOLES, TEARS, LARGE PANEL DEFECTS, AND DESTRUCTIVE SAMPLE LOCATIONS THAT ARE LESS THAN 2M2 (TOTAL AREA). PATCHES AND REPAIRS ARE TO BE OVERLAID WITH A STRIP OF NEW MATERIAL AND SEAMED (CAP STRIPPED). STRIP SHALL HAVE ROUNDED CORNERS AND EXTEND A MINIMUM OF 200 MM BEYOND THE EDGE OF THE REPAIR OR DEFECT AREA. AFTER REPAIRS ARE COMPLETED, THE REPAIRED SEAM SHALL BE NON-DESTRUCTIVELY TESTED.
    - 44.2. REMOVAL AND REPLACE – USED TO REPLACE AREAS WITH LARGE DEFECTS WHERE THE PRECEDING METHODS ARE NOT APPROPRIATE. ALSO USED TO REMOVE EXCESS MATERIAL (WRINKLES) FROM THE INSTALLED LINER.
    - 44.3. ONCE THE REPAIR HAS BEEN COMPLETED, FURTHER NON-DESTRUCTIVE OR DESTRUCTIVE TESTING SHALL BE CARRIED OUT.
45. FULL RECORDS OF LINER TESTING AND INSPECTION SHALL BE SUBMITTED PROGRESSIVELY TO THE PRINCIPAL, AS THE WORK PROCEEDS. FINAL COMPLETION WILL NOT BE CERTIFIED UNTIL ALL RECORDS HAVE BEEN SUBMITTED AND APPROVED BY THE PRINCIPAL.
    - 45.1. RECORDS SHALL INCLUDE, BUT NOT LIMITED TO, THE FOLLOWING:
    - 45.2. CONTRACTOR'S AS-BUILT PANEL LAYOUT DRAWING SHOWING PANEL NUMBERS AND JOINT NUMBERS, TO BE MARKED UP PROGRESSIVELY WITH THE ROLL NUMBER USED FOR EACH PANEL, AND WITH THE LOCATIONS OF SAMPLES TAKEN FOR DESTRUCTIVE TESTING;
    - 45.3. MANUFACTURER'S ROLL PRODUCTION TEST REPORTS FOR ALL ROLLS USED IN THE WORK;
    - 45.4. SUBGRADE CERTIFICATION REPORTS;
    - 45.5. DAILY TEST REPORTS REFERENCED TO JOINT NUMBERS ;
    - 45.6. DAILY TEST WELD FIELD TEST REPORTS REFERENCED TO JOINT NUMBERS, EQUIPMENT IDENTIFICATION, AND OPERATOR, AND INCLUDING WEATHER AND TEMPERATURE CONDITIONS AND ANY ADJUSTMENTS TO EQUIPMENT CONTROLS;
    - 45.7. NON-DESTRUCTIVE AND DESTRUCTIVE TEST FIELD REPORT AND RECORD OF SUBMISSION FOR LABORATORY TESTING REFERENCED TO JOINT NUMBER;
    - 45.8. LABORATORY TEST REPORTS TO BE AVAILABLE WITHIN TWO WEEKS OF TESTING; AND
    - 45.9. RECORD DRAWING INDICATING LINER SEAM LOCATIONS, DESTRUCTIVE TEST LOCATIONS, CAP STRIP LOCATIONS, PATCHES AND ALL REPAIRS FOR THE LINER SYSTEM.

BITUMINOUS GEOMEMBRANE LINER BALLAST ANCHORS

1. BALLAST ANCHORS SHALL BE SOIL ANCHOR PENETRATOR PE18SQ (OR ENGINEER APPROVED EQUIVALENT).
2. BALLAST ANCHOR SPACING INTERVALS ALONG BATTER (AS PER DETAIL 1, Q-4522-20-DH-0003).
   - 2.1. POINT A – EVERY 5 METRES (NEAREST SEAM OVERLAP).
   - 2.2. POINT B AND C – EVERY 5 METRES (NEAREST SEAM OVERLAP.)
3. BITUMSEAL SHALL BE USED BETWEEN THE BALLAST PLATE AND BITUMINOUS GEOMEMBRANE LINER.
4. BALLAST ANCHOR LOCATE AT ANCHOR POINT A (CREST OF DAM) SHALL BE PAINTED WITH HIGH VISIBILITY SAFETY PAINT.

DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DRAWN	DWG CHECK	DESIGN	ENG DES CHECK	OE DRAFT SUPER	OE PROJECT APPROVAL
		0	14/07/2017	ISSUED FOR CONSTRUCTION		MD	BF			

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DWG CHECK	MD	17.07.17
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TITLE
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BRINE POND 7
GENERAL NOTES STANDARD CIVIL DRAWING

PROJECT NO. 83503552
MOD NO.
SCALE NTS
DRAWING NO. Q-4522-20-DH-0001
REVISION 0
CADFILE Q-4522-20-DH-0001.dwg
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Tue, 11 Jul 2017 - 4:19pm C:\USERS\MLFOWLER\DESKTOP\ORIGIN\Q-4522-20-DH-0001.DWG Fowler, Marie

Liner and wastewater tank storage specifications for existing and new wastewater tanks

13 Oct 2016	Enviro Liner® 1000 Properties				
Style	**ASTM**	**EL 1020**	**EL 1030**	**EL 1040N**	**EL 1040**
Thickness	D5199	20 mil 0.5 mm	30 mil 0.75 mm	36 mil 0.91 mm	40 mil 1.0 mm
Density (Typical)	D792	0.93	0.93	0.93	0.93
Tensile Strength at Break	D6693	76 ppi 13 N/mm	114 ppi 20 N/mm	136 ppi 24 N/mm	152 ppi 27 N/mm
Elongation	D6693	800%	800%	700%	800%
Tear Resistance	D1004	11 lbs 49 N	16 lbs 70 N	19 lbs 84 N	22 lbs 100 N
Puncture Resistance	D4833	28 lbs 120 N	42 lbs 190 N	54 lbs 240 N	56 lbs 250 N
Carbon Black Content	D6370	≥ 2.0%	≥ 2.0%	2.0%	≥ 2.0%
High Pressure OIT	D5885	400 min	400 min	N/A	400 min
Low Temperature Impact Resistance	D746	-69°F -56°C	-69°F -56°C	-40°F -40°C	-69°F -56°C
Service Temperatures	Max Continuous Use	140°F 60°C	140°F 60°C	140°F 60°C	140°F 60°C

18 Oct 2016		Enviro Liner® 1000 Shop Seam Strengths			
Style	**ASTM D6392**	**Enviro Liner® 1020**	**Enviro Liner® 1030**	**Enviro Liner® 1040N**	**Enviro Liner® 1040**
Heat Bonded Seam Strength	25.4 mm (1") Strip	30 ppi 5.2 N/mm	45 ppi 7.7 N/mm	50 ppi 8.7 N/mm	60 ppi 10.3 N/mm
Peel Adhesion Strength (Wedge Weld)	25.4 mm (1") Strip	25 ppi 4.3 N/mm	38 ppi 6.5 N/mm	45 ppi 7.9 N/mm	50 ppi 8.7 N/mm

FlexiPond Wind Loading

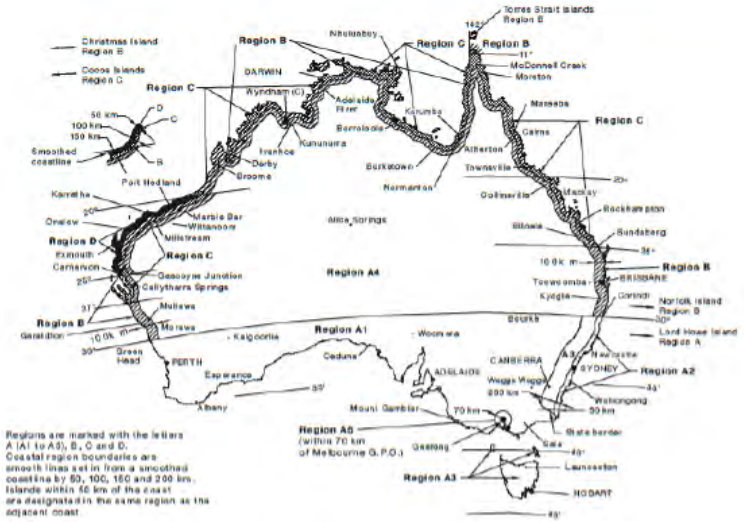
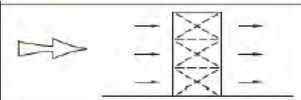


FIGURE 3.1(A) WIND REGIONS

(g) *2 effective surfaces* Lateral pressure on windward and leeward walls		0.9	1.0 (not an effective surface)
(h) *2 effective surfaces* Lateral pressure on external and internal surfaces		0.9	0.9

Wind Rating as per AS1170.2:2011(R2016)

- Individual panel (or a straight line section of assembled panels)
- Overturning/Sliding rating (e.g. in storage or prior to installation) **rated to a maximum of 100km/hr**

- Fully Assembled (with corner pieces, locking pins and cables)
- **Stable to all wind conditions in all wind regions (includes cyclonic)**

Support Slide: Certified Working Parameters

- Wind Rating as per AS1170.2:2011(R2016), Structural Design Actions Part2 : Wind Actions
  - Individual panel (or a straight line section of assembled panels)
    - Overturning/Sliding rating (e.g. in storage or prior to installation) rated to a maximum of 100km/hr
  - Fully Assembled (with corner pieces, locking pins and cables)
    - Stable to all wind conditions in all wind regions (includes cyclonic)
    - However, recommend minimum 100mm of fluid in tank at shallow end to stop liner from blowing away/tearing

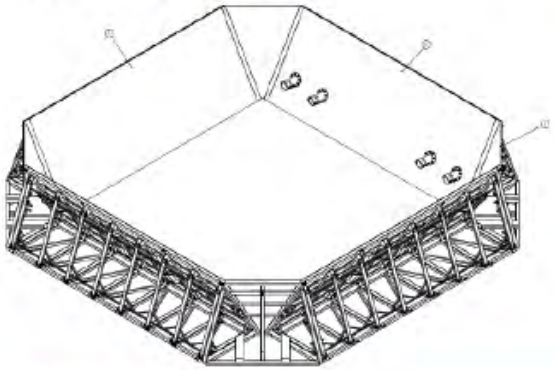
- Hydrostatic Loading as per AS NZS 1170.1-2011(R2016) and AS3990-1993(R2016)
  - Assembled with cables and pins
    - Fluid maximum specific gravity of 1.2 in conjunction with wind loading
    - Structurally able to handle erosion under 70% of the frame (although not recommended as the liner would be removed under the panel by the hydrostatic fluid
    - Cables to be capable of being safely loaded to 160kN

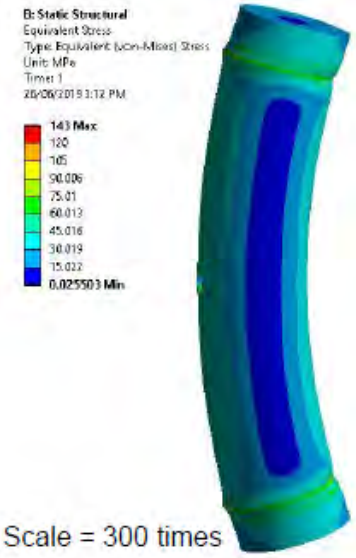
- Installation conditions
  - Site Slope
    - See chart for numbers of panels versus slope
  - Ground Bearing Pressures
    - Uniformly supported panels exert a pressure of 35 kPa beneath the frame members when filled with 1.2 SG fluid
    - The liner exerts a pressure on the ground of 25 kPa when filled with 1.2 SG fluid
    - As a reference – A typical passenger vehicle tyres exert approx. 200kPa on ground
  - Ground/Site Preparation
    - Assessment would be on a site-specific basis
    - Recommended final site preparation of a bedding material of loose sand or fine aggregate to ensure uniform loading under frame members
    - A depth of not less than 100mm would ensure final levelling could be performed during assembly of the panels
    - Alternatively, a ground level tolerance of +/- 16mm should be used to ensure uniform loading under frame members
    - To reduce the likelihood of erosion, it is recommended that a spoon drain or similar be provided around the structure, particularly on the high side or where there is the potential for significant runoff to impact the structure. This would also be site specific.

FlexiPond Structural Integrity

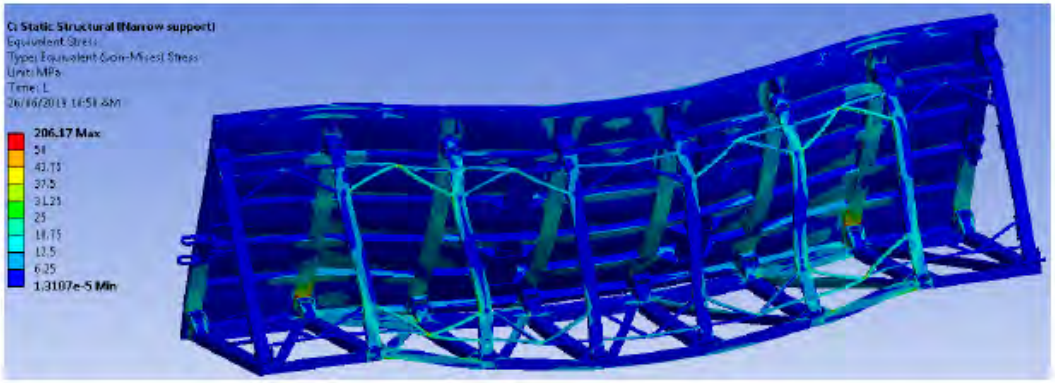
FlexiPond is designed and Engineered to AS3990 Mechanical Equipment – Steelwork

Finite Element Analysis (FEA) software used to simulate various load conditions and confirm engineering calculations





Deformed Scale = 300 times



Deformed Scale = 340 times

Structural FEA of Frame Connecting Pin

- Supported in the middle of the pin
- Loaded on either end of the pin

Structural FEA simulating erosion under 70% of Structure

- Supported on either side by the ground and horizontal cables
- Fluid hydrostatic pressure acting on the panel surface