Appendix A: Change notice – Regulation 22

Interest holder	Tamboran B2 Pty Ltd	**EMP Title**	Beetaloo Sub-basin Shenandoah South E&A Program EMP	**Unique EMP ID**	TAM1-3	**Mod #**	7	**Date**	9 January 2025
Brief Description	Use of impact monitoring bores installed within 100 m downgradient of the Shenandoah S2-1H petroleum well. Use of existing regional control monitoring bores within 25 km of the intended E&A wells (for example, use of existing groundwater monitoring bores on Kyalla 117 N2, located 4.3 km south-east of the Shenandoah S2 well site) to satisfy baseline requirements.								
Geospatial files included?	N/A								

Does the proposed change result in a new, or increased, or potential or actual environmental impact or risk?	**If an INCREASE in the existing potential or actual environmental risk, is it provided for in the EMP?**	**Does the proposed change require additional mitigation measures to be included?**	**Has additional stakeholder engagement been conducted?**	**Does it require additional environmental performance standards and measurement criteria?**	**Does it affect compliances with Sacred Site Authority Certificates?**	**Does it affect current rehabilitation, weed fire, wastewater, erosion and sediment control, spill or emergency response plans?**	**Will the environmental outcome continue to be achieved, and will the impacts and risks be managed to ALARP and acceptable?**
No. There are no new or increased environmental impacts or risks through the new placement of the impact and monitoring bores. In fact, the new locations reduce health and safety risks by eliminating potential line of fire impacts to workers and bore infrastructure.	N/A. No increased impact or risk with sufficient controls outlined in the EMP.	No. Existing mitigation measures are in place to cover the groundwater monitoring program.	N/A. The construction of groundwater monitoring has already been communicated with stakeholders.	No. Environmental performance standards within the existing approved EMP are sufficient.	No. Activity is covered under the existing AAPA certificates C2024-030 and C2024-031.	No. There is no change to any of these environmental factors.	Yes. There environmental performance measures outlined in EMP *Table 66 Environmental outcomes, performance standards and measurement criteria – hydrological processes* will be met.

Additional contextual information	

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	7	Date	9 January 2025

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3.5 Groundwater monitoring and extraction bores

New control and impact groundwater monitoring bores will be installed at each of the new exploration sites to satisfy condition B.4.17.2 of the Code. These bores are designed to monitor upgradient (control) and downgradient (impact) of exploration wells proposed to be stimulated. Sampling of the new bores will be initiated as soon as possible upon completion, to collect the required baseline data prior to drilling and stimulation as per Clause B.4.17.2(b) of the Code. Further information on the groundwater monitoring program is provided in section 3.27.1. These monitoring bores will also be utilised to supply groundwater to support exploration activities.

3.27.1 Groundwater monitoring

… For the 2024 drilling program, baseline has been achieved for the proposed Shenandoah S-2H well proposed for the Kyalla 117 N2 site. For the proposed Shenandoah S2-1H and 2H wells, delays outside of Tamboran's control have impacted approval timing by approximately 6 months, primarily associated with technical availability of field scouts and consultants in preparation of the required approvals. Additional time was also allowed to accommodate ongoing stakeholder engagement to ensure stakeholders had sufficient time to understand the content of the EMP prior to submission. Subject to the timing of the proposed drilling of Shenandoah S2-1H and 2H wells, these delays may result in Tamboran not being able to achieve the 6 months of baseline groundwater monitoring prior to drilling. Given the circumstances were outside of Tamboran's control, Tamboran has complied with Section B.4.17.2 of the code and will ensure monitoring bores are constructed prior to drilling and 6 Months of baseline data will be obtained prior to stimulation.

Table 34: Monitoring program summary

Monitoring program	Purpose	Monitoring points	Parameters	Frequency	Investigation thresholds	Reference document
Groundwater monitoring	Detect changes in groundwater resulting from drilling and stimulation activities	Newly constructed impact and monitoring bores at Shenandoah S2, Shenandoah S B and Shenandoah SC. Groundwater monitoring bores at Kyalla 117 N2: • RN040896 Anthony Lagoon Bed CMB. • RN041132 Gum Ridge Formation CMB. • RN041136 Gum Ridge Formation IMB. • RN041137 Anthony Lagoon Beds IMB. • Any proposed bores to be constructed to	Level and EC	Quarterly measurements with real-time (continuous) level and electrical conductivity logging before, during and 1 month after stimulation	+/-1 m water level change observed at the impact monitoring bore EC >200 µs/cm change or within 1 standard deviation of arithmetic mean[35]	Code B.4.17
			Temperature, electrical conductivity, pH	Quarterly commencing 6 months prior (baseline) and three-monthly after stimulation and then annually for 3 years	EC >200 µs/cm change pH >1 unit change or Within 1 standard deviation of arithmetic mean[35]	
			Water monitoring suites (Appendix J)	Quarterly commencing 6 months prior (baseline) and three-monthly after stimulation	BTEX and Dissolved Methane - outside of the baseline, control bore and 1 standard deviation[36]	

Amended EMP text

3.5 Groundwater monitoring and extraction bores

Tamboran will use a combination of new groundwater monitoring bores installed at each of the new exploration sites with existing upgradient control groundwater monitoring bores to satisfy groundwater monitoring requirements. These bores are designed to monitor upgradient (control) and downgradient (impact) of exploration wells proposed to be stimulated. Impact bores will be located at each well site within 100 m downgradient of a well array. Control bores will be located upgradient within 25 km. Sampling of the new bores will be initiated as soon as possible upon completion, to collect the required baseline data prior to drilling and stimulation as per Clause B.4.17.2(b) of the Code. Further information on the groundwater monitoring program is provided in section 3.27.1. These monitoring bores will also be utilised to supply groundwater to support exploration activities.

3.27.1 Groundwater monitoring

Baseline monitoring data will be collected from the control monitoring bores in accordance with condition B.4.17.2(b) of the Code. Baseline groundwater monitoring results will be collected from each new control bore as soon as drilled and quarterly until the commencement of drilling. Groundwater monitoring of impact bores will commence upon drilling of the bore (prior to stimulation). During stimulation, level loggers will be installed in the bores at least 1 month before and after. Upon completion of stimulation, monitoring of the control and impact bores will continue for a period of 3 years.

For the 2024 drilling program, baseline has been achieved for the proposed Shenandoah S-2H well proposed for the Kyalla 117 N2 site. For the proposed Shenandoah S2 wells, Tamboran will use the existing control monitoring bores constructed on Kyalla 117 N2 (approximately 4.3 km to the south) to satisfy baseline conditions. These control bores have approximately 6 years of monitoring data with initial water chemistry results from the Shenandoah S2 location is similar to the control monitoring bores at Kyalla 117 N2 location. Tamboran has complied with Section B.4.17.2(b) of the Code as demonstrated through existing regional groundwater monitoring to date and will ensure sufficient baseline data (i.e. 6 months) is obtained for all new locations prior to stimulation.

Table 34: Monitoring program summary

Monitoring program	Purpose	Monitoring points	Parameters	Frequency	Investigation thresholds	Reference document
Groundwater monitoring	Detect changes in groundwater resulting from drilling and stimulation activities	Newly constructed impact and monitoring bores at Shenandoah S2, Shenandoah S B and Shenandoah SC. Groundwater monitoring bores at Kyalla 117 N2: • RN040896 Anthony Lagoon Bed CMB. • RN041132 Gum Ridge Formation CMB. • RN041136 Gum Ridge Formation IMB. • RN041137 Anthony Lagoon Beds IMB. • Any proposed bores to be constructed to	Level and EC	Quarterly measurements with real-time (continuous) level and electrical conductivity logging before, during and 1 month after stimulation	+/-1 m water level change observed at the impact monitoring bore EC >200 µs/cm change or within 1 standard deviation of arithmetic mean[35]	Code B.4.17(b)
			Temperature, electrical conductivity, pH	Quarterly commencing 6 months prior (baseline) and three-monthly after stimulation and then annually for 3 years	EC >200 µs/cm change pH >1 unit change or Within 1 standard deviation of arithmetic mean[35]	
			Water monitoring suites (Appendix J)	Quarterly commencing 6 months prior (baseline) and three-monthly after stimulation	BTEX and Dissolved Methane - outside of the baseline, control bore and 1 standard deviation[36]	

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Current EMP text

		support the E&A wells				

Appendix M Risk assessment

Ref	Environmental factor	Risk scenario description	Risk source	Code of practice (the Code)
1	**Hydrological processes**	Changes in aquifer quality from subsurface (drilling and stimulation) activities impacting a receptor (groundwater user or Groundwater Dependent Ecosystem).	Contamination from drilling fluids. Drilling fluids used to drill through the Cambrian Limestone Aquifer (CLA) are water-based with clay inhibition in the form of KCl. This may result in temporary elevated levels of chlorides in the CLA immediately adjacent to the well bore during the drilling of the top-hole section of the well. This risk also includes use of groundwater monitoring bore construction.	B.4.10 Drilling fluids B.4.17 Groundwater monitoring
2			Cross flow of formation through inappropriate well barrier design and construction.	B.4.10 Drilling fluids B.4.17 Groundwater monitoring
3			Crossflow through fracture growth into aquifer from stimulation activities allowing the migration of fluid and gas.	B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and Flowback Operations B.4.17 Groundwater monitoring
4			Stimulation activity induces seismic activity that enables cross formational flow between shallow aquifers.	B.4.13 Hydraulic Stimulation and Flowback Operations B.4.17 Groundwater monitoring
7			Leakage of either flowback, produced water, or hydrocarbons (liquid and gaseous) from suspended or abandoned wells.	B.4.1 Well Integrity Management B.4.2 Aquifer Isolation B.4.3 Well design and barriers B.4.15 Well suspension and decommissioning B.4.15.2 Mandatory require-ments for decommissioning wells B.4.17 Groundwater monitoring D.5.5 Leak Remediation and Notification
14		Unsustainable groundwater extraction impacts landholders and groundwater dependent ecosystems.	Over extraction of groundwater for civils, drilling, stimulation and seismic activities.	B.4.17 Groundwater monitoring
74	**Community and economy**	Reduction in land productivity.	Over extraction of groundwater.	A.4.1.1 Well pad specific site selection requirements

Amended EMP text

		support the E&A wells				

Appendix M Risk assessment

NB: A revised risk assessment is attached to this change notice.

Ref	Environmental factor	Risk scenario description	Risk source	Code of practice (the Code)
1	**Hydrological processes**	Changes in aquifer quality from subsurface (drilling and stimulation) activities impacting a receptor (groundwater user or Groundwater Dependent Ecosystem).	Contamination from drilling fluids. Drilling fluids used to drill through the Cambrian Limestone Aquifer (CLA) are water-based with clay inhibition in the form of KCl. This may result in temporary elevated levels of chlorides in the CLA immediately adjacent to the well bore during the drilling of the top-hole section of the well. This risk also includes use of groundwater monitoring bore construction.	B.4.10 Drilling fluids Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34
2			Cross flow of formation through inappropriate well barrier design and construction.	B.4.10 Drilling fluids Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34
3			Crossflow through fracture growth into aquifer from stimulation activities allowing the migration of fluid and gas.	B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and Flowback Operations Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34
4			Stimulation activity induces seismic activity that enables cross formational flow between shallow aquifers.	B.4.13 Hydraulic Stimulation and Flowback Operations Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34
7			Leakage of either flowback, produced water, or hydrocarbons (liquid and gaseous) from suspended or abandoned wells.	B.4.1 Well Integrity Management B.4.2 Aquifer Isolation B.4.3 Well design and barriers B.4.15 Well suspension and decommissioning B.4.15.2 Mandatory requirements for decommissioning wells Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34

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				B.4.17 Groundwater monitoring

Appendix M Risk assessment

Ref	Environmental factor	Risk scenario description	Risk source	Detect
10	**Hydrological processes**	Contamination of aquifer from surface activities (chemical and waste storage, handling, treatment, recycling and spills) impacting a receptor (groundwater user or GDE).	Surface spills from storage, handling, treatment, recycling and transportation of flowback water (including gathering lines)	• Leak detection to be located within the interstitial space between the primary and secondary liner to detect any potential leaks. • Leak detection alarms to identify when a leak is potentially identified • Daily inspections during wet season and weekly inspections during the dry season to identify any potential leaks. • Impact and control groundwater monitoring bores installed within 20m of exploration wells to detect any potential contamination. • Quarterly groundwater monitoring. • Sampling for NORMs to characterise and assess levels within drilling wastewater and flowback undertaken.
11			Storage, handling and transportation of chemicals, fuels and wastes. Including on unsealed roads during the wet season.	• Daily inspections during wet season when chemicals are stored and weekly thereafter to identify and respond to any potential leaks. • Impact and control groundwater monitoring bores installed around exploration wells to detect any potential contamination. • Groundwater monitoring of control and impact monitoring bores on a quarterly basis.
12			Overtopping of drilling sumps and flowback tanks (including during wet season)	• Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times • Daily significant rainfall monitoring during the wet season. • Spill Management Plan implemented to prevent, detect and respond to spills. • Impact and control groundwater monitoring bores installed within 20m of exploration wells to

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				D.5.5 Leak Remediation and Notification
14		Unsustainable groundwater extraction impacts landholders and groundwater dependent ecosystems.	Over extraction of groundwater for civils, drilling, stimulation and seismic activities.	B.4.17 Groundwater monitoring
74	**Community and economy**	Reduction in land productivity.	Over extraction of groundwater.	A.4.1.1 Well pad specific site selection requirements Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34

Appendix M Risk assessment

NB: A revised risk assessment is attached to this change notice.

Ref	Environmental factor	Risk scenario description	Risk source	Detect
10	**Hydrological processes**	Contamination of aquifer from surface activities (chemical and waste storage, handling, treatment, recycling and spills) impacting a receptor (groundwater user or GDE).	Surface spills from storage, handling, treatment, recycling and transportation of flowback water (including gathering lines)	• Leak detection to be located within the interstitial space between the primary and secondary liner to detect any potential leaks. • Leak detection alarms to identify when a leak is potentially identified • Daily inspections during wet season and weekly inspections during the dry season to identify any potential leaks. • Groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly. • Quarterly groundwater monitoring. • Sampling for NORMs to characterise and assess levels within drilling wastewater and flowback undertaken.
11			Storage, handling and transportation of chemicals, fuels and wastes. Including on unsealed roads during the wet season.	• Daily inspections during wet season when chemicals are stored and weekly thereafter to identify and respond to any potential leaks. • Groundwater monitoring bores installed to detect any potential contamination. • Groundwater monitoring of control and impact monitoring bores on a quarterly basis.
12			Overtopping of drilling sumps and flowback tanks (including during wet season)	• Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times • Daily significant rainfall monitoring during the wet season. • Spill Management Plan implemented to prevent, detect and respond to spills.

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				detect any potential contamination, with monitoring completed quarterly • Monthly inspections of right of way to identify leaks.					• Groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly. • Monthly inspections of right of way to identify leaks.
13			Failure of flowback storage tank, including structural failure	• Weekly wastewater tank integrity inspections during wastewater storage to detect. • Impact and control groundwater monitoring bores installed within 20m of exploration wells to detect any potential contamination. • Quarterly groundwater monitoring completed to detect potential contamination.	13			Failure of flowback storage tank, including structural failure	• Weekly wastewater tank integrity inspections during wastewater storage to detect. • Groundwater monitoring bores installed to detect any potential contamination. • Quarterly groundwater monitoring completed to detect potential contamination.
16	**Inland water environmental quality**	Contamination of surface water from surface activities.	Overtopping of drilling sumps and flowback tanks (including wet season operations)	• Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times. • Daily significant rainfall monitoring during the wet season. • Spill Management Plan implemented to prevent, detect and respond to spills. • Impact and control groundwater monitoring bores installed within 20m of exploration wells to detect any potential contamination, with monitoring completed quarterly.	16	**Inland water environmental quality**	Contamination of surface water from surface activities.	Overtopping of drilling sumps and flowback tanks (including wet season operations)	• Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times. • Daily significant rainfall monitoring during the wet season. • Spill Management Plan implemented to prevent, detect and respond to spills. • Groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly.
31	**Terrestrial environmental quality**	Soil contamination due to spills and leaks of chemicals, wastes or wastewater.	Drill sump and flowback tank overtopping	• Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times. • Daily significant rainfall monitoring during the wet season. • Spill Management Plan implemented to prevent, detect and respond to spills. • Impact and control groundwater monitoring bores installed within 20m of exploration wells to detect any potential contamination, with monitoring completed quarterly.	31	**Terrestrial environmental quality**	Soil contamination due to spills and leaks of chemicals, wastes or wastewater.	Drill sump and flowback tank overtopping	• Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times. • Daily significant rainfall monitoring during the wet season. • Spill Management Plan implemented to prevent, detect and respond to spills. • Groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly.

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
1	**Hydrological processes**	Changes in aquifer quality from subsurface (drilling and stimulation) activities impacting a receptor (groundwater user or Groundwater Dependent Ecosystem).	Contamination from drilling fluids. Drilling fluids used to drill through the Cambrian Limestone Aquifer (CLA) are water-based with clay inhibition in the form of KCl. This may result in temporary elevated levels of chlorides in the CLA immediately adjacent to the well bore during the drilling of the top hole section of the well. This risk also includes use ofgroundwater monitoring bore construction.	B.4.10- Drilling fluids Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34	•Drilling fluids used to drill aquifers are low toxic, water-based with addition of bentonite and salt in the form of potassium or calcium chloride for clay inhibition. (Engineering) •Drilling fluids included in chemical risk assessment and determined to be of low concern through adoption of standard chemical management practices (Administration) •Results of existing exploration well will be used to optimise the drilling of all proposed new wells, with fluid systems modified where fluid loss zones are anticipated (Elimination) •Impacted area likely to be localised around the immediate vicinity of each well bore (Elimination) •Karst system likely to result in rapid dilution (Elimination) •Site selection: No pastoralist extraction bores within 1 km. (Elimination) Groundwater monitoring bores constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia utilising low toxicity drilling fluids and muds •No major GDE linked to CLA within 20 km of extraction point, •Raw water supplied via gathering lines that have contained wastewater will not be used when drilling through aquifers, including the CLA (Gum Ridge and Anthony Lagoon Formation) and Bukalara Sandstone (if present). •Stygofauna eDNA has not been detected in the deep Gum Ridge bore; any impact is likely to be minor and localised	•Monitoring of drilling fluid returns to identify fluid losses and modify fluid systems (Engineering) •Impact groundwater monitoring bores constructed in compliance with code of proactive monitoring down gradient of exploration well, with any changes detected rapidly (Engineering)	•Use or loss of circulation material (such as fibres or dissolvable marbles) to mitigate drilling fluid losses when drilling within aquifers (Engineering) • During loss of circulation events, minimal additives used. •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	1	3	L	Yes	This risk consequence is managed through the Code requirements that only water based drilling fluids are to be used which will not result in a residual toxic effect to the aquifer. The consequence is anticipated to be "minor", with a locally restricted, rapidly reversible impact. The likelihood is reduced by the type of drilling fluids used to drill through the aquifer, protection of aquifer by cement casing for drilling below aquifer depth, rapid dilution of karst formations and the4km separation distance from the closest pastoral user. The likelihood of contamination at any receptor is considered remote- with a probability lower than 1%. □	Yes	Low
2			Cross flow of formation through inappropriate well barrier design and construction.	B.4.10 Drilling fluids Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34	•Each well designed and constructed with multiple (typically 4) casing barriers and specifically-engineered cement in place to protect aquifers from the anticipated pressures and formation quality likely to be encountered (such as formation salinity, corrosion risk, permeability etc.) - this includes the Conductor casing, surface casing,intermediate casing andproduction casing. •Casing shoe for the conductor and surface casing section to be located in the base of each aquifer unit, with cement returned to surface •Any impacted area likely to be localised, around the immediate vicinity of the E&A wells. •No driving head between saline formations (below Gum Ridge) and surface aquifers- cross flow potential is limited •No landholder bores within 1km. • Groundwater monitoring bores constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia •No major GDE linked to CLA within 20 km of extraction point, •Stygofauna eDNA has not been detected in the deep Gum Ridge bore; any impact is likely to be minor and localised	•Well Barrier Integrity Validated (WBIV) through casing pressure tests and Casing shoe integrity leak of test during the construction of each casing string •Monitoring of cement returns to surface, with cement volume sand density as per programme •Cement bond logs(CBL)completed on each well prior to stimulation to confirm integrity •Each well designed, with a Well Barrier Integrity Validation report approved by DITT as part of Well Operations Management Plan (WOMP). •Groundwater monitoring bores installed to detect and trigger response in the case of contamination.	•2 stage cement job completed where fluid losses.1st stage places cement from the casing shoe to the base of the loss zone. 2nd stage places cement 30m above the zone of losses, using an inflatable casing packer coupled with a stage tool assembly. •Cement repair jobs (such as squeeze jobs) to be performed to mitigate poor cement coverage. •Plug and abandonment and re-drilling of new vertical/ horizontal well sections where required.	3	1	L	Yes	The risk of cross formation flow is managed through the Code which provides specific well barrier design and validation requirements to mitigate the risk of aquifer interconnectivity.The well barrier design is submitted to DITT as a part of the WOMP and must be approved prior to the commencement of drilling.The integrity of each well is validated prior to the commencement of hydraulic fracture. the consequence of an interconnectivity event is likely to be "serious", with spatially restricted (to the vicinity of the well), medium term reversible impacts. The Likelihood of multiple casing and cement failures from occurring is considered remote, with a probability lower than 1%. This is confirmed by the NT inquiry that estimated the likely well failure rate (total failure of all barriers) to be less than 0.1%.	Yes	Low
3			Crossflow through fracture growth into aquifer from stimulation activities allowing the migration of fluid and gas.	B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and Flowback Operations Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34	•Each well designed and constructed with multiple (typically 4) casing barriers and specifically-engineered cement in place to protect aquifers from the anticipated pressures and formation quality likely to be encountered (such as formation salinity, corrosion risk, permeability etc.) - this includes the Conductor casing, surface casing,intermediate casing andproduction casing. •Casing shoe for the conductor and surface casing section to be located in the base (aquitard) of each aquifer unit, with cement returned to surface Geomechanical data collected during drilling of existing wells used to understand fracture gradients. •Geomechanical modelling validated from Amungee NW-1H stimulation results and ensure to appropriate fracture barriers are sufficient to contain the fracture propagation. •Modelling to factor in results of existing wells to optimise stimulation design. •Hydraulic fracture stimulation risk assessment completed prior to stimulation to determine fracture growth. •Minimum 1400 m vertical separation distance between target formation and closest aquifer. •Each horizontal well to be at least 2-400 m separated, with the separation distance determined through the Mechanical earth model and results from stimulation of existing wells. •Overlying sequences have a higher fracturing pressure reducing the risk of fracture migration out of the target shale.. •Any impacted area likely to be localised, around the immediate vicinity of the E&A wells. •No driving head between saline formations (below Gum Ridge) and surface aquifers- cross flow potential is limited •No landholder bores within 1 km. •No major GDE linked to CLA within 20 km of extraction point •Stygofauna eDNA has not been detected in the deep Gum Ridge bore; any impact is likely to be minor and localised	•Well Barrier Integrity Validated (WBIV) through casing pressure tests and Casing shoe integrity leak of test during the construction of each casing string •Monitoring of cement returns to surface, with cement volume sand density as per programme •Cement bond logs (CBL) completed on each well prior to stimulation to confirm integrity. •A Well Barrier Integrity Validation report approved by DITT as part of Well Operations Management Plan (WOMP). • Real time pressure monitoring of stimulation pressure to determine if a fracture has propagated outside the design operating envelope. •Groundwater monitoring bores installed to detect and trigger response in the case of contamination.	•Stimulation activities to cease and be reviewed where fracture propagation extends beyond the target formation (noting a 1400m separation between the closest regional aquifer).Where fracture growth is suspected to reach an aquifer,Stimulation activity on pad suspended until a go forward plan submitted by Tamboran and approved by DITT.	3	1	L	Yes	The risk is managed through the Code requirements for well integrity, validation and stimulation modelling.The consequences of aquifer interconnectivity is further reduced through pressure monitoring during stimulation. Any uncontrolled fracture growth is likely to be detected rapidly using pressure monitoring and managed to prevent growth into aquifers. Management of any pressure indicating interconnection would be investigated and could result in a potential repair and/ or abandonment of the well. Contamination is likely to be serious, with impacts locally restricted to the vicinity of the well and reversible over the moderate term (months to years).The likelihood of a fracture growth into an aquifer is controlled by the stress regime of the overburden and the 600m separation distance between the target formation and overlying aquifers.The likelihood is considered "remote", with a probability of <1%.	Yes	Low
4			Stimulation activity induces seismic activity that enables cross formational flow between shallow aquifers.	B.4.13 Hydraulic Stimulation and Flowback Operations Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34	•Wells are located away from known geohazards, with no significant faults within proximity of activity (Elimination) •Stimulation is not linked to major seismic events (reinjection of wastewater is generally recognised as the main cause). No reinjection of wastewater proposed (Elimination) •Stimulation stages deployment will be away from geohazards to reduce the loss of fluids into any encountered faults (Elimination) • The Beetaloo is not prone to seismic activity and there is no evidence of recent earthquake activity as most faults and the major subsurface structure are confined to Cambrian or older strata.This is supported by the National seismic Hazard Assessments completed by Allen 2018 (Figure 33), which highlight the Beetaloo is located within a low hazard area (Elimination) •Any faults encountered during drilling will be assessed to determine risk of stimulating with appropriate separation distances applied (Elimination). •1400 m separation distance between target Velkerri formation and the Gum Ridge Aquifer. (Elimination) •No landholder bores within 1km(Elimination) •No major GDE linked to CLA within 20 km of extraction point •Stygofauna eDNA has not been detected in the deep Gum Ridge bore; any impact is likely to be minor and localised	•Monitoring of stimulation pressure to detect and respond to anomalies which may indicate fluid being pumped to an open geological structure (Engineering) •Geoscience Australia's Waramungu seismic array located approximately 250km from the proposed area. •Seismometer to be located adjacent to each well pad. It is likely that any material seismic events above a 2 MkWill be detected via this array if they occur (Administration) •An induced seismicity traffic light system has been adopted and outlined in the WOMP (Administration)	•Where seismic activity is recorded in Tamboran's tenure during hydraulic stimulation activities, the actions in the WOMP Traffic Light System will be enacted as summarised below: Green: Local Magnitude (Ml) <2.0- no action required Orange: ML 2.0- <3.5Ml- Report event to DITT and continue operations Red: ML> 3.5- Stimulation activity on pad suspended until a go forward plan submitted by Tamboran and approved by DITT.	2	1	L	Yes	The consequence of a induced seismicity, based upon evidence from the UK and US, indicates that the consequence is likely to be "moderate", with most events restricted to discrete areas at a size that generally cannot be detected at the surface (below 2 order of magnitude). Larger events are rare and generally a factor of the existing built up stress regime of the area- rather than a factor of the intensity of hydraulic fracturing or wastewater injection. The likelihood of a seismic event is reduced through the geological setting of the Beetaloo Basin itself and the safeguards implemented in the Code requiring geohazard assessment and avoidance. In theBeetaloo, there have been no earthquakes over magnitude 3 measured since records began.The area is not prone to seismic activity and there is no evidence of recent earthquake activity as most faults and the major subsurface structure are confined to Cambrian or older strata.This is supported by the National seismic Hazard Assessments completed by Allen 2018 (Figure 33), which highlight the Beetaloo is located within a low hazard area. The Code requires any geohazard (such as fault) identified prior to drilling (from existing seismic or interpreted data) or encountered during drilling to have a risk assessment to the determine the potential for reactivation.Any faults identified would not be stimulated, with a risk-based buffer applied. Given the number of wells stimulated in the US without issue and geological setting of the Beetaloo basin, the likelihood is considered remote, with a probability less than 0.1%.	Yes	Low
5			Migration via fractures intersecting with offset wells (including the adjacent horizontal wells) or intersecting an existing geohazard.	B.4.13 Hydraulic Stimulation and Flowback Operations	•Proposed sites will be screened for geohazards using seismic before drilling • Wells are located away from known geohazards, with no significant faults within proximity of activity (Elimination) •Results from existing wells confirm the lack of significant faulting or other geohazards •Previous stimulations completed in basin (such as Amungee NW 1H and 2h) without any uncontrolled fracture growth (Elimination) •Fracture modelling undertaken to determine maximum fracture growth prior to the commencement of stimulation activities. • Any faults encountered during drilling will be assessed to determine risk of stimulating with appropriate separation distances applied (Elimination). •Stimulation stages deployment will be away from geohazards to reduce the loss of fluids into any encountered faults (Elimination) •Separation of at least 200 m between each horizontal well, with final separation distance determined through modelling. (Elimination) •Each adjacent well designed and constructed with multiple (4) casing barriers and specifically-engineered cement in place to protect aquifers- this includes the 18.625" Conductor casing, 13.75" surface casing, 9.625" intermediate casing and 5.5" production casing.(Elimination) •1400 m separation distance between target Velkerri formation and the Gum Ridge Aquifer (Elimination) •No landholder bores within 1 km(Elimination) •Closest legacy exploration well 15 km (well is abandoned). •No major GDE linked to CLA within 20 km of extraction point. •Stygofauna eDNA has not been detected in the deep Gum Ridge bore; any impact is likely to be minor and localisedStygofauna eDNA has been detected in the Amungee NW1 bore; impact likely to be localised.	•Monitoring of stimulation pressure to detect and respond to anomalies which may indicate fluid being pumped to an open geological structure or migrating away from target zone (Engineering) • Pressure monitoring undertaken on adjacent wells •Groundwater monitoring bores adjacent to exploration wells (Administration)	•Stimulation activities to cease where fracture propagation is suspected to have interacted with an adjacent well.Stimulation activity on pad suspended until a go forward plan submitted by Tamboran and approved by DITT.	2	1	L	Yes	If an integrity issue was to occur, leakage of gas and flowback would be contained within the inner casing strings of the existing adjacent well , significantly reducing the consequence and likelihood of an event.The likelihood risk is mitigated through the 1) design of adjacent E&A wells which are constructed in accordance with the Code using multiple, verified barriers (Cement and steel casing) 2) the location of the closest historic exploration well is located approximately 20km from the well pad and 3) Geohazards have not been identified during the drilling of the existing wells. The likelihood is considered Remote", with a probability lower than 1%.	Yes	Low
6			Crossflow/well integrity caused by the deviation of an E&A well into the adjacent well during drilling	B.4.1 Well Integrity Management B.4.3 Well design and barriers	•Separation distance between adjacent wells: Vertical separation of >10m and horizontal separation of>200m used to ensure appropriate well separation. (Engineering) •Each adjacent well designed and constructed with multiple (4) casing barriers and specifically-engineered cement in place to protect aquifers- this includes the 18.625" Conductor casing, 13.75" surface casing, 9.625" intermediate casing and 5.5" production casing.(Engineering) • 1400 m separation distance between target Velkerri formation and the Gum Ridge Aquifer. (Elimination) •Subsurface collision of a well during drilling is unlikely to result in formation cross flow, with collision likely at depth (below Aquifers) and flow restricted to the well being drilled. Well being drilled will have multiple barriers (at least the conductor casing and surface casing) and blow out prevention in place during drilling (Engineering/Elimination) • Tamboran has conducted multiwell drilling operations across Australia, including the Cooper, Bowen and Surat Basins. Tamboran and their contractors experience is mature. (Engineering) •No major GDE linked to CLA within 20 km of extraction point, althoughStygofauna eDNA has been detected in the Amungee NW1 bore; impact likely to be localised •Stygofauna eDNA has not been detected in the deep Gum Ridge bore; any impact is likely to be minor and localisedStygofauna eDNA has been detected in the Amungee NW1 bore; impact likely to be localised	•Continuous GPS tracking of the drill bit to detect and respond to vertical and horizontal well deviations during drilling (Engineering) •Pressure monitoring undertaken on adjacent wells (Engineering)	•Well orientation to be actively controlled to prevent deviations into adjacent wells (Engineering) • Wells remediated in accordance with the code of practice (engineering) •Well suspension and abandonment may be required where wells interact during drilling (Engineering)	3	1	L	Yes	The consequence of the vertical or horizontal section of the well deviating into the adjacent well during drilling is primarily a destruction in asset value (potential plug and abandonment of both wells).Any cross flow is likely to be contained within both of the well bores- with casing and cement isolating the relevant aquifers. Given the continuous logging of GPS location of the bit, the likelihood is considered remote, with a probability less than 1%.	Yes	Low
7			Leakage of either flowback, produced water, or hydrocarbons (liquid and gaseous) from suspended or abandoned wells.	B.4.1 Well Integrity Management B.4.2 Aquifer Isolation B.4.3 Well design and barriers B.4.15 Well suspension and decommissioning B.4.15.2 Mandatory requirements for decommissioining wells Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34 D.5.5 Leak Remediation and Notification	•Each well designed and constructed with multiple (4) casing barriers and specifically-engineered cement in place to protect aquifers- this includes the 18.625" Conductor casing, 13.75" surface casing, 9.625" intermediate casing and 5.5" production casing (Engineering) •Casing shoe for the conductor and surface casing section to be located in the base of each aquifer unit, with cement returned to surface (Engineering) •Well design and Well Barrier Integrity Validation reports submitted to DITT as part of Well Operations Management Plan (WOMP). (Administration) •Cement plugs used to isolate hydrocarbon zones from aquifers •Cement plugs to be tagged to test plug integrity •Casing annuli pressure to be monitored to determine successful formation isolation. •Any impacted area likely to be localised, around the immediate vicinity of the E&A wells. (Elimination) •No landholder bores within 1km. (Elimination) •No major GDE linked to CLA within 20 km of extraction point, although eDNA indicates the presence of stygofauna in the Amungee NW1 bore	•Integrity of isolation validated before and after stimulation and maintained throughout well life (Engineering) •Monitoring of cement returns to surface, with cement volume sand density as per programme (Engineering) •Cement bond logs(CBL)completed on each well prior to stimulation to confirm integrity (Engineering) •A Well Barrier Integrity Validation report approved by DITT as part of Well Operations Management Plan (WOMP) (Administration) •Routine (6 monthly) monitoring of well integrity in accordance with Code (Engineering) •Routine (6 monthly) well leak detection on all wells.	•Any contamination event to be characterised and have remediation plans developed and executed immediately in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	3	1	L	Yes	The risk is primarily reduced through the stringent well barrier design, construction and verification requirements outlined in the Code.If an integrity issue was to occur, leakage of gas and flowback would be contained within the inner casing strings significantly reducing the consequence and likelihood of an event.A contamination event is likely to result in "serious", reversible moderate impacts (months to years) restricted to the vicinity of the well pad.The likelihood is reducedby the presence of multiple casing strings, likely low leakage rate and rapid dilution of any contamination. The NT Inquiry concluding the likelihood of this scenario being very low, typically less than 0.1%. This likelihood of thisrisk is therefore considered to be "remote".	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
8		Contamination of aquifer from surface activities (chemical and waste storage, handling, treatment, recycling and spills) impacting a receptor (groundwater user or GDE).	Surface contamination from storage and disposal of drilling fluids, additives, muds and cuttings on-site.	A.4.7 Containment of Contaminants B.4.13 Hydraulic Stimulation and Flowback Operations C.5.1 Drilling Materials C.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan C.8.1 Wastewater Management Plan	•Each well cellar to be concrete lined to contain drilling fluids with pumps to prevent overflow •Drill cuttings and muds are not expected to contain high NORMs levels- with validation testing undertaken in accordance with the Code •Open wastewater evaporation tanks and drill sumps to have a 1:1000ARI wet season freeboard (wet season freeboard 1.3m). •Drilling sumps to be lined with an impermeable coletanche liner with a permeability of less than6 x10-14 m/s . •Drilling sump to be designed and operated to handle the drilling of multiple wells •Sump solid levels to be periodically removed from the sump between wells to maintain sump capacity •Any removed drilling muds and cuttings from the sump will be stored on an impermeable liner with a permeability of less than6 x10-14 m/s-any fluid captured and directed to the wastewater tank •Drill cuttings and muds to be tested and either disposed of onsite in accordance with the Code of Practice or disposed of at a licenced waste management facility. •Storage areas to be lined with an impermeable liner (with a permeability of less than6 x10-14 m/s to prevent contamination •Separation between sump and aquifer over 70 m, with interbedded clays present. •Nearest landholder extraction bore 1km. •No major GDE linked to CLA within 20 km of extraction point, althoughStygofauna eDNA has been detected in the Amungee NW1 bore; impact likely to be localised •Drilling waste trial to be completed during the dry season, trial area to be lined as per code, with material to be dried before handling and site bunded to contain residual fluid.	•Inspections of secondary containment to be undertaken daily during the wet season (leak detection may be utilised for liner integrity inspections) and weekly at other times to identify potential liner issues. • Groundwater monitoring bores installed at each exploration well site to detect any potential contamination. •Groundwater monitoring completed quarterly to detect changes in groundwater quality.	•Any damage to sump liner to be repaired as soon as practicable. •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering) • Any spills of drilling fluid and muds to be cleaned up as soon as practicable	2	2	L	Yes	In accordance with the Code, the onsite storage anddisposal of drilling fluids and cuttings can only occur if the activity does not represent an unacceptable environmental hazard. All drilling fluids, muds and cutting will be stored in a lined sump, with testing undertaken prior to final disposal. Sump liner failure is considered to be a low consequence event, with contamination likely to be restricted to the immediate vicinity of the sump due to a lack of hydrological head. Onsite disposal will only occur if determined to be safe by an independent third party.The consequences are therefore likely to be restricted to a Moderate- short term reversible impacts. The likelihood of contamination through drilling fluid, mud and cuttings storage and failure is considered highly unlikely, with the probability below 10%.This is largely due to the separation distance between the underlying aquifer, use of lined sumps andthird partydisposal suitability assessments.	Yes	Low
9			Storage, handling and transportation of produced hydrocarbons.	A.4.7 Containment of Contaminants C.3.3 Wastewater management legislative requirements C.8.2 Spill Management Plan	• Use of a horizontal flare reduces potential risks during simultaneous activities on the well pad such as flaring and hydraulic fracture stimulation. • Tanks to be compliant with AS 1692 and double-lined • Spill Management Plan implemented to prevent, detect and respond to spills. • Separation between condensate storages and closest aquifer over 70 m, with interbedded clays likely to limit any contaminant migration. • Any condensate transportation to be undertaken by licenced transporters (for dangerous goods or wastes) • No indication of shallow groundwater in the vicinity of the flare pit. •Nearest landholder extraction bore 1 km. • Impact and control groundwater monitoring bores installed to detect any potential contamination. • Spills and leaks to be cleaned upimmediately. • No major GDE linked to CLA within 20 km of extraction point, although stygofauna eDNA has been detected in the Amungee NW1 bore; impact likely to be localised	•Weekly inspections to identify any potential leaks or spills from storage and handling areas. •Daily level monitoring during production •Quarterly groundwater monitoring	•Spill management plan implemented outlining leak classification, response and reporting requirements •All leaks to be cleaned up as soon as practicable •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	2	1	L	Yes	The regulatory regime legislating the storage, handling and transportation of dangerous goods and combustible liquids within Australia is mature. Double lined tanks will be used which will reduce the potential for spills/ leaks. Any spillage is likely to be locally restricted, small and rapidly detected.Consequences are considered moderate, with impacts spatially restricted to the well pad, primarily located on the surface (condensate has low mobility) an likely to be of a short term (days to weeks).The likelihood of contamination is influenced by the lack of mobility of condensate, separation distance between aquifer and the surface and likely rapid detection of any spills.The likelihood of a groundwater event from condensate management is considerredremote witha <1% probability.	Yes	Low
10			Surface spills from storage, handling, treatment, recycling and transportation of flowback water (including gathering lines)	A.4.7 Containment of Contaminants B.4.13 Hydraulic Stimulation and Flowback Operations C.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan C.8.1 Wastewater Management Plan	•Tanks to be double-lined with impermeable liners with impermeable membrane with coefficient of permeability of less than 10-9 m/s • Liner damage from termites to be managed through deployment of baits and termite deterrents (termites/spraying) • Where extended wastewater evaporation with high EC fluid is proposed, a thicker liner (0.71 to 0.91mm) will be used to reduce the risk of liner tears from salt solids •Leak detection to be located within the interstitial space between the primary and secondary liner to detect any potential leaks. •Chemical storage & handling areas to have secondary containment, with an impermeable membrane with coefficient of permeability of $<10^{-9}$ m/s. • The well pad is compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s • The site is earthen bunded to prevent offsite release of flowback - an additional level of containment, as the primary and secondary containment is the principle spill risk control. •The earthen bund is constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied. •The site earthen bund has a bund wall height of 300 mm capable of managing at least 110% of the largest wastewater tank volume. •Licenced waste transporters to be used for all listed waste transportation •Evaporation tanks storing solid salt to have a higher density liner capable of resisting the puncture of the salt solids. •Based on the Amungee NW-1H well, NORM levels are not anticipated to be significant.- with characterisation of levels within drilling wastewater and flowback undertaken to validate. • All flowback transfer piping to have secondary containment around surface connection points • All piping used to transfer flowback to be appropriately pressure rated, tested and maintained to prevent spills •Separation between chemical storages and closest aquifer over 70 m, with interbedded clays likely to limit any contaminant migration. •Gathering lines designed, constructed and operated in accordance with the APGA Code, with leak detection and shut off valves constructed. • Gathering have a design life of in excess of 50 years • Gathering line burial depth and hardness of polyethylene pipeline to minimise termite attack •All suspended and decommissioned line sot be purged clean of residual contaminants •No sink holes in vicinity of gathering lines • Nearest landholder extraction bore >1 km. •No major GDE linked to CLA within 20 km of extraction point, although stygofauna eDNA has been detected in the Amungee NW1 bore; impact likely to be localised	•Leak detection to be located within the interstitial space between the primary and secondary liner to detect any potential leaks. • Leak detection alarms to identify when a leak is potentially identified •Daily inspections during wet season and weekly inspections during the dry season to identify any potential leaks. •Impact and control groundwater monitoring bores installed to detect any potential contamination •Quarterly groundwater monitoring •Sampling for NORMs to characterise and assess levels within drilling wastewater and flowback undertaken.	•Liner leaks to be investigated and liners repaired as soon as practicable •Spills and leaks to be cleaned up and rectified immediately •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	2	1	L	Yes	The consequence and likelihood of groundwater contamination are reduced by the duration of the activity,separation of underlying aquifer units for the surface, mandated use of double lined tanks with continuous leak detection and secondary containment for all chemical storage areas. Any spill onsite is therefore likely to be small, restricted to the chemical storage areas and rapidly detected.The potential consequence ofground water contamination event is likely to be "moderate", with potential spill consequences likely to be locally restricted,moderate-short termand reversible.The likelihood is reduced down to remote with a probability of less than 1%.This is primarily influenced by the lack of spill sources, separation distance between aquifers and the surface and spill management plan that will rapidly detect any spills.	Yes	Low
11			Storage, handling and transportation of chemicals, fuels and wastes. Including on unsealed roads during the wet season.	A.4.7 Containment of Contaminants C.3.3 Wastewater management legislative requirements C.8.2 Spill Management Plan	•All chemical, fuel and waste storage, and high risk spill handling areas are to have secondary containment, with an impermeable liner with coefficient of permeability of less than 10-9 m/s •Licenced waste transporters to be used to transport listed wastes. •Chemicals to be transported in accordance with the Australian Dangerous Goods Code and NT Dangerous Goods Act. •No chemical or wastewater transportation during wet season, unless transportation is undertaken in accordance with the following: -Unless a risk assessment determined the activity is safe and low risk -Transportation will not occur on track where the surface is not safe to allow transportation vehicles to drive upon -Wastewater and chemical transportation will not be undertaken through flooded waterways -The transportation of wastewater/ chemicals during rainfall events will be avoided -Driving on unsealed roads and access tracks will be avoided 24 hours following a >20mm rainfall event -After a >20mm rainfall event, or when the integrity of any unsealed road may be compromised due to prolonged rainfall, each unsealed access track proposed to b e used for wastewater/ chemical transportation will be inspected to ensure the integrity of the road is sufficient to allow safe passage of the proposed transport vehicle. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to prevent offsite release of flowback.This is considered an additional level of containment, as the primary and secondary containment is the principle spill risk control. •Site earthen bunding will have a minimum bund wall height of 300mm capable of managing at least 110% of the largest wastewater tank volume. •The earthen bund will be constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied. •All transportation of listed wastes and dangerous goods to be undertaken via licenced contractors. •Area is remote with major urban areas to be avoided during the transportation of dangerous goods and wastes in accordance with the NT Dangerous Goods Act. •Separation between chemical stores and closest aquifer over 70m, with interbedded clays likely to limit any potential contaminant migration. •Nearest landholder extraction bore 1km. •Depth of aquifers generally below known stygofauna distribution range (elimination)	•Daily inspections during wet season when chemicals are stored and weekly thereafter to identify and respond to any potential leaks. •Impact and control groundwater monitoring bores installed around exploration wells to detect any potential contamination. •Groundwater monitoring of controland impact monitoring bores on a quarterly basis.	•Liner leaks to be investigated and liners repaired as soon as practicable •Spills and leaks to be cleaned up and rectified immediately •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	2	2	L	Yes	The storage, handling and management of chemicals is a standard activity that is managed through a mature nationally uniform regulatory setting.The Code further reduces the likelihood/consequence of chemical spills and contamination, through the mandated use of secondary containment, a spill management plan and groundwater monitoring. Any spills are likely to be locally restricted and rapidly detected (hours to days). The consequence of a spill/ leak is therefore considered to be "moderate", with moderate short term(days). Given the requirement for a spill management plan, secondary containment requirements and 70m separation distance to aquifers, the likelihood of a spill/leak reaching an aquifer is considered remote with a probability of less than 1%.	Yes	Low
12			Overtopping of drilling sumps and flowback tanks (including during wet season)	A.4.7 Containment of Contaminants C.6 Monitoring mandatory requirements C.8.2 Spill Management Plan	•Drilling sump to be designed and operated to handle the drilling of multiple wells •Sump solid levels to be periodically removed from the sump between wells (or as required) to maintain sump capacity •Covered tanks to manage flowback storage, with enough enclosed storage onsite to manage all stored flowback. •Results from previous well testing used to optimise available tank capacity to allow for multiple wells •Additional tank capacity to be installed as required, with new tank capacity taking less than 14 days (subject to access and resource availability) •Open wastewater evaporation tanks and drill sumps to have a 1:1000ARI wet season freeboard (wet season freeboard 1.3m). •All flowback wastewater (other than the minimum volume required to integrity of the open tank liner) to be transferred to enclosed tanks prior to the onsite of a "significant rainfall event (>300mm of forecasted rain over a 4 day periodic) • Wastewater transfers into any tank/ sump will cease prior to fluid levels exceed the relevant freeboard level . Wastewater transfers into a open tank/sump will not occur until levels return to below the relevant freeboard. •Sufficient pumps available onsite to meet volume transfer requirements, with available pump redundancy in case of mechanical issues. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to 300 mm to prevent offsite release of flowback.This is an additional level of containment, as the primary and secondary containment is the principle spill risk control. Site earthen bunding capable of managing at least 110% of the largest wastewater tank volume. The earthen bund will be constructedto withstand a tank failure scenario with appropriate compaction and stabilisation applied. •Site is manned at all times or have telemetered level logging during wastewater storage, with helicopters to be used to fly in staff when road access is prevented. •Separation between underlying aquifers >70m, with interbedded clays likely to limit any potential contaminant migration. •Nearest landholder extraction bore 1 km. •Depth of aquifers generally below known stygofauna distribution range (elimination) • all gathering lines constructed in accordance with Code of Practice for Upstream Polyethylene Gathering Network in the CSG Industry, Version 5, August 2019 (APGA 2019). •Gathering lines hydrotested to confirm integrity, with leak detection used to identify leaks.	•Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times •Daily significant rainfall monitoring during the wet season. •Spill Management Plan implemented to prevent, detect and respond to spills. •Impact and control groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly. • Monthly inspections of right of way to identify leaks	•All flowback (other than the volume required to maintain the integrity of an open tank liner) to be transferred to enclosed tanks 8 hours before the onset of a significant rainfall event (defined as >300mm of rain over a 4 day period) •Operations (flowback and drilling) to cease prior towastewater (sump or flowback storage) freeboards being exceeded or prior to the capacity of enclosed tank storage being insufficient to manage all flowback. • No additional drilling fluids or wastewater shall be added to the sump/tank once the freeboard has been met. Any flowback stored within an open top tank above the freeboard level must be transferred to the enclosed tanks onsite immediately. •DEPWS to be notified within 48 hours where the freeboard of a tank or sump has been exceeded and the forward monitoring and management strategies to prevent an overtopping event (including revised action and reporting triggers) •Drilling fluids to be transferred to wastewater tanks,removed from site or other actions implemented(such as deployment of covers etc.) to minimise the risk of overtopping to ensure the sump freeboard level remains above 1:1000 ARI 7-day rainfall event (580mm)- unless otherwise agree to with prior approval from DEPWS to account for forecasted risk mitigation factor (such as forecasted climatic/seasonal factors) •Flowback activities to cease and new wastewater tanks to be constructed onsite if flowback wastewater storage volumes areinsufficient to maintain the required enclosed freeboard levels • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the NEPM (Assessment of site Contamination)(Engineering)	2	1	L	Yes	The Code provides onerous regulatory requirements that essentially eliminate the risk of wastewater storage overtopping events.The consequences of an overtopping event are limited through the construction of earthen bunds and compaction of the well pad.A wastewater management plan, spill management plan and emergency response plan is implemented to further ensure any overtopping events are prevented, detected and responded to. In the event of an overtopping incident, such spill is likely to be contained onsite and rapidly responded to. The consequence of an overtopping event is therefore considered to be "moderate", with moderate short term (weeks-months) contamination.Given the requirements for enclosed tanks and a1"1000 wet season freeboard, the potential for overtopping are considered remote, with a probability less than 1%.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
13			Failure of flowback storage tank, including structural failure	A.4.1 Site selection and planning c.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	•Wastewater Management Plan implemented in accordance with the Codes of Practice to mitigate the risk associated with wastewater generation and management. •Spill Management Plan implemented to prevent, detect and respond to spills- including requirements for daily wastewater tank inspections during the wet season and weekly at all other times. •Tanks designed and engineered to AS3990 Mechanical Equipment- Steel Work, AS 1170.1 Hydrostatic loading, AS1170.2 Wind Rating (cyclonic wind rating) •Wastewater tank liner with impermeable membrane with coefficient of permeability of less than 10-9 m/spermeability, 120N picture resistance and 49N tear resistance •Covered wastewater tanks and condensate tanks to have vents to prevent pressure build up. •Sufficient pump capacity available to recover any spilled wastewater. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The wastewater storage area is earthen bunded to 300 mm to prevent offsite release of flowback.This is an additional level of containment, as the primary and secondary containment is the principle spill risk control. Site earthen bunding capable of managing at least 110% of the largest wastewater tank volume. The earthen bund will be constructedto withstand a tank failure scenario with appropriate compaction and stabilisation applied. •Separation between well pad and closest aquifer over 70m, with interbedded clays likely to limit any potential contaminant migration. •Nearest landholder extraction bore 1 km. •No major GDE linked to CLA within 20 km of extraction point, althoughStygofauna eDNA has been detected in the Amungee NW1 bore; impact likely to be localised	•Weekly wastewater tank integrity inspections during wastewater storage to detect •Impact and control groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly. •Quarterly groundwater monitoring completed to detect potential contamination.	•Wastewater tank structural defects to be rectified as soon as practicable. •Wastewater to be transferred from defective tanks to alternative tanks onsite until repairs completed. •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately •Earth moving equipment available regionally to clean up spills •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering	3	1	L	Yes	The consequences of a tank failure are negated through the use of double lined, engineered above ground tank which have continuous leak detection and alarms. Tanks and their liners are designed with sufficient structural integrity to withstand cyclonic winds, extreme temperatures and loading stress forces under a range of conditions.A spill management pan is in force to detect, prevent and respond to potential spills of wastewater. If a storage failure was to occur, the wastewater would be restricted to the well pad.Flowback would be pumped into available enclosed and open tank storage, with contaminated soil removed from site. the consequences are likely to be "serious", being locally restricted, moderate duration (weeks) and reversible.The likelihood is reduced by the Code requirements , tank design separation distancesto the underlying aquifer. The likelihood is considered Remote, withe a probability less than 1%.	Yes	Low
14		Unsustainable groundwater extraction impacts landholders and groundwater dependent ecosystems.	Over extraction of groundwater for civils, drilling, stimulation and seismicactivities.	Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34	•Groundwater extraction for activities to be restricted to the minimum water required (220ML per site (110ML per well)). (Elimination) •All water take licenced in accordance with NT Water Act under Water Extraction Licence (WEL) GRF 10285 (Administration) •Drawdown from the activities and other users assessed by DEPWS as a part of WEL; impacts to closest receptor not anticipated (Administration/ Elimination) Karst system is under allocated, with sufficient available capacity to support proposed water extraction requirements. (Elimination) •Closest pastoral bore is >1 km from extraction point (Elimination)	•Continuous flow meters to monitor take and water balance implemented to ensure compliance with WEL (Administration) •Groundwater monitoring completed to identify impacts associated with water extraction (Engineering)	•Groundwater extraction to cease where sustained drawdown post pumping exceeds 1 m (Administration)	3	1	L	Yes	The extraction of groundwater for the proposed activities requires all take to be licenced.The proposed take is assessed as a part of the licence application, with the assessment considering current and future water take levels.Based on this assessment, it was determined that the extraction rate would not impact upon adjacent users.The risk consequence is determined to be "serious"- given any impact is likely to cause pastoralist and broader community concern.The likelihood of such a consequence from occurring is considered remote (probability <1%) due to the quality of the Cambrian limestone aquifer, separation distance from surrounding users and under utilisation of the targeting aquifer.	Yes	Low
15	**Inland water environmental quality**	Contamination of surface water from surface activities.	Failure of flowback storage tank.	A.4.1 Site selection and planning C.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	•Wastewater Management Plan implemented in accordance with the Codes of Practice to mitigate the risk associated with wastewater generation and management. •Spill Management Plan implemented to prevent, detect and respond to spills- including requirements for daily wastewater tank inspections during the wet season and weekly at all other times. •Tanks designed and engineered to AS3990 Mechanical Equipment- Steel Work, AS 1170.1 Hydrostatic loading, AS1170.2 Wind Rating (cyclonic wind rating) •Wastewater tank liner with impermeable membrane with coefficient of permeability of less than 10-9 m/spermeability, 120N picture resistance and 49N tear resistance •Higher density liners used for evaporation tanks where long term evaporation could generate solid salt that could puncture a liner. • Liner damage from termites to be managed through deployment of baits and termite deterrents (termites/spraying) •Covered wastewater tanks and condensate tanks to have vents to prevent pressure build up. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to 300 mm to prevent offsite release of flowback.This is an additional level of containment, as the primary and secondary containment is the principle spill risk control. Site earthen bunding capable of managing at least 110% of the largest wastewater tank volume. The earthen bund will be constructedto withstand a tank failure scenario with appropriate compaction and stabilisation applied. • No mapped watercoursesin proximity to gathering lines or sites containing flowback. Closest stream order 1 ~12km away with closest major wetland >90 km away (Lake Woods). •Firebreaks maintained and lids to be flooded with water to combat ember attack damaging liner	•Weekly wastewater tank integrity inspections during wastewater storage to detect •Routine level monitoring and alarms	•Wastewater tank structural defects to be rectified as soon as practicable. •Wastewater to be transferred from defective tanks to alternative tanks onsite until repairs completed. •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately •Earth moving equipment available regionally to clean up spills •Emergency response plan implemented. • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	3	1	L	Yes	The consequence and likelihood of a containment failure are negated through onerous wastewater management requirements stipulated in the Code. The well pad is bunded, preventing the offsite release of wastewater in the event of a failure.A spill management plan is required to be implemented to prevent, detect and respond to spills to prevent offsite releases.The spill is therefore likely to be smaller, with any spillage restricted to the well pad. The consequence of a spill is therefore considered to be "serious", with moderate short term (weeks-months) contamination. The area is not in close proximity to major watercourse with at least 12 km separation distance for sites storing flowback and drilling fluid.Shenandoah South is 450m from an intermittent stream order 1- with no long term storage proposes..Given the separation distance and bunding, the likelihood is considered remote, with the probability of occurring less than 1%.	Yes	Low
16			Overtopping of drilling sumps and flowback tanks (including wet season operations)	A.4.7 Containment of Contaminants C.6 Monitoring mandatory requirements C.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	•Drilling sump to be designed and operated to handle the drilling of multiple wells •Sump solid levels to be periodically removed from the sump between wells (or as required) to maintain sump capacity •Covered tanks to be used to manage flowback storage, with enough enclosed storage onsite to manage all stored flowback. •Results from previous well testing have been used to optimise available tank capacity to allow for multiple wells •Additional tank capacity to be installed as required, with new tank capacity taking less than 14 days (subject to access and resource availability) •Open wastewater evaporation tanks and drill sumps to have a 1:1000ARI wet season freeboard (wet season freeboard 1.3m). •All flowback wastewater (other than the minimum volume required to integrity of the open tank liner) to be transferred to enclosed tanks prior to the onsite of a "significant rainfall event (>300mm of forecasted rain over a 4 day periodic) • Wastewater transfers into any tank/ sump will cease prior to fluid levels exceeding the relevant freeboard level. Wastewater transfers into a open tank/sump will not occur until levels return to below the relevant freeboard. •Sufficient pumps available onsite to meet volume transfer requirements, with available pump redundancy in case of mechanical issues. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to 300 mm to prevent offsite release of flowback.This is an additional level of containment, as the primary and secondary containment is the principle spill risk control. Site earthen bunding capable of managing at least 110% of the largest wastewater tank volume. The earthen bund will be constructedto withstand a tank failure scenario with appropriate compaction and stabilisation applied. •Site is manned at all times or have telemetered level logging during wastewater storage, with helicopters to be used to fly in staff when road access is prevented. •Separation between well pad and closest aquifer over 70m, with interbedded clays likely to limit any potential contaminant migration. •Nearest landholder extraction bore 1 km. •Depth of aquifers generally below known stygofauna distribution range (elimination)	•Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times •Daily significant rainfall monitoring during the wet season. •Spill Management Plan implemented to prevent, detect and respond to spills. •Impact and control groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly.	•All flowback (other than the volume required to maintain the integrity of an open tank liner) to be transferred to enclosed tanks 8 hours before the onset of a significant rainfall event (defined as >300mm of rain over a 4 day period) •Operations (flowback or drilling) to cease prior to the wastewater (sump or flowback storage)open tank freeboard being exceeded or beforeenclosed tank capacity is insufficient to manage all flowback stored on the site. • No additional drilling fluids or wastewater shall be added to the sump/tank once the freeboard has been exceeded. Any flowback stored within an open top tank above the freeboard level must be transferred to the enclosed tanks onsite within 24 hours. •DEPWS to be notified within 48 hours where the freeboard of a tank or sump has been exceeded and the forward monitoring and management strategies to prevent an overtopping event (including revised action and reporting triggers) •Drilling fluids to be transferred to wastewater tanks,removed from site or other actions implemented(such as deployment of covers etc.) to minimise the risk of overtopping where the sump freeboard level is below 1:1000 ARI 7-day rainfall event- unless otherwise agree to with prior approval from DEPWS to account for forecasted risk mitigation factor (such as forecasted climatic/seasonal factors) •New wastewater tanks to be constructed onsite if flowback wastewater storage volumes areinsufficient to maintain the required enclosed freeboard levels •Operations (flowback and drilling) to cease if insufficient wastewater (sump or flowback storage) is available to meet freeboard and enclosed tank availability requirement. • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the NEPM (Assessment of site Contamination) (Engineering)	2	1	L	Yes	The consequence and likelihood of a wastewater storage overflowing are minimised through the onerous wastewater management requirements stipulated in the Code. This includes well pad bunding, tank level alarms, tank freeboard requirements and use of a wastewater management plan.Any overflow is likely to be restricted to the well pad, rapidly detected and promptly cleaned up.The use of enclosed tanks, freeboard and well pad bunding essentially eliminates the likelihood potential for a wastewater storage tank to overflow.Given the onerous regulatory requirements, the likelihood of an overtopping event is considered Remote, with a <1% probability of occurring.	Yes	Low
17			Transportation accident releasing chemical or wastewater (drilling fluid and flowback).	A.4.7 Containment of Contaminants C.8.2 Spill Management Plan	•No chemical or wastewater transportation during wet season, unless transportation is undertaken in accordance with the following: •Transportation will not occur on track where the surface is not safe to allow transportation •Wastewater and chemical transportation will not be undertaken through flooded waterways •Unless a risk assessment determined the activity is safe and low risk •The transportation of wastewater/ chemicals during rainfall events will be avoided •Driving on unsealed roads and access tracks will be avoided 24 hours following a >20mm rainfall event •After a >20mm rainfall event, or when the integrity of any unsealed road may be compromised due to prolonged rainfall, each unsealed access track proposed to b e used for wastewater/ chemical transportation will be inspected to ensure the integrity of the road is sufficient to allow safe passage of the proposed transport vehicle •All wastes to be transported in accordance with the NT Waste Management and Pollution Control Act. •All dangerous goods to be transported in accordance with the NT Dangerous Goods Act and Australian Dangerous Goods Code. •Transportation route to avoid major urban areas •All drivers to be appropriately licenced •Fatigue management plan implemented, requiring journey management plans and drivers to rest every 2 hours •Strict drug and alcohol policy implemented, with routine testing and zero tolerance policy to alcohol (0.00% limit) and drugs •Area is remote with major urban centres to be avoided. •Risk to any receptor is identical to that of normal diesel or petroleum tankers. •Training of Tamboran supervisors regarding chain of responsibility requirements to minimise the risk of driver fatigue •The transportation of waste and chemicals across Australia is a standard practice with mature codes and legislation in place.the transportation of fuels, chemicals and wastes occurs every year in the NT to support existing industry's during the wet season.	•Transport incident statistics collected and monitored. •Onsite assurances and fit for work assessments completed periodically on transport companies.	•Spill Management Plan and Emergency Response Plan implemented to prevent, detect and respond to spills. •Contractor performance reviews completed where breaches in requirements are escalated and actions implemented to rectify defects.	3	1	L	Yes	The transportation of wastes and chemicals is a tightly controlled industry with mature practices designed to prevent, detect and respond to transportation spills. Any accident is likely to be restricted to road corridors and result in "serious", short term (days-weeks) reversible impacts.All contractors must be appropriately licenced, with National uniform legislation in place to offer a high level of regulatory protection.This risk is considered identical to that of bulk diesel and other dangerous goods transportation- a common activity throughout Australia.Fuel and chemical transport accidents are rare given the number of transportation movements in Australia. The likelihood of an event occurring is therefore considered "remote", what a probability of less than 1%.	Yes	Low
18			Storage and handling of chemicals and fuel.	A.4.7 Containment of Contaminants C.8.2 Spill Management Plan	•All areas where chemicals and fuels are stored, will have secondary containment with a coefficient of permeability of less than 10-9 m/s • Secondary containment to be maintained in a good working order •Spill Management Plan implemented to prevent, detect and respond to spills. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to prevent offsite release of contaminants, with all stormwater directed to an onsite retention pond for testing prior to offsite release. The earthen bund will be constructed to withstand a tank failure scenario with appropriate compaction and stabilisation applied. •Area is remote with closest homestead approximately 16 km away.	•Daily inspections will be implemented during the wet season and spills rectified immediately	•All spills to be cleaned up as soon as practicable (within the shift that spill was observed) •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	2	1	L	Yes	The storage, handling and management of chemicals is a standard activity that is managed through a mature regulatory setting.The Code further reduces the likelihood and consequence of chemical spills and contamination, through the mandated use of secondary containment, a spill management plan and groundwater monitoring. A spill event is likely to result in moderate, short term reversible impacts restricted to the existing well pad.The likelihood is further reduced down to remote (<1% probability of occurring) based onthe 12 km separation distance from the sites stoning flowback/ drilling wastewater, with no long-term storage at Shenandoah N A.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
19			Release of contaminated stormwater from activities to surface water, including during flooding	A.4.1 Site selection and planning A.4.3 Erosion and sediment control and hydrology	•Erosion and sediment controls implemented around the sites to minimise erosion and sediment releases (Engineering) •Stockpiled debris to be used to discourage water concentration. (Engineering) •Well pad to be earthen bunded to prevent offsite release of stormwater from exposed surfaces (Engineering) •Sites to be maintained, with vegetation cover on exposed bunds/ stockpiles established and erosion and sediment controls kept in working order (Elimination) •Contaminated stormwater to be retained on-site, treated and disposed off-site at a licenced disposal facility (Administration/ Engineering) •A sediment sock to be used to reduce sediment levels within stormwater releases. (Engineering) •Clean stormwater to be reused or released off-site in a manner that reduces the risk of erosion (Elimination) •Well pad located away from watercourses or regional flow paths. (Elimination) •Area is remote with closest major watercourse at least 12 km away from any site storing flowback . Shenandoah N A located 450m from an intermittent stream order 1- with no long term storage of drilling wastes. (Elimination)	•Pre-wet season site assessment completed to identify any maintenance requirements (Administration) •Stormwater captured in sediment basin to be tested and released offsite in a controlled manner (Engineering) • Drilling waste compost area to be inspected weekly.	•Maintenance to be undertaken on erosion and sediment controls to ensure ongoing functionality (Engineering) •Corrective actions implemented where releases of water from drilling waste compost area is detected.	**1**	**2**	**L**	Yes	All stormwater retained onsite during well testing will be collected in a purpose built sediment basin and tested prior to release. Releases must comply with the stipulated criteria to ensure contaminants are not released from site. The release of stormwater will also be via a "Sediment sock", with a reasonable consequence of minor, localised reversible impacts. The likelihood is reduced down to remote (<1% probability of occurring) based onthe 12 km separation distance from the sites storing flowback/ drilling wastewater, with no long-term storage at Shenandoah N A.	Yes	Low
20			Runoff from sewage treatment irrigation areas.	A.4.1 Site selection and planning	•Irrigation areas located away from watercourses (Elimination) •A wastewater suitability acceptance assessment has been completed and a design approval for wastewater disposal received in accordance with the NT Department of Health Code for On-site Wastewater Management (July 2014) (Engineering) •Wastewater irrigation to comply with DOH requirement (Engineering) •Areas appropriately sized to accommodate irrigation volume (Engineering) •Area is remote with closest major watercourse at least 12 km away fromthe Shenandoah Sth locations . Shenandoah N A located 450m from an intermittent stream order 1- with no long termcamp activities. (Elimination)	•Wastewater system performance to be monitored in accordance with the manufacturers requirements (Administration)	•Where wastewater specifications are exceeded, corrective actions will be implemented to ensure wastewater is returned back into specification (Engineering)	**1**	**1**	**L**	Yes	The management of sewerage and greywater is mature with various NT wastewater management guidelines. Due to the temporary nature of the activity, the maximum contamination resulting from sewerage and grey water irrigation is likely to be minor, with any impacts locally restricted and temporary in nature.The closest watercourse isat least 450 away from Shenandoah N A, with 12km from the next closest site.Shenandoah N A doe snot have long erm activity planned. The potential contamination of these features considered remote (probability <1%).	Yes	Low
21			Uncontrolled release of formation fluid encountered during drilling, stimulation, barrier failure	B.4.1 Well integrity management B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and flow back operations D.5.8 Venting and flaring	•Drilling overbalanced to reduce the inflows of hydrocarbons and fluids (Engineering) •Blow out prevention in place to manage well failure and uncontrolled gas/ fluid/pressure influxes (Engineering) •Blow out preventor pressure rating and testing •All equipment will be API compliant to handle expected conditions (Engineering) •Site manned during operation (Administration) •Well suspended with multiple cement and casing barriers in place- with 4 casing section utilised (conductor, surface, intermediate and production).(Engineering) •Barricading to be used to protect each exploration well from vehicle collision during multi-well drilling activities. (Engineering)	•Process monitoring to detect events that could potentially result in a uncontrolled release of gas/fluids/pressure (such as fluid balances, well head pressure etc.) (Engineering) •Routine (monthly) well inspections (Administration	•An emergency as diverter and flare to be used during drilling to manage gas ingress (Engineering) •Contracts in place with emergency well intervention specialists (such as Boots and Cootes) (administration) •Emergency response plan implemented (administration)	**2**	**2**	**L**	Yes	The Code and standard drilling, stimulation and well testing safety controls are designed to prevent the uncontrolled release of hydrocarbons and produced fluids. The consequence are anticipated to be moderate, with impacts likely to be moderate, restricted in duration (minutes to hours).The likelihood is considered highly unlikely with a occurrence probability less than 10%, based on the well designed, construction and operations requirements mandated by the Code.	Yes	Low
22			Uncontrolled release of wastewater, chemicals or fuel from site due to regional flooding.	A.4.1 Site selection and planning A.4.3 Erosion and sediment control and hydrology	•Area is remote with closest major watercourse at least 12 km away from any site storing flowback. Shenandoah N A located 450m from an intermittent stream order 1- with no long term storage of drilling wastes. No sites impacted by regional flooding (Elimination) • No major wetlands, with Longreach lagoon 50km+, Lake Woods 90km+ • Flood modelling of well pad completed to optimise site location (Elimination) •Activity located away from regional flow paths with low erosivity of flood anticipated (Elimination) •Erosion and sediment controls implemented around the sites to minimise erosion and sediment releases, including diversion bunds (Engineering) •Stockpiled debris to be used to discourage water concentration. (Engineering) •Well pad to be earthen bunded to prevent offsite release of water and to prevent flood impacts- bunds to be sized to accommodate 1:100 AEP flood (Engineering) • Stormwater retained onsite to be tested and regularly discharged to maintain the integrity of the site during flowback wastewater storage. •Clean stormwater to be reused where possible or released off-site in a manner that reduces the risk of erosion (Elimination) •Contaminated stormwater to be retained on-site, treated and disposed off-site at a licenced disposal facility (Administration/ Engineering) •Sites to be maintained, with vegetation cover on exposed bunds/ stockpiles established and erosion and sediment controls kept in working order (Elimination) •Well pad located away from watercourses or regional flow paths. (Elimination) •Wastewater Management Plan implemented in accordance with the Codes of Practice to mitigate the risk associated with wastewater generation and management. •Spill Management Plan implemented to prevent, detect and respond to spills- including requirements for daily wastewater tank inspections during the wet season and weekly at all other times. •Tanks designed and engineered to AS3990 Mechanical Equipment- Steel Work, AS 1170.1 Hydrostatic loading, AS1170.2 Wind Rating (cyclonic wind rating) •Wastewater tank liner with impermeable membrane with coefficient of permeability of less than 10-9 m/spermeability, 120N picture resistance and 49N tear resistance •Higher density liners used for evaporation tanks where long term evaporation could generate solid salt that could puncture a liner. • Liner damage from termites to be managed through deployment of baits and termite deterrents (termites/spraying) •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to 300 mm to prevent offsite release of flowback.This is an additional level of containment, as the primary and secondary containment is the principle spill risk control. Site earthen bunding capable of managing at least 110% of the largest wastewater tank volume. The earthen bund will be constructedto withstand a tank failure scenario with appropriate compaction and stabilisation applied •Gathering lines are not to be operated where the line is affected by flood waters. • Regional flooding would involve order of magnitude larger volume of low Electrical conductivity water (many GL) mixing with relatively small volumes (< 11ML/or flowback or smaller volume of chemical/ fuel release)- Dilution would reduce the impact down to negligible.	•Pre-wet season site assessment completed to identify any maintenance requirements (Administration) •Stormwater captured in sediment basin to be tested and released offsite in a controlled manner (Engineering)	•Maintenance to be undertaken on erosion and sediment controls to ensure ongoing functionality (Engineering)	**1**	**2**	**L**	Yes	All stormwater retained onsite during well testing will be collected in a purpose built sediment basin and tested prior to release. Releases must comply with the stipulated criteria to ensure contaminants are not released from site. The release of stormwater will also be via a "Sediment sock", with a reasonable consequence of minor, localised reversible impacts. The likelihood is reduced down to remote (<1% probability of occurring) based onthe 12 km separation distance from the sites storing flowback/ drilling wastewater, with no long-term storage/ activity at Shenandoah N A.	Yes	Low
23			Failure or leak from wastewater gathering line network, including from sabotage	A.4.1 Site selection and planning A.4.7 Containment of Contaminants C.3.3 Wastewater management legislative requirements c.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	• Selection and placement of gathering line easement(s) - co-location with access tracks. •Gathering lines are used, these will be designed, constructed and maintained in accordance with "Code of Practice for Upstream Polyethylene Gathering Networks in the CSG Industry, Version 5", August 2019 (APGA 2019) • Gathering have a design life of in excess of 50 years • Gatherine line burial depth and hardness of polyethylene pipeline to minimise termite attack • Gathering lines are located in remote areas with limited access, minimising the risk of sabotage •PE pipes shall be manufactured in accordance with AS/NZS 4130 and shall be third-party certified by a JAS-ANZ accredited certifier under the StandardsMark, GasMark or WaterMark schemes or equivalent. •Pipes to be pressure tested/ hydrotested to confirm integrity. • Marking and product traceability shall be in accordance with the Standard. Appendix A of AS/NZS 4130 shall be used as the basis for demonstrating conformity. • Pipes for gathering networks shall be Series 1 conforming to AS/NZS 4130. A design, risk assessment and testing regime, inline with the PEGN code, will ensure suitable material selection and selection of facility overpressure protection equipment to reduce the probability of leaks to ALARP •Aboveground gathering lines to be temporary (<12 months), with no transfers where fires or severe weather events are predicted • Identification and signage to prevent excavation damage • Emergency shutdown systems and response procedures to investigate and manage loss of containment. • Flowline / gathering networks will be fitted with manifolds and valves to isolate it into sections. Valves will be locked at all times unless attended by authorised personnel to prevent unintentional operation. •upon cessation of use/ suspension (triggered after 3 months of no use),gathering lines will be purged of any residual wastewater • Fuel loads within right of ways to be kept low to reduce fire risks. Overhanging trees that could fall on pipelines will be removed. • No mapped watercourses or wetlands in proximity to gathering lines, Closest stream order 1 ~12km away with closest major wetland >90 km away (Lake Woods). •Upon cessation of use,gathering lines will be purged of wastewater- wastewater should not be stored in pipework • Fuel loads within right of ways to be kept low to reduce fire risks. Overhanging trees that could fall on pipelines will be removed. • Prior to the abandonment of gathering lines, each line is to be purged clean of contaminants and pigged as required to remove scale. Testing to confirm no residual contaminants.	• Remote monitoring of pressure, flow and leaks on gathering networks • Remotely operated isolation at mid line valves on gathering networks • Monthly gathering line inspections during continual operations or where batch transfer is proposed, before and during each batch transfer.	• Emergency response and spill management plans enacted to respond to spills •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately •Earth moving equipment available regionally to clean up spills •Gathering network system will not be restarted until the leak is repaired and an investigation is carried out as to how the leak occurred and how it will be prevented from re-occurring •Emergency response plan implemented. • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	**2**	**2**	**L**	Yes	All flowlines will be constructed and installed in accordance with Australian Standards. The flow/ pipeline pressure readings from the flow meters will continually be compared to detect an imbalance in inflow and outflow volumes. If there is an imbalance of 1% of flow (noting temperature and flow meter accuracy is a limiting factor), the system will alarm and transfer operations stopped until the imbalance in flow is investigated and rectified. The likelihood of such a consequence from occurring is considered highly unlikely(probability <1%) due to the multiple failsafe's installed on the flowline networks and separation distance from surround users.	Yes	Low
24			Release of contaminated leachate to surface water from the composting of drilling mineral waste	C.5.1 Drilling Materials A.4.7 Containment of Contaminants C.8.2 Spill Management Plan	•The composting of drilling wastes will only be undertaken during the dry season (May to September), with any storage beyond this point to require lining and covers to prevent leachate formation and run off. •Drilling waste willrequire to be dry, with no ponding of water present in the trial area or leachate present. •The trial area willhave an earthen bund and graded sufficiently to prevent both run-on and run-off of stormwater • any fluids within the trial area to be removed immediately. • Any fluids beyond the trail area will be considered a spill in accordance with the Spill management plan and managed accordingly. •The trial area willhave an earthen bund and graded sufficiently to prevent both run-on and run-off of stormwater •Upon completion of the trial, the composted drilling material will be either a) returned to the sump b) stockpiled on a liner with a cover will additional approvals are sought to re-use the material or c) trucked offsite to a licenced landfill.	•Weekly inspections completed on the trail area to detect ponding and releases form the trial area	•Where ponding or releases are identified, controls implement to mitigate future release by a) redesigning trial location b) removing wastes from area c) drying out the waste material further before use or d) implementing other controls to prevent the incident form re-occurring as appropriate.	**1**	**3**	**L**	Yes	The composting trial will be undertaken in the dry season to reduce (virtually eliminate) the risk of runoff form the site.Dry drilling waste will be utilised, further reducing the potential for leachate generation.The site will be bunded and contoured to contain any residual fluids if present/generated, with any fluid removed asap.The site will be cleaned up and tested to ensure any residual contaminants are removed. Given the controls, the level of potential contamination and risk to soils is considered minor (1) and likelihood unlikely	Yes	Low
25		Changes in surface water hydrology resulting in vegetation dieback from ponding and diversions away from natural surface systems with environmental and cultural value.	Infrastructure located on regional flow path resulting in changes to surface water flow.	A.4.1 Site selection and planning A.4.3 Erosion and sediment control and hydrology	•Well pad located away from watercourses and regional flow paths. (Elimination) •Well pads designed to divert stormwater around, without impeding natural surface water flows (Engineering) •Stockpiled debris to be used to discourage water concentration, with vegetation establish on stockpiles to reduce exposed surfaces •Area is remote with closest major watercourse at least 12 km away from any site storing flowback . Shenandoah N A located 450m from an intermittent stream order 1- with no long term storage of drilling wastes. (Elimination) •The well site is flat, with water to be diverted around the perimeter of the site. (Elimination)	•Erosion and Sediment Control Plan in place with routine pre and post wet season inspection and maintenance (administration)	•Maintenance to be undertaken on erosion and sediment controls to ensure ongoing functionality (Engineering)	**1**	**2**	**L**	Yes	Due to the lack of major water courses, and impact is likely to "minor", locally restricted and reversible. The likelihood is reduced down to highish unlikely (probability <10%) due to the absent of watercourses and controls implemented in accordance with NT Land Clearing Guidelines to avoid changes in the hydrological setting.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
26			Changes to terrestrial ground surface levels associated with seismic activity.	B.4.13 Hydraulic Stimulation and Flowback Operations	•Wells are located away from known geohazards, with no significant faults within proximity of activity (Elimination) • Amungee NW-1H stimulation completed without inducing seismic activity (Elimination) •Stimulation is not linked to major seismic events (reinjection of wastewater is generally recognised as the main cause). No reinjection of wastewater proposed (Elimination) •Stimulation stages deployment will be away from geohazards to reduce the loss of fluids into any encountered faults (Elimination) •TheBeetaloo is not prone to seismic activity and there is no evidence of recent earthquake activity as most faults and the major subsurface structure are confined to Cambrian or older strata.This is supported by the National seismic Hazard Assessments completed by Allen 2018 (Figure 33), which highlight the Beetaloo is located within a low hazard area (Elimination) •Any faults encountered during drilling will be assessed to determine risk of stimulating with appropriate separation distances applied (Elimination). •Any induced seismicity likely to be minor(<3 Ml) and not at a level capable of altering earths surface.	•Monitoring of stimulation pressure to detect and respond to anomalies which may indicate fluid being pumped to an open geological structure (Engineering) •Geoscience Australia's Waramungu seismic array located approximately 300km of the sites. Seismometer to be deployed at each site.It is likely that any material seismic events above a 2 Mlwill be detected via this array if they occur (Administration) •An induced seismicity traffic light system has been adopted and outlined in the WOMP (Administration)	•Where seismic activity is recorded in Tamboran's tenure during hydraulic stimulation activities, the actions in the WOMP Traffic Light System will be enacted as summarised below; Green: Local Magnitude (Ml) <2.0- no action required Orange: Ml 2.0- <3.5Ml- Report event to DITT and continue operations Red: Ml> 3.5- Stimulation activity on pad suspended until a go forward plan submitted by Tamboran and approved by DITT.	**1**	**1**	**L**	Yes	The consequence of a induced seismicity, based upon evidence from the UK and US, indicates that the consequence is likely to be "minor", with most events restricted to discrete areas at a size that generally cannot be detected at the surface (below 2 order of magnitude). This limits the potential for changes in terrestrial surface level. Larger events are rare and generally a factor of the existing built up stress regime of the area- rather than a factor of the intensity of hydraulic fracturing or wastewater injection. The likelihood of a seismic event is reduced through the geological setting of the Beetaloo Basin itself and the safeguards implemented in the Code requiring geohazard assessment and avoidance. In theBeetaloo, there have been no earthquakes over magnitude 3 measured since records began.The area is not prone to seismic activity and there is no evidence of recent earthquake activity as most faults and the major subsurface structure are confined to Cambrian or older strata.This is supported by the National seismic Hazard Assessments completed by Allen 2018 (Figure 33), which highlight the Beetaloo is located within a low hazard area. The Code requires any geohazard (such as fault) identified prior to drilling (from existing seismic or interpreted data) or encountered during drilling to have a risk assessment to the determine the potential for reactivation.Any faults identified would not be stimulated, with a risk-based buffer applied. Given the number of wells stimulated in the US without issue and geological setting of the Beetaloo basin, the likelihood is considered remote, with a probability less than 0.1%.	Yes	Low
27	**Terrestrial environmental quality**	Loss in long-term soil productivity and viability.	Soil compaction from access tracks,leases and2D seismic.	A.4.1 Site selection and planning	• Clearing will be limited to the minimum necessary to extend well pad, camp lease and install helipad, laydown yard and fence line/ firebreak and seismic lines (Engineering) •All well pads, camp pads, helipads to be stripped of topsoil (Elimination) •Areas to be rehabilitated to reduce impacts associated with compaction (Engineering) •Disturbance area is small (<0.01% of EP 98 and <0.006% of total tenure area) (Elimination)	•Rehabilitation monitoring to assess soil productivity impacts (Administration)	•Areas with poor rehabilitation will be maintained to reduce impact (Engineering)	**1**	**3**	**L**	Yes	During the construction/operation of well pads, access tracks , camp pads etc., these sites will be compacted. Long term impacts of this compaction will be addressed during the rehabilitation of the sites.A loss of productivity is anticipated in the earlier stages of rehabilitation, returning back to pre-disturbed state within ~10 years.This will be accelerated through removal of hard stand areas, ripping and scarifying compacted surface.the consequences is likely to be "moderate", being locally restricted, with a moderate- long (years) recovery time.The likelihood of long term productivity impairment is considered "unlikely" (probability <30%), given the observed rehabilitation from previous disturbance activities.	Yes	Low
28			Soil erosion from cleared areas (access tracks, well pads, camp pads and 2D seismic).	A.4.3 Erosion and sediment control and hydrology	•Clearing limited to minimum necessary to extend well well pad, camp well pad and install helipad, laydown yard and fence line/firebreak(Engineering) •Erosion and Sediment Control Plan in place and maintained in functioning condition (Engineering) •Sites to be maintained, with erosion and sediment controls kept in working order (Engineering) •Stockpiled debris to be used to discourage water concentration. (Engineering) •Areas to be rehabilitated to reduce impacts associated with compaction (Engineering) •Disturbance area is small (less than 0.005% of total tenure area) (Elimination) •Clearing of slopes >2% will be avoided.	•Pre and post wet season erosion and sediment control inspections. •Rehabilitation monitoring to assess soil productivity impacts (Administration)	•Maintenance completed on areas where erosion is occurring or where the controls are defective (Engineering) •Areas with poor rehabilitation will be maintained to reduce impact (Engineering)	**1**	**3**	**M**	Yes	The erosion and sediment release from cleared area is a well-documented impact. The consequences of sediment releases are likely to be minor, a function of the low risk nature of the site soils types, design of well pads and ongoing inspection and maintenance programs.The likelihood of these minor locally restricted releases of sediment is considered likely (Probability 90%).	Yes	Low
29		Long term surface disturbance from 2D seismic detonation charges	Soil erosion and instability from 2D seismic detonation charges	A.4.3 Erosion and sediment control and hydrology	• Charges are only laid within the designated seismic lines (Elimination) •Charges are small and placed 15 - 20 m below the ground surface (Engineering) •The blast zone is underground resulting in no visible surface disturbance (Engineering)	•Pre and post wet season erosion and sediment control inspections. •Rehabilitation monitoring to assess soil productivity impacts (Administration)	•Maintenance completed on areas where erosion is occurring or where the controls are defective (Engineering) •Areas with poor rehabilitation will be maintained to reduce impact (Engineering)	**1**	**1**	**L**	Yes	The charges are small and the detonation zone is subsurface, resulting in no long surface disturbance or blast impact sites.	Yes	Low
30		Soil contamination due to spills and leaks of chemicals, wastes or wastewater.	Spills/leaks from the on-site storing,handling, treatment, recycling and disposal of fuels. Condensate, hydrocarbons, drilling additives, stimulation additives,flowback fluid,solid wastes, storage, transportation of wastes and during 2D seismic	A.4.7 Containment of Contaminants c.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	•All chemical, fuel and waste storage, and high risk spill handling areas are to have secondary containment, with an impermeable liner with coefficient of permeability of less than 10-9 m/s • Liner damage from termites to be managed through deployment of baits and termite deterrents (termites/spraying) • Where extended wastewater evaporation with high EC fluid is proposed, a thicker liner (0.71 to 0.91mm) will be used to reduce the risk of liner tears from salt solids •Licenced waste transporters to be used to transport listed wastes. •Chemicals to be transported in accordance with the Australian Dangerous Goods Code and NT Dangerous Goods Act. •No chemical or wastewater transportation during wet season, unless a risk assessment determined the activity is safe and low risk •Evaporation tanks storing solid salt to have a higher density liner capable of resisting the puncture of the salt solids. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to prevent offsite release of flowback.This is considered an additional level of containment, as the primary and secondary containment is the principle spill risk control. •Site earthen bunding will have a minimum bund wall height of 300mm capable of managing at least 110% of the largest wastewater tank volume. •The earthen bund will be constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied. • All flowback transfer piping to have secondary containment around connection points • All piping used to transfer flowback to be appropriately pressure rated, tested and maintained to prevent spills •All transportation of listed wastes and dangerous goods to be undertaken via licenced contractors. •Area is remote with major urban areas to be avoided during the transportation of dangerous goods and wastes in accordance with the NT Dangerous Goods Act. •All vehicles mechanically maintained and free of oil leaks. •Portable storage bunding and spill kits on hand during seismic.	•Daily inspections during wet season and weekly thereafter to identify and respond to any potential leaks.	•Liner leaks to be investigated and liners repaired as soon as practicable •Spills and leaks to be cleaned up and rectified immediately •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	**2**	**2**	**L**	Yes	The storage, handling and management of chemicals is a standard activity that is managed through a mature regulatory setting.The Code further reduces the likelihood and consequence of chemical spills and contamination, through the mandated use of secondary containment, a spill management plan and groundwater monitoring. A spill event is likely to result in moderate, short term reversible impacts restricted to the existing well pad.The likelihood is further reduced down to highly unlikely(<10% probability of occurring) based onthe use of secondary containment, rapid spill detection and rehabilitation requirements.	Yes	Low
31			Drill sump and flowback tank overtopping.	A.4.7 Containment of Contaminants C.5.1 Drilling Materials C.5.2 Management of produced water from petroleum wells C.6 Monitoring mandatory requirements C.8.2 Spill Management Plan	•Drilling sump to be designed and operated to handle the drilling of multiple wells •Sump solid levels to be periodically removed from the sump between wells (or as required) to maintain sump capacity •Covered tanks to be used to manage flowback storage, with enough enclosed storage onsite to manage all stored flowback. •Results from previous well testing have been used to optimise available tank capacity to allow for multiple wells •Additional tank capacity to be installed as required, with new tank capacity taking less than 14 days (subject to access and resource availability) •Open wastewater evaporation tanks and drill sumps to have a 1:1000 ARI wet season freeboard (wet season freeboard 1.3m). •All flowback wastewater (other than the minimum volume required to integrity of the open tank liner) to be transferred to enclosed tanks prior to the onsite of a "significant rainfall event (>300mm of forecasted rain over a 4 day periodic) • Wastewater transfers into any tank/ sump will cease prior to fluid levels exceed the relevant freeboard level. Wastewater transfers into a open tank/sump will not occur until levels return to below the relevant freeboard. •Sufficient pumps available onsite to meet volume transfer requirements, with available pump redundancy in case of mechanical issues. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded (300 mm high) to prevent offsite release of flowback.This is an additional level of containment, as the primary and secondary containment is the principle spill risk control. Site earthen bunding will be capable of managing at least 110% of the largest wastewater tank volume. The earthen bund will be constructed to withstand a tank failure scenario with appropriate compaction and stabilisation applied. •Site is manned at all times or have telemetered level logging during wastewater storage, with helicopters to be used to fly in staff when road access is prevented. •Separation between well pad and closest aquifer over 70m, with interbedded clays likely to limit any potential contaminant migration. •Nearest landholder extraction bore 1 km. •Depth of aquifers generally below known stygofauna distribution range (elimination)	•Daily monitoring of tank and sump levels (along with available storage space)during the wet season and weekly at all other times •Daily significant rainfall monitoring during the wet season. •Spill Management Plan implemented to prevent, detect and respond to spills. •Impact and control groundwater monitoring bores installed to detect any potential contamination, with monitoring completed quarterly.	•All flowback (other than the volume required to maintain the integrity of an open tank liner) to be transferred to enclosed tanks 8 hours before the onset of a significant rainfall event (defined as >300mm of rain over a 4 day period) •Operations (flowback and drilling) to cease if insufficient wastewater (sump or flowback storage) is available to meet freeboard and enclosed tank availability requirement. • No additional drilling fluids or wastewater shall be added to the sump/tank once the freeboard has been exceeded. Any flowback stored within an open top tank above the freeboard level must be transferred to the enclosed tanks onsite within 24 hours. •DEPWS to be notified within 48 hours where the freeboard of a tank or sump has been exceeded and the forward monitoring and management strategies to prevent an overtopping event (including revised action and reporting triggers) •Drilling fluids to be transferred to wastewater tanks,removed from site or other actions implemented(such as deployment of covers etc.) to minimise the risk of overtopping where the sump freeboard level is below 1:1000 ARI 7-day rainfall event- unless otherwise agree to with prior approval from DEPWS to account for forecasted risk mitigation factor (such as forecasted climatic/seasonal factors) •New wastewater tanks to be constructed onsite if flowback wastewater storage volumes areinsufficient to maintain the required enclosed freeboard levels •Operations (flowback and drilling) to cease if insufficient wastewater (sump or flowback storage) is available to meet freeboard and enclosed tank availability requirement. • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the NEPM (Assessment of site Contamination) (Engineering)	**2**	**1**	**L**	Yes	The consequence and likelihood of a wastewater storage overflowing are minimised through the onerous wastewater management requirements stipulated in the Code. This includes well pad bunding, tank level alarms, tank freeboard requirements and use of a wastewater management plan.Any overflow is likely to be restricted to the well pad, rapidly detected and promptly cleaned up.The use of enclosed tanks, freeboard and well pad bunding essentially eliminates the likelihood potential for a wastewater storage tank to overflow.Given the onerous regulatory requirements, the likelihood of an overtopping event is considered Remote, with a <1% probability of occurring.	Yes	Low
32			Uncontrolled release of formation fluid encountered during drilling, stimulation, barrier failure	B.4.1 Well integrity management B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and flow back operations D.5.8 Venting and flaring	•Drilling overbalanced to reduce the inflows of hydrocarbons and fluids (Engineering). •Blow out prevention in place to manage well failure and uncontrolled gas/ fluid/pressure influxes (Engineering) •Blow out preventor pressure rating and testing •All equipment will be API compliant to handle expected conditions (Engineering) •Site manned during operation (Administration) •Well suspended with multiple cement and casing barriers in place- with 4 casing section utilised (conductor, surface, intermediate and production).(Engineering) •Barricading to be used to protect each exploration well from vehicle collision during multi-well drilling activities. (Engineering)	•Process monitoring to detect events that could potentially result in a uncontrolled release of gas/fluids/pressure (such as fluid balances, well head pressure etc.) (Engineering) •Routine (monthly) well inspections (Administration	•An emergency as diverter and flare to be used during drilling to manage gas ingress (Engineering) •Contracts in place with emergency well intervention specialists (such as Boots and Cootes) (administration) •Emergency response plan implemented (administration)	**2**	**2**	**L**	Yes	The Code and standard drilling, stimulation and well testing safety controls are designed to prevent the uncontrolled release of hydrocarbons and produced fluids. The consequence are anticipated to be moderate, with impacts likely to be moderate, restricted in duration (minutes to hours).The likelihood is considered highly unlikely with a occurrence probability less than 10%, based on the well designed, construction and operations requirements mandated by the Code.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
33			Chemical and waste transportation accident.	A.4.7 Containment of Contaminants C.8.2 Spill Management Plan	•Risk assessment completed for all wet season transportation of chemicals and wastes (Administration) •All wastes to be transported in accordance with the NT Waste Management and Pollution Control Act. (Administration) •All dangerous goods to be transported in accordance with the NT Dangerous Goods Act and Australian Dangerous Goods Code.(Administration) •No chemical or wastewater transportation during wet season, unless a risk assessment determined the activity is safe and low risk •Transportation route to avoid major urban areas •All drivers to be approximately licenced (Administration) • Fatigue management plan implemented, requiring journey management plans and drivers to rest every 2 hours (Administration) •Access track maintained to allow periodic wet weather access •Strict drug and alcohol policy implemented, with routine testing and 0 zero tolerance policy to alcohol (0.00% limit) and drugs (Administration) •Area is remote with major urban centres to be avoided. (Elimination) •Risk to any receptor is identical to that of normal diesel or petroleum tankers. •Training of Tamboran supervisors regarding chain of responsibility requirements to minimise the risk of driver fatigue (Administration) •The transportation of waste and chemicals across Australia is a standard practice with mature codes and legislation in place.the transportation of fuels, chemicals and wastes occurs every year in the NT to support existing industry's during the wet season.(Engineering)	•Transport incident statistics collected and monitored. (Administration) •Onsite assurances and fit for work assessments completed periodically on transport companies (Administration)	•All transport spills to be cleaned up immediately (engineering) •Contractor performance reviews completed where breaches in requirements are escalated and actions implemented to rectify defects.(administration)	3	1	L	Yes	The transportation of wastes and chemicals is a tightly controlled industry with mature practices designed to prevent, detect and respond to transportation spills. Any accident is likely to be restricted to road corridors and result in "serious", short term (days-weeks) reversible impacts.All contractors must be appropriately licenced, with National uniform legislation in place to offer a high level of regulatory protection.This risk is considered identical to that of bulk diesel and other dangerous goods transportation- a common activity throughout Australia.Fuel and chemical transport accidents are rare given the number of transportation movements in Australia. The likelihood of an event occurring is therefore considered ""highly unlikely", what a probability of less than 10%.	Yes	Low
34			On-site disposal of drill muds and cuttings.	C.5.1 Drilling Materials	• Drilling muds, water basedare low residual toxicity.(Elimination) • Sodium and Chloride levels to be reduced through segregation of drilling fluids from muds and mixing with clean material onsite •Drilling muds and cuttings from the sump maybe transferred and stored in a pit/sump on site that is compliant with C.4.1.2 for the storage of drilling muds and cuttings to dry the cuttings and reduce waste volumes. •Drilling muds (water-based) to be tested and a disposal strategy developed by a suitably qualified third-party in a manner that minimises the risk to the environment. •Drilling muds (water-based) removed from site where onsite disposal is unsafe. •DEPWS engaged to confirm final disposal strategy. • Rehabilitation monitoring to monitor ongoing site rehabilitation	•Drilling muds (water based) to be tested and a disposal strategy developed by a suitably qualified third-party in a manner that minimises the risk to the environment. Rehabilitation monitoring completed on all disposal areas	•Additional rehabilitation actions implemented where rehabilitation objectives are not being met.	2	2	L	Yes	In accordance with the Code, the onsite storage anddisposal of drilling fluids and cuttings can only occur if the activity does not represent an unacceptable environmental hazard. All drilling fluids, muds and cuttings will be stored in a lined sump, with testing undertaken prior to final disposal.Onsite disposal will only occur if determined to be safe by an independent third party.The consequences are therefore likely to be restricted to a Moderate- short term reversible impacts. The likelihood of contamination through drilling fluid, mud and cuttings storage and failure is considered highly unlikely, with the probability below 10%.This is largely due to the separation distance between the underlying aquifer, use of lined sumps andthird partydisposal suitability assessments.	Yes	Low
35			Failure or leak from wastewater gathering line network, including from sabotage.	A.3 Surface activities mandatory requirements requirements A.3.8 Containment of Contaminants C.4.2 Management of produced water and flowback fluid C.7.2 Spill Management	• Selection and placement of gathering line easement(s) - co-location with access tracks. •Gathering lines are used, these will be designed, constructed and maintained in accordance with "Code of Practice for Upstream Polyethylene Gathering Networks in the CSG Industry, Version 5", August 2019 (APGA 2019) • Gathering line burial depth and hardness of polyethylene pipeline to minimise termite attack • Gathering lines are located in remote areas with limited access, minimising the risk of sabotage •PE pipes shall be manufactured in accordance with AS/NZS 4130 and shall be third party certified by a JAS-ANZ accredited certifier under the StandardsMark, GasMark or WaterMark schemes or equivalent. •Pipes to be pressure tested/ hydrotested to confirm integrity. •Marking and product traceability shall be in accordance with the Standard. Appendix A of AS/NZS 4130 shall be used as the basis for demonstrating conformity. •Pipes for Gathering Networks shall be Series 1 conforming to AS/NZS 4130. A design, risk assessment and testing regime, inline with the PEGN code, will ensure suitable material selection and selection of facility overpressure protection equipment to reduce the probability of leaks to ALARP •aboveground gathering lines to be temporary (<12 months), with no transfers where fires or severe weather events are predicted • Identification and signage to prevent excavation damage • Emergency shutdown systems and response procedures to investigate and manage loss of containment. • Flowline / gathering networks will be fitted with manifolds and valves to isolate it into sections. Valves will be locked at all times unless attended by authorised personnel to prevent unintentional operation. •upon cessation of use/ suspension (triggered after 3 months of no use),gathering lines will be purged of any residual wastewater •Fuel loads within right of ways to be kept low to reduce fire risks. Overhanging trees that could fall on pipelines will be removed. •Prior to the abandonment of gathering lines, each line is to be purged clean of contaminants and pigged as required to remove scale. Testing to confirm no residual contaminants. • Gathering line damage from termites to be managed through deployment of baits and termite deterrents (termites/spraying)	• Remote monitoring of pressure, flow and leaks on gathering networks (pressure and leak detection) • Remotely operated isolation valves on gathering networks • Monthly gathering line inspections during continual operations or where batch transfer is proposed, before and during each batch transfer.	• Emergency response and spill management plans enacted to respond to spills •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately •Earth moving equipment available regionally to clean up spills •Gathering network system will not be restarted until the leak is repaired and an investigation is carried out as to how the leak occurred and how it will be prevented from re-occurring •Emergency response plan implemented. • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	2	2	L	Yes	The risk of a flowline failure is minimised by being constructed to a relevant code, including material selection, certification and system design.Industry standard welding techniques and QA/QC protocols will be implemented to ensure compliance with the APGA code. Hydrotesting will be completed to confirm the integrity of the system and detect any leaks prior to commissioning.Leak detection will be implemented on the gathering line system with leaks able to be rapidly (instantaneously) detected. Telemetered valves will allow remote shut down of gathering lines should leaks be detected. Flowlines to be used for long term deployment will be buried.Any surface lines will be temporary and will be removed when not in use. Pipelines will not be used during periods of bushfire or extreme weather. Burying permanent flow lines ensures there is added protection against fire, flood, cyclonic winds, extreme temperatures and loading stress forces under a range of conditions. A spill management pan is in force to detect, prevent and respond to potential spills of wastewater and gas. If a failure was to occur, the wastewater would be restricted to the immediate vicinity of the gathering line.given the leak detection and remote shut in procedures- The potential leak rate is likely to be lower than 1000L which would mainly be restricted to within the gathering line right of way. The likelihood of such a consequence from occurring is considered highly unlikely (probability <10%) due to the multiple failsafe's installed on the gathering networks.The consequence is considered moderate, given the likely size of the spill.	Yes	Low
36			Failure of a flowback tank or catastrophic failure of liner.	A.4.1 Site selection and planning A.4.7 Containment of Contaminants C.8.2 Spill Management Plan	•Tanks designed and engineered to AS3990 Mechanical Equipment- Steel Work, AS 1170.1 Hydrostatic loading, AS1170.2 Wind Rating (cyclonic wind rating) •Wastewater tank liner with impermeable membrane with coefficient of permeability of less than 10-9 m/spermeability, 120N picture resistance and 49N tear resistance •Higher density liners used for evaporation tanks where solid salt crystals/ crusts are anticipated to form •Covered wastewater tanks and condensate tanks to have vents to prevent pressure build up. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to prevent offsite release of flowback.This is considered an additional level of containment, as the primary and secondary containment is the principle spill risk control. •Site earthen bunding will have a minimum bund wall height of 300mm capable of managing at least 110% of the largest wastewater tank volume. •The earthen bund will be constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied. •firebreaks maintained and lids to be flooded with water to combat ember attack damaging liner • Termite baits and spraying to be used to prevent termite damage to liners	•Weekly wastewater tank integrity inspections during wastewater storage to detect •Routine level monitoring and alarms	•Wastewater tank structural defects to be rectified as soon as practicable. •Wastewater to be transferred from defective tanks to alternative tanks onsite until repairs completed. •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately •Earth moving equipment available regionally to clean up spills •Emergency response plan implemented. •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	3	1	L	Yes	The consequences of a tank failure are negated through the use of double lined, engineered above ground tank which have continuous leak detection and alarms. Tanks and their liners are designed with sufficient structural integrity to withstand cyclonic winds, extreme temperatures and loading stress forces under a range of conditions.A spill management pan is in force to detect, prevent and respond to potential spills of wastewater. If a storage failure was to occur, the wastewater would be restricted to the well pad.Flowback would be pumped into available enclosed and open tank storage, with contaminated soil removed from site. the consequences are likely to be "serious", being locally restricted, moderate duration (weeks) and reversible.The likelihood is reduced by the Code requirements , tank design separation distancesto the underlying aquifer. The likelihood is considered Remote, withe a probability less than 1%.	Yes	Low
37		Soil contamination from the drift of saline wastewater offsite from mechanical evaporation units.	Wastewater evaporation mist transported offsite during wastewater treatment.	A.4.1 Site selection and planning	• Units to be operated in daylight hours with manual imitation • Units to be inspected daily for drift. •Automated wind speed and direction cut offs to be implemented to prevent drift outside of the wastewater tank(Engineering) •Evaporators located within the wastewater tank considering the predominant wind direction (from the SE) to ensure no drift outide of the wastewater tanks (Engineering) •No homesteads, sacred sites or sensitive environmental areas in the vicinity of the proposed well pads (Elimination)	•Daily monitoring to detect drift (Engineering)	•Evaporation units to cease operation where drift identified (Engineering) •Any driftto be reported as an incident with the spill management plan followed. (Administration) •Evaporators to be modified/ repositioned to control drift (Engineering)	2	2	L	Yes	The use of enhanced evaporators to manage wastewater is a well-known technology used through multiple mining and wastewater treatment industries.Evaporators were used successfully on the Amungee NW-1H well to reduce fluid levels decreasing offsite trucking volumes. The prevention of wastewater drift from outside of the wastewater tank is restricted through wind speed and direction cut offs and the location of the evaporator within the wastewater storage.The sites are continuously manned during well testing, thus the risk of drift and associated impacts is anticipated to be moderate, with short term, reversible impacts. Given the aforementioned controls, the likelihood of moderate impacts is reduced to Highly unlikely, with a potential of lower than 10%.	Yes	Low
38		Soil contamination from the composting of drilling mineral waste	Leachate or runoff from composted material contaminates soil	A.4.7 Containment of Contaminants C.8.2 Spill Management	•The composting of drilling wastes will only be undertaken during the dry season (May to September), with any storage beyond this point to require lining and covers to prevent leachate formation and run off. •A dedicated trial area on a well pad/ laydown yard will be demarcated and signed •The trial area will be a compacted clay liner or geomembrane type liner meeting the requirements of clause B.4.16.2(h) and C.4.1.2 (b) of the code. •Drilling waste willrequire to be dry, with no ponding of water present in the trial area or leachate present. • any fluids beyond the trail area will be considered a spill in accordance with the Spill management plan and managed accordingly. •The trial area willhave an earthen bund and graded sufficiently to prevent both run-on and run-off of stormwater •Waste material will be blended with manure and using a front end loader/ tractor/bob cat onsite at to stabilise it (such as 1 part waste: 1 part manure etc.) •The material will be tested in accordance with the suite in Table 9 of the Code of Practice •Upon completion of the trial, the composted drilling material will be either a) returned to the sump b) stockpiled on a liner with a cover will additional approvals are sought to re-use the material or c) trucked offsite to a licenced landfill. • The trial area will have all contaminated soil/ material removed, with testing completed to determine the site is free of contamination.	•Weekly inspections completed on the trail area to detect ponding and releases form the trial area •Monitoring of soils post trial andsite clean up to demonstrate no contamination	•Where ponding or releases are identified, controls implement to mitigate future release by a) redesigning trial location b) removing wastes from area c) drying out the waste material further before use or d) implementing other controls to prevent the incident form re-occurring as appropriate.	1	2	L	Yes	The composting trial will be undertaken in the dry season to reduce (virtually eliminate) the risk of runoff form the site.Dry drilling waste will be utilised, further reducing the potential for leachate generation.The site will be bunded and contoured to contain any residual fluids if present/generated, with any fluid removed asap.The site will be cleaned up and tested to ensure any residual contaminants are removed. Given the controls, the level of potential contamination and risk to soils is considered minor (1) and likelihood unlikely	Yes	Low
39		Soil contamination from the disposal of greywater and sewerage from camp activities.	Greywater and sewerage disposal (camps).	C.4.2 Management of flowback water	•Sewerage wastewater irrigated as per Department of Health Code for On-site Wastewater Management (July 2014) (Engineering)(Elimination) •A wastewater suitability acceptance assessment has been completed and a design approval for wastewater disposal received in accordance with the NT Department of Health Code for On-site Wastewater Management (July 2014) (Engineering) •Wastewater irrigation to comply with DOH requirement (Engineering) •Areas appropriately sized to accommodate irrigation volume (Engineering) • Area is remote with closest watercourse at least 12 km awayfor sites in Shenandoah South and 450m away for Shenandoah North (no long term activity at this location (Elimination)	•Wastewater system performance to be monitored in accordance with the manufacturers requirements (Administration)	•Where wastewater specifications are exceeded, corrective actions will be implemented to ensure wastewater is returned back into specification (Engineering)	1	2	L	Yes	The management of sewerage and greywater is mature with various NT wastewater management guidelines. Due to the temporary nature of the activity, the maximum contamination resulting from sewerage and grey water irrigation is likely to be minor, with any impacts locally restricted and temporary in nature. The closest watercourse is at least 450m away form Shenandoah N A and 12km to the next closest site. Potential contamination of these features considered remote (probability <1%).	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
40	**Terrestrial ecosystems**	Impact to listed threatened habitats and listed threatened flora and fauna, including habitatfragmentation, impacts to non-listed fauna and livestock from exploration activities.	Land clearing impacts listed threatened species and/or their habitat	A.3.1 Site selection and planning A.3.5 Biodiversity protection	•Areas scouted by qualified ecologist prior to clearance to identify threatened flora and fauna and high valued habitat that may be impacted by proposed activities (Elimination) •Areas are not considered high conservation value, are not threatened/endangered and not significantly fragmented, with impacts unlikely to result in significant disturbance to threatened/endangered species. (Elimination) •Existing pastoral access tracks used to avoid additional habitat fragmentation (Elimination) •Land clearing to be minimised through the sharing of infrastructure to reduce the number of tanks required to manage flowback at each site (i.e. centralised sites, less land clearing) (elimination) • Low impact seismic priorities, with avoidance of clearing large trees (>25 cm trunk at 1.3 m)(Elimination) •Pre-clearance walk downs with cultural managers experienced in identifying native wildlife to identify and avoid clearing large trees(>25 cm trunk at 1.3 m), potential falcon nests (with 300 m buffer applied where possible) or threatened species. (Elimination) •Areas to be pegged out post walk down with optimised route selected. •Work will stop to allow listed species to move on, with work only commencing once listed threatened species has left the immediate area of clearing (Elimination) •No clearing of riparian vegetation or within wetlands (Elimination) • Experienced personnel with native wildlife identification used to inspect all proposed cleared areas immediately before clearing to identify potential grey falcon nests and other listed threatened fauna (Elimination) • Fences to be minimised to areas of proposed activity (Elimination)	• Disturbance survey using global position system (GPS) (Administration) •Fauna interaction logs to be kept to record fauna deaths and interactions (Administration) • Records of large trees cleared and avoided retained (administration)	•Where impacts are identified, practices will be reviewed and modified to reduce impact on fauna (Administration/ engineering) .	1	2	L	Yes	The areas for proposed clearing have been surveyed by ecologists who have not identified listed threatened species.Suitable habitat in the area exists and this will be avoided through practices defined in the NTG Land Clearing Guideline including avoidance of clearing to riparian vegetation, wetlands,large habitat trees and trees where suspected Grey flacon nests are present. The consequence of the activity causing material impacts to listed species is considered minor based on limited area of clearing, low probability of impacting multiple individual listed species an the availability of habitat locally/ regionally.The likelihood is considered highly unlikely with a <10% chance of impacts to listed threatened species occurring.	Yes	Low
41			Activity (vehicle and machinery) noise and lighting on well pads and access tracks.	A.4.1 Site selection and planning A.4.2 Noise	•Site location avoids areas of high conservation value as a priority (Elimination) •Areas are not considered high conservation value, are not threatened/endangered and not fragmented, with impacts unlikely to result in significant disturbance to threatened/endangered species. (Elimination) •Impacts likely to be temporal, with fauna able to move to adjacent areas to escape impacts. (Elimination) •Fauna monitoring at Kyalla has not identified any impacts, with fauna identified in areas around operations. (Engineering)	•Anecdotal evidence form pastoralists and Traditional Owners (Administration) •Impacts arelikely to be temporal, with detection extremely difficult.	•Where impacts are identified, practices will be reviewed and modified to reduce impact on fauna (Administration/ engineering) .	1	3	L	Yes	Fauna may be disturbed through transport movements along access tracks and drilling, stimulation and well testing activities around the well pad. The consequence of activity nuisance is anticipated to be minor, with localised, short term impacts to areas immediately adjacent to access tracks.The likelihood of the risk is reduced through the isolated location (lack of environmental and community receptors), regionally extensive vegetation communities (good outside refuge away from access tracks and limited transport movements during the evenings. The impact to fauna is considered highly unlikely given the ability of fauna to move to other areas of refuge away from E&A activities.	Yes	Low
42			Failure of flowback storage tanks.	A.4.1 Site selection and planning A.4.7 Containment of Contaminants c.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	•Tanks designed and engineered to AS3990 Mechanical Equipment- Steel Work, AS 1170.1 Hydrostatic loading, AS1170.2 Wind Rating (cyclonic wind rating) •Wastewater tank liner with impermeable membrane with coefficient of permeability of less than 10-9 m/spermeability, 120N picture resistance and 49N tear resistance •Higher density liners used for evaporation tanks where solid salt crystals/ crusts are anticipated to form •Covered wastewater tanks and condensate tanks to have vents to prevent pressure build up. •Well sites to be compacted to above 100kpa to achieve a permeability of approximately 1x10m-7/s •The site is earthen bunded to prevent offsite release of flowback.This is considered an additional level of containment, as the primary and secondary containment is the principle spill risk control. •Site earthen bunding will have a minimum bund wall height of 300mm capable of managing at least 110% of the largest wastewater tank volume. •The earthen bund will be constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied. •firebreaks maintained and lids to be flooded with water to combat ember attack damaging liner • Termite baits and spraying to be used to prevent termite damage to liners	•Weekly wastewater tank integrity inspections during wastewater storage to detect (administration) •Routine level monitoring and alarms (Engineering)	•Wastewater tank structural defects to be rectified as soon as practicable. (Engineering) •Wastewater to be transferred from defective tanks to alternative tanks onsite until repairs completed. (Engineering) •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately (Engineering) •Earth moving equipment available regionally to clean up spills (Engineering) •Emergency response plan implemented (Administration) •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	3	1	L	Yes	The consequences of a tank failure are negated through the use of double lined, engineered above ground tank which have continuous leak detection and alarms. Tanks and their liners are designed with sufficient structural integrity to withstand cyclonic winds, extreme temperatures and loading stress forces under a range of conditions.A spill management pan is in force to detect, prevent and respond to potential spills of wastewater. If a storage failure was to occur, the wastewater would be restricted to the well pad.The consequences are likely to be "serious", being locally restricted, moderate duration (weeks) and reversible.The likelihood is reduced by the Code requirements , tank design, separation distances to sensitive places and the well pad bunding.. The likelihood is considered Remote, with a probability less than 1%.	Yes	Low
43			Failure or leak from wastewater gathering line network (including from sabotage) impacting on terrestrial flora and fauna and surrounding vegetation communities	A.3 Surface activities mandatory requirements requirements A.3.8 Containment of Contaminants C.4.2 Management of produced water and flowback fluid C.7.2 Spill Management	• Selection and placement of gathering line easement(s) - co-location with access tracks. •Gathering lines are used, these will be designed, constructed and maintained in accordance with "Code of Practice for Upstream Polyethylene Gathering Networks in the CSG Industry, Version 5", August 2019 (APGA 2019) • Gathering lines are located in remote areas with limited access, minimising the risk of sabotage •PE pipes shall be manufactured in accordance with AS/NZS 4130 and shall be third-party certified by a JAS-ANZ accredited certifier under the StandardsMark, GasMark or WaterMark schemes or equivalent. •pipes to be pressure tested/ hydrotested to confirm integrity. •Marking and product traceability shall be in accordance with the Standard. Appendix A of AS/NZS 4130 shall be used as the basis for demonstrating conformity. •Pipes for Gathering Networks shall be Series 1 conforming to AS/NZS 4130. A design, risk assessment and testing regime, inline with the PEGN code, will ensure suitable material selection and selection of facility overpressure protection equipment to reduce the probability of leaks to ALARP •aboveground gathering lines to be temporary (typically <12 months), with no transfers where fires or severe weather events are predicted • Identification and signage to prevent excavation damage • Emergency shutdown systems and response procedures to investigate and manage loss of containment. • Flowline / gathering networks will be fitted with manifolds and valves to isolate it into sections. Valves will be locked at all times unless attended by authorised personnel to prevent unintentional operation. •upon cessation of use/ suspension (triggered after 3 months of no use),gathering lines will be purged of any residual wastewater •Fuel loads within right of ways to be kept low to reduce fire risks. Overhanging trees that could fall on pipelines will be removed.	• Remote monitoring of pressure, flow and leaks on gathering networks (pressure and leak detection) • Remotely operated isolation valves on gathering networks • monthly gathering line inspections during continual operations or where batch transfer is proposed, before and during each batch transfer.	• emergency response and spill management plans enacted to respond to spills •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately •Earth moving equipment available regionally to clean up spills •Gathering network system will not be restarted until the leak is repaired and an investigation is carried out as to how the leak occurred and how it will be prevented from re-occurring •Emergency response plan implemented. • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	2	2	L	Yes	The risk of a flowline failure is minimised by being constructed to a relevant code, including material selection, certification and system design.Industry standard welding techniques and QA/QC protocols will be implemented to ensure compliance with the APGA code. Hydrotesting will be completed to confirm the integrity of the system and detect any leaks prior to commissioning.Leak detection will be implemented on the gathering line system with leaks able to be rapidly (instantaneously) detected. Telemetered valves will allow remote shut down of gathering lines should leaks be detected. Flowlines to be used for long term deployment will be buried.Any surface lines will be temporary and will be removed when not in use. Pipelines will not be used during periods of bushfire or extreme weather. Burying permanent flow lines ensures there is added protection against fire, flood, cyclonic winds, extreme temperatures and loading stress forces under a range of conditions. A spill management pan is in force to detect, prevent and respond to potential spills of wastewater and gas. If a failure was to occur, the wastewater would be restricted to the immediate vicinity of the gathering line.given the leak detection and remote shut in procedures- The potential leak rate is likely to be lower than 1000L which would mainly be restricted to within the gathering line right of way. The likelihood of such a consequence from occurring is considered highly unlikely (probability <10%) due to the multiple failsafe's installed on the gathering networks.The consequence is considered moderate, given the likely size of the spill.	Yes	Low
44			Uncontrolled release of formation fluid encountered during drilling, stimulation, barrier failure	B.4.1 Well integrity management B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and flow back operations D.5.8 Venting and flaring	•Drilling overbalanced to reduce the inflows of hydrocarbons and fluids (Engineering). •Blow out prevention in place to manage well failure and uncontrolled gas/ fluid/pressure influxes (Engineering) •Blow out preventor pressure rating and testing •All equipment will be API compliant to handle expected conditions (Engineering) •Site manned during operation (Administration) •Well suspended with multiple cement and casing barriers in place- with 4 casing section utilised (conductor, surface, intermediate and production).(Engineering) •Barricading to be used to protect each exploration well from vehicle collision during multi-well drilling activities. (Engineering)	•Process monitoring to detect events that could potentially result in a uncontrolled release of gas/fluids/pressure (such as fluid balances, well head pressure etc.) (Engineering) •Routine (monthly) well inspections (Administration	•An emergency as diverter and flare to be used during drilling to manage gas ingress (Engineering) •Contracts in place with emergency well intervention specialists (such as Boots and Cootes) (administration) •Emergency response plan implemented (administration)	2	2	L	Yes	The Code and standard drilling, stimulation and well testing safety controls are designed to prevent the uncontrolled release of hydrocarbons and produced fluids. The consequence are anticipated to be moderate, with impacts likely to be moderate, restricted in duration (minutes to hours).The likelihood is considered highly unlikely with a occurrence probability less than 10%, based on the well designed, construction and operations requirements mandated by the Code.	Yes	Low
45			Introduction and spread of weeds in the area (including civil construction, seismic and E&A activities) .	A.4.5 Weed management	•All equipment and vehicles to be washed-down and to have a Biosecurity Declaration Certificate prior to access to site (Elimination) •Areas of proposed exploration have been surveyed and are deemed to have low weed abundance (elimination) •Activity will be restricted to defined well pads and camp pads (Elimination)	•6 monthly monitoring implemented around infrastructure to detect the spread/ introduction of weed species (administration) •Tamboran assurance activities to target equipment wash-down certificates to ensure standards are being met. (Administration)	•Where weed outbreaks are identified associated with Tamboran's activities, infestations will be treated in accordance with the Weed Management Plan. (elimination) •Corrective actions implemented where ongoing biosecurity breaches are identified.	2	3	M	Yes	The area in the vicinity sites is free of weeds. Weeds are present across the broader property. Any introduction of weeds is likely to result in localised impact, with weed management requirements likely to reduce the consequence down to "moderate, short term.Due to the inherent nature of weed prevention the risk likelihood is considered unlikely, witha probability less than <30%.	Yes	Low
46			Accidental ignition of fire from exploration activities (drilling, stimulation, flaring, seismic and general access).	A 4.6 Fire management	•Bushfire management plan implemented to prevent and respond to bushfires- including establishment of communication and fire response protocols with pastoralists (Administration) •Bushfire awareness included in site inductions. (Administration) •Designated smoking areas on-site (Elimination) •Firefighting equipment to be available to deal with fires (Engineering). •Fire breaks have been constructed around the well site and camp pads (Engineering) •Minimum of 45m separation distances between flares and surrounding vegetation (Engineering) •Ignition sources placed outside of the hazardous area. (Elimination) •Intrinsically safe equipment used in hazardous area. (Elimination) •Hazardous area drawing will provide classification of hazardous zones while drilling. (Elimination) •No flaring during periods of total fire ban (Elimination) •Activities will comply with landholder and regional bushfire management plans. (Elimination) •Area in the vicinity of well sites have had recent (within 1-2 years) fire activity, reducing the fuel load (Elimination) •Fire tender to be used during seismic clearing, with a spotter to identify and respond to any ignition events (Elimination)	•Annual fire preparedness assurance activities completed where activities are proposed during high fire risk periods (administration) •Daily monitoring of bushfires in the region during periods of high fire danger (administration) •Annual fire frequency mapping using the Northern Australia Fire Information fire history database (administration)	•Fire hazard reduction strategies (such as back burning) to be implemented to reduce the risk of fire ignition/ impact as required (Elimination) •Where a bushfire is started and cannot be controlled, Tamboran to engage with pastoralist to coordinate response activities	3	2	M	Yes	Fire is a common occurrence within the Barkly Region. A fire is likely to have a serious impact, with moderate term reversible impacts (years).With the appropriate controls, such as separation distances, firebreaks, and adherence to total fire bans, the likelihood of causing a fire from drilling, stimulation and well testing is anticipated to be highly unlikely, with a predicted occurrence of <10%.	Yes	Low
47			Poor rehabilitation of the site reduces regional habitat and promotes weed invasions (including civil construction,seismic and E&A activities)	A.4.8 Rehabilitation	•A site specific Rehabilitation Plan has been developed and will be implemented progressively (Engineering) •Areas will have infrastructure and wastes removed, sumps and pits backfilled, topsoil respread and vegetation re-introduced. (Engineering) •Rehabilitation timing will consider seasonal constraints, with rehab completed prior to the wet season to maximise revegetation chance (Engineering) •Rehabilitation to commence within 4 weeks upon completion of seismic activities.	•Rehabilitation monitoring to be undertaken to track rehabilitation progress (Administration)	•Maintenance will be undertaken periodically to fix any defects (Engineering)	1	3	L	Yes	Risks associated with rehabilitation are well known. Knowledge of rehabilitation within the Beetaloo Basin has been gained, based on previous seismic line rehabilitation programs.	Yes	Low
48			Trapping and drowning of fauna in storage tanks and sumps.	C.5.1 Drilling Materials	•Wastewater tank walls are 2m high with minimal risk of animals accessing tanks (elimination) •Well pads fenced to prevent stockaccess (engineering) •Sump coletanche liner is rough, with fauna able to climb out of sump (Engineering) •Sump fenced when not in use in a manner to reduce fauna access to sump(Engineering) •Limited habitat for threatened fauna in area surrounding site (Elimination) •Wastewater saline, with freshwater tanks to be preferred by birds • Previous fauna cameras installed around well pads have not detected significant wildlife presence in and around operating sites. (Elimination)	•Weekly inspections during wastewater storage. •Monitoring of fauna interaction with wastewater	•Where ongoing fauna interactions with wastewater are identified through monitoring, additional controls shall be implemented as appropriate (such as additional fencing, deterrents etc.) (Engineering)	2	2	L	Yes	Risks associated with potentially trapping and drowning fauna in storage tanks and sumps are well understood. Tamboran has extensive experience in managing sumps, ponds and tanks to prevent fauna ingress.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
49			Contaminants in water and soil pass through the food chain and bioaccumulate in fauna causing detrimental impacts to local species and communities	A.4.7 Containment of Contaminants C.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	•All chemicals stored in designated areas with secondary containment (Engineering) •Chemical risk assessments with no chemicals considered above low concern levels when used in accordance with standard procedures and controls (Elimination) •The site is earthen bunded to prevent offsite release of flowback.This is considered an additional level of containment, as the primary and secondary containment is the principle spill risk control. (Engineering) •Site earthen bunding will have a minimum bund wall height of 300mm capable of managing at least 110% of the largest wastewater tank volume. (Engineering) •The earthen bund will be constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied. (Engineering) •Wastewater evaporation to have drift controls to prevent drift beyond the wastewater tank (engineering) •No offsite wastewater discharge (elimination) •Chemical mixing units and operating procedures designed to mitigated the formation of chemical airborne particulate matter (Engineering/ Administration) •Onsite burial of drilling waste can only occur where no material impacts to flora and fauna are anticipated (engineering) •Salt is the main hazard and does not bioaccumulate- UV and oxidation of organic compounds and metals in wastewater likely to degrade chemicals rapidly (within days)(Elimination) •Well pads fenced to prevent livestock accesses (engineering) •Sump fenced to prevent fauna access. (engineering) •Gathering lines designed, constructed, tested and operated in accordance with Code of Practice: Upstream Polyethylene Gathering Networks- CSG industry (APGA2019)	•Routine site weekly inspections to identify poor chemical handling or wastewater storage practices (engineering) •Monitoring of fauna interactionwith wastewater tanks and area surrounding the site (Administration) • monthly gathering line inspections •Gathering line leak detection used to identify leaks	•Where ongoing fauna interactions with wastewater or chemicals are identified through monitoring, additional controls shall be implemented as appropriate to reduce the potential for exposure (such as additional fencing, deterrents etc.) (Engineering) •All spills are to be cleaned up immediately, preventing the exposure to livestock and fauna	2	1	L	Yes	A chemical risk assessment and flowback characterisation program ensures all potential chemicals that are persistent, bio accumulative and toxic at high concentrations are identified and appropriate management strategies implemented. The risks associated with fauna ingestion of chemicals is well known and measures to prevent ingestion (such as fences and separation distances to activity) are deployed as standard practice. Tamboran has extensive operational experience in drilling and stimulating of conventional and unconventional petroleum wells with no evidence of impacts on biota from chemicals. Gathering lines will be designed, constructed, tested and operated in accordance with well accepted standards to prevent leaks and releases to the environment. Leak detection and routine inspections are utilised to identify leaks. Given the saline nature of wastewater, bioaccumulation is not considered likely based on the lack of palatability. Combined in the availability of habitat in the area which would-be impacted by a release/ spill- the risk is considered minor, with the likelihood remote.	Yes	Low
50			Vehicle and machinery collisions with fauna during civiland maintenance activities – fauna mortality results in a localised impact to listed threatened species .	A.4.4 Biodiversity protection	•Vegetation clearing at exploration sitesto be conducted with visual checks to identify fauna/fauna habitat during clearing •Vehicle speed limited to 60km/hr to be reduced around areas of high risk of fauna collision (Administration) •Vehicle movements to avoid driving at night (Elimination) •Fauna collisions observed during the existing activities have been minimal, with collision restricted to several wallabies along access track (Elimination) • Absence of listed threatened species identified in the vicinity of the well pad,access tracks and seismic lines. •Large trees and habitat trees to be avoided during seismic clearing through line deviation.	•Fauna mortality data is collected as part of Tamboran's incident and observation management procedures (Administration)	•Where ongoing fauna collisions are reported, additional controls shall be investigated, such as reduced speed limits in high risk areas will be implemented. (Administration)	1	3	L	Yes	Fauna collisions with vehicles are a commonly associated with roads. It is anticipated that a small number of fauna collisions will be experienced during the activity (1-2 animals per month), with minor, short term, reversible impacts to local fauna species. The likelihood of causing a localised decline in species abundance is considered remote.	Yes	Low
51			Encouragement of feral animals and other pest species increases leading to competition with native species.This includes the introduction of cane toads.	A.4.4 Biodiversity protection	•Camp wastes to be storage to be animal proof (Engineering) •All food scraps to be removed from site and disposed of at a licenced facility (Elimination) •Food scraps to be frozen and stored within freezer during wet season (Elimination) •Experience from existing activities has not detected increased feral animal prevalence, with only 1 feral dog identified in 6 months of camp operations. (Elimination)	•Feral fauna observation data is collected as part of Tamboran's incident and observation management procedures (Administration)	•Where ongoing feral animal presence is detected, additional controls will be investigated in consultation with the pastoralist (such as fencing, removal of water sources etc.) (Engineering)	1	3	L	Yes	Feral animals may be increased through the provision of access to water, food (camps) and hunting habitat (such as road corridors). The use of the existing site and access tracks limits the additional risk associated with provision of additional hunting habitat.Food scraps and waste will be frozen and disposed of offsite which will reduce the food availability for pests. Wastewater is too saline for cane toads to survive, with the design of the tanks likely to restrict toad habitat. The anticipated consequence is minor, with the potential pest species increase anticipated to be small. The likelihood is determined to be unlikely, with a probability of less than 30%.	Yes	Low
52			Activity (vehicle, machinery and seismic activity) noise & vibration during 2D seismic acquisition.	A.4.1 Site selection and planning A.4.2 Noise	•Seismic lines avoid areas of high conservation value as a priority (Elimination) •Areas are not considered high conservation value, are not threatened/endangered and not fragmented, with impacts unlikely to result in significant disturbance to threatened/endangered species. (Elimination) •Impacts likely to be temporal, with fauna able to move to adjacent areas to escape impacts. (Elimination) •Avoid vegetation clearing as much as practicable •In open woodlands, limit clearing to grasses and shrubs (Avoidance) •During seismic surveys, detonations will not occur when cattle are in proximity (Elimination) •Cattle will be mustered way from seismic area in consultation with pastoralist (Elimination) •During detonation, a short sharp thud will be heard, and potential small level vibration field within 1 km of charge going off. Tamboran will work with pastoralist to ensure cattle are mustered away from the activity. (Elimination)	•Anecdotal evidence from pastoralists and Traditional Owners (Administration) •Impacts arelikely to be temporal, with detection extremely difficult.	•Where impacts are identified, practices will be reviewed and modified to reduce impact on fauna (Administration/ engineering)	1	3	L	Yes	Fauna may be disturbed through transport movements along access tracks and seismic lines. The consequence of activity nuisance is anticipated to be minor, with localised, short term impacts to areas immediately adjacent to access tracks. The likelihood of the risk is reduced through the isolated location (lack of environmental and community receptors), regionally extensive vegetation communities (good outside refuge away from access tracks, seismic activity and limited transport movements during the evenings. The impact to fauna is considered highly unlikely given the ability of fauna to move to other areas of refuge away from seismic activities and ongoing engagement with pastoralists re cattle.	Yes	Low
53			Introduction and spread of weeds in the area during 2D seismic.	A.4.5 Weed management	•All equipment and vehicles to be washed-down and to have a Biosecurity Declaration Certificate prior to access to site (Elimination) •Areas of proposed exploration have been surveyed and are deemed to have low weed abundance (elimination) •Activity will be restricted to defined seismic lines and camp sites (Elimination) •Vegetation pushed during seismic line preparation will be placed back over cleared areas immediately after seismic recording (Engineering) •Preparation of seismic lines will minimise the removal of vegetation, rootstock, topsoil and seed bank, increasing the rate of vegetation recovery (Engineering) •Avoid seismic lines in water courses (unless co-located with an access track)	•6 monthly monitoring implemented around infrastructure to detect the spread/ introduction of weed species (administration) •Tamboran assurance activities to target equipment wash-down certificates to ensure standards are being met. (Administration)	•Where weed outbreaks are identified associated with Tamboran's activities, infestations will be treated in accordance with the Weed Management Plan. (elimination) •Corrective actions implemented where ongoing biosecurity breaches are identified.	2	3	M	Yes	The area in the vicinity sites is free of weeds. Weeds are present across the broader property. Any introduction of weeds is likely to result in localised impact, with weed management requirements likely to reduce the consequence down to "moderate, short term.Due to the inherent nature of weed prevention the risk likelihood is considered unlikely, witha probability less than <30%	Yes	Low
54			Accidental ignition of fire during 2D seismic acquisition and general access.	A 4.6 Fire management	•Bushfire management plan implemented to prevent and respond to bushfires- including establishment of communication and fire response protocols with pastoralists (Administration) •Bushfire awareness included in site inductions. (Administration) •Designated smoking areas on-site (Elimination) •Firefighting equipment to be available to deal with fires (Engineering). •Vehicles to be equipped with fire extinguishers. •Fire response to be implemented during seismic program, with spotters and fire trailers utilised to put out spot fires during work •Activities will comply with landholder and regional bushfire management plans. (Elimination) •Area in the vicinity of the seismic activity have had recent (within 1-2 years) fire activity, reducing the fuel load (Elimination)	•Annual fire preparedness assurance activities completed where activities are proposed during high fire risk periods (administration) •Daily monitoring of bushfires in the region during periods of high fire danger (administration) •Annual fire frequency mapping using the Northern Australia Fire Information fire history database (administration)	•Fire hazard reduction strategies (such as back burning) to be implemented to reduce the risk of fire ignition/ impact as required (Elimination) •Where a bushfire is started and cannot be controlled, Tamboran to engage with pastoralist to coordinate response activities	3	2	M	Yes	Fire is a common occurrence within the Barkly Region. A fire is likely to have a serious impact, with moderate term reversible impacts (years).With the appropriate controls, such as separation distances, firebreaks, and adherence to total fire bans, the likelihood of causing a fire from drilling, stimulation and well testing is anticipated to be highly unlikely, with a predicted occurrence of <10%	Yes	Low
55			Poor rehabilitation of the 2D seismic lines reduces regional habitat and promotes weed invasions	A.4.8 Rehabilitation	•A site specific Rehabilitation Plan has been developed and will be implemented progressively (Engineering) •Vegetation pushed during seismic line preparation will be placed back over cleared areas immediately after seismic recording (Engineering) •Preparation of seismic lines will minimise the removal of vegetation, rootstock, topsoil and seed bank, reducing the risk of erosion and increasing the rate of vegetation recovery (Engineering)	•Rehabilitation monitoring to be undertaken to track rehabilitation progress (Administration)	•Maintenance will be undertaken periodically to fix any defects (Engineering)	1	4	M	Yes	Risks associated with rehabilitation are well known. Knowledge of rehabilitation within the Beetaloo Basin has been gained, based on previous seismic line rehabilitation programs.	Yes	Low
56			Poor rehabilitation of the gathering lines reduces regional habitat, promotes weed invasions and results in minimal ecological function of the right of way	A.4.8 Rehabilitation	• Gathering lines purged and flushed of all wastewater •Gathering lines inspected and pigged to remove scale •Lines flushed and tested to confirm contamination removal •Surface infrastructure removed, including valve pits, drains, and signs to 750mm below ground •Pipe left insitu to avoid disturbance and avoid erosion/ impacts to established vegetation •HDPE has sufficient mechanical strength to avoid long term subsidence • reseeding of gathering line with locally sourced woody trees as required	• rehabilitation monitoring to identify erosion, poor vegetation re-establishmentand weeds	• periodic maintenance completed on areas of poor rehabilitation.	1	2	L	Yes	The risk associated with leaving HDPE in place is largely associated with contaminant removal.The risk associated with disturbing the soils and clearing vegetation to remove the pipe is not considered ALARP as this increasing the risk of erosion and subsidence.. By removing all contaminants and surface infrastructure, the gathering line right of way can be allowed to be re-established with woody vegetation to return back to pre-established conditions.As the gathering line is likely to have substantial grass/ shrub coverage already, the impacts are considered minor (1) and likelihood considered unlikely.	Yes	Low
57			Vehicle and machinery collisions with fauna during 2D seismic activities – fauna mortality results in a localised impact to listed threatened species	A.4.4 Biodiversity protection	•Pre-clearance site inspections (October - March) to minimise impacts to breeding / fledging of the Crested Shrike Tit. (Elimination) •Vegetation clearing of seismic lines to be conducted with visual checks to identify fauna/fauna habitat during clearing. •Vehicle speeds during seismic acquisition limited to <60 km/hrand mostly occurring at walking pace (Administration) •Vehicle movements to avoid driving at night (Elimination) •Fauna collisions observed during the existing activities have been minimal, with collision restricted to several wallabies along access track (Elimination)	•Fauna mortality data is collected as part of Tamboran's incident and observation management procedures (Administration)	•Where ongoing fauna collisions are reported, additional controls shall be investigated, such as reduced speed limits in high risk areas will be implemented. (Administration)	1	3	L	Yes	Fauna collisions with vehicles are a commonly associated with roads. It is anticipated that a small number of fauna collisions will be experienced during the activity (1-2 animals per month), with minor, short term, reversible impacts to local fauna species. The likelihood of causing a localised decline in common or listed threatened species abundance is considered remote.	Yes	Low
58	**Culture and heritage**	Disturbance of sacred site or culturally sensitive area, loss of spiritual connection with land and decline in environmental value of area used for hunting, foraging and enjoyment.	Sites disturbed directly by exploration activities	A.4.1 Site selection and planning	•Exploration Agreements with Determined Traditional owners covering all proposed exploration activities. •All areas of the proposed activity to be cleared by NLC and Archaeologist (Appendix L) (Elimination) •AAPA certificates for proposed work program have been granted (Elimination) •The location of infrastructure has considered proximity to sacred sites and cultural heritage artefacts (Elimination) •Areas of cultural heritage to be avoided during construction through the use of Cultural managers (Elimination) •Areas of cultural significance are identified through Restricted Work Areas (Elimination) •Implementation of the unexpected finds protocol (Administration).	•Archaeologists complete Cultural Heritage Assessment to identify culturally sensitive areas. •Tamboran completes 6 monthly assurance programs to confirm access to sacred sites has not occurred.	•N/A- no access to sacred sites anticipated. (Elimination)	3	1	L	Yes	All sites of the proposed activity must have Traditional Owner clearance via the NLC and informed by Cultural Heritage Assessment by a trained archaeologist. AAPA certificates are required for all activities to ensure sacred sites are not impacted by activities. The remote location of the activity, lack of sacred sites in the vicinity of the sites and contractual requirements prohibiting access reduce the likelihood down to "highly unlikely", with a probability lower than 10%.	Yes	Low
59			Accidental ignition by site activities (civil works, drilling, grinding) or site personnel.	A 4.6 Fire management	•Bushfire management plan implemented to prevent and respond to bushfires- including establishment of communication and fire response protocols with pastoralists (Administration) •Bushfire awareness included in site inductions. (Administration) •Designated smoking areas on-site (Elimination) •Firefighting equipment to be available to deal with fires (Engineering). •Fire breaks have been constructed around the lease and camp pads (Engineering) •Minimum of 45m separation distances between flares and surrounding vegetation (Engineering) •Ignition sources placed outside of the hazardous area. (Elimination) •Intrinsically safe equipment used in hazardous area. (Elimination) •Hazardous area drawing will provide classification of hazardous zones while drilling. (Elimination) •No flaring during periods of total fire ban (Elimination) •Activities will comply with landholder and regional bushfire management plans. (Elimination)	•Annual fire preparedness assurance activities completed where activities are proposed during high fire risk periods (administration) •Daily monitoring of bushfires in the region during periods of high fire danger (administration) •Annual fire frequency mapping using the Northern Australia Fire Information fire history database (administration)	•Fire hazard reduction strategies (such as back burning) to be implemented to reduce the risk of fire ignition/ impact as required (Elimination) •Where a bushfire is started and cannot be controlled, Tamboran to engage with pastoralist to coordinate response activities	3	2	M	Yes	Fire is a common occurrence within the Barkly Region. A fire is likely to have a serious impact, with moderate term reversible impacts (years).With the appropriate controls, such as separation distances, firebreaks, and adherence to total fire bans, the likelihood of causing a fire from drilling, stimulation and well testing is anticipated to be highly unlikely, with a predicted occurrence of <10%	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
60			Flowback tank structural/ catastrophic liner failure.	A.4.1 Site selection and planning A.4.7 Containment of Contaminants C.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	•Tanks designed and engineered to AS3990 Mechanical Equipment- Steel Work, AS 1170.1 Hydrostatic loading, AS1170.2 Wind Rating (cyclonic wind rating) (Engineering) •Wastewater tank liner with impermeable membrane with coefficient of permeability of less than 10-9 m/s permeability, 120N picture resistance and 49N tear resistance (Engineering) • Higher density liners to be used for evaporation tanks where solid salt may be generated due to long term wastewater evaporation •Covered wastewater tanks and condensate tanks to have vents to prevent pressure build up. (Engineering) •The well pad is compacted to above 100 kpa to achieve a permeability of approximately 1x10m-7/s (Engineering) •The site is earthen bunded to prevent offsite release of flowback.This is considered an additional level of containment, as the primary and secondary containment is the principle spill risk control. (Engineering) •The site earthen bund has a minimum bund wall height of 300 mm capable of managing at least 110% of the largest wastewater tank volume.(Engineering) •The earthen bund is constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied.(Engineering) •Sacred site areas mapped as restricted work areas with no access permitted (Elimination, Administration) •Firebreaks maintained and lids to be flooded with water to combat ember attack damaging liner • Termite baits and spraying to be used to prevent termite damage to liners	•Weekly wastewater tank integrity inspections during wastewater storage to detect (administration) •Routine level monitoring and alarms (Engineering)	•Wastewater tank structural defects to be rectified as soon as practicable. (Engineering) •Wastewater to be transferred from defective tanks to alternative tanks onsite until repairs completed. (Engineering) •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately (Engineering) •Earth moving equipment available regionally to clean up spills (Engineering) •Emergency response plan implemented (Administration) •Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	3	1	L	Yes	The consequences of a tank failure are negated through the use of double lined, engineered above ground tank which have continuous leak detection and alarms. Tanks and their liners are designed with sufficient structural integrity to withstand cyclonic winds, extreme temperatures and loading stress forces under a range of conditions.A spill management pan is in force to detect, prevent and respond to potential spills of wastewater. If a storage failure was to occur, the wastewater would be restricted to the well pad, limiting the impact on adjacent pastoral activities and community..Flowback would be pumped into available enclosed and open tank storage, with contaminated soil removed from site. The consequences are likely to be "serious", being locally restricted, moderate duration (weeks) and reversible (requiring rehabilitation).The likelihood is reduced by the Code requirements , tank design separation distancesto the underlying aquifer. The likelihood is considered Remote, with a probability less than 1%.	Yes	Low
61			Failure or leak from wastewater gathering line network, including from sabotage.	A.3 Surface activities mandatory requirements requirements A.3.8 Containment of Contaminants C.4.2 Management of produced water and flowback fluid C.7.2 Spill Management	• Selection and placement of gathering line easement(s) - co-location with access tracks. •Gathering lines are used, these will be designed, constructed and maintained in accordance with "Code of Practice for Upstream Polyethylene Gathering Network in the CSG Industry, Version 5", August 2019 (APGA 2019) • Gathering lines are located in remote areas with limited access, minimising the risk of sabotage • Gathering have a design life of in excess of 50 years •PE pipes shall be manufactured in accordance with AS/NZS 4130 and shall be thirdparty certified by a JAS-ANZ accredited certifier under the StandardsMark, GasMark or WaterMark schemes or equivalent. •pipes to be pressure tested/ hydrotested to confirm integrity. •Marking and product traceability shall be in accordance with the Standard. Appendix A of AS/NZS 4130 shall be used as the basis for demonstrating conformity. •Pipes for Gathering Networks shall be Series 1 conforming to AS/NZS 4130. A design, risk assessment and testing regime, inline with the PEGN code, will ensure suitable material selection and selection of facility overpressure protection equipment to reduce the probability of leaks to ALARP •aboveground gathering lines to be temporary (typically <12 months), with no transfers where fires or severe weather events are predicted • Identification and signage to prevent excavation damage • Emergency shutdown systems and response procedures to investigate and manage loss of containment. • Flowline / gathering networks will be fitted with manifolds and valves to isolate it into sections. Valves will be locked at all times unless attended by authorised personnel to prevent unintentional operation. •upon cessation of use/ suspension (triggered after 3 months of no use),gathering lines will be purged of any residual wastewater •Fuel loads within right of ways to be kept low to reduce fire risks. Overhanging trees that could fall on pipelines will be removed.	• Remote monitoring of pressure, flow and leaks on gathering networks (pressure and leak detection) • Remotely operated isolation valves on gathering networks • monthly gathering line inspections during continual operations or where batch transfer is proposed, before and during each batch transfer.	• emergency response and spill management plans enacted to respond to spills •Pumps located onsite to recover fluid and transfer into existing tanks, with spills and leaks to be cleaned up and rectified immediately •Earth moving equipment available regionally to clean up spills •Gathering network system will not be restarted until the leak is repaired and an investigation is carried out as to how the leak occurred and how it will be prevented from re-occurring •Emergency response plan implemented. • Any contamination event to be characterised and have remediation plans developed and executed in accordance with the process outlined in schedule A of the National Environmental Protection (Assessment of site Contamination) Measures (Engineering)	2	2	L	Yes	The risk of a flowline failure is minimised by being constructed to a relevant code, including material selection, certification and system design.Industry standard welding techniques and QA/QC protocols will be implemented to ensure compliance with the APGA code. Hydrotesting will be completed to confirm the integrity of the system and detect any leaks prior to commissioning.Leak detection will be implemented on the gathering line system with leaks able to be rapidly (instantaneously) detected. Telemetered valves will allow remote shut down of gathering lines should leaks be detected. Flowlines to be used for long term deployment will be buried.Any surface lines will be temporary and will be removed when not in use. Pipelines will not be used during periods of bushfire or extreme weather. Burying permanent flow lines ensures there is added protection against fire, flood, cyclonic winds, extreme temperatures and loading stress forces under a range of conditions. A spill management pan is in force to detect, prevent and respond to potential spills of wastewater and gas. If a failure was to occur, the wastewater would be restricted to the immediate vicinity of the gathering line.given the leak detection and remote shut in procedures- The potential leak rate is likely to be lower than 1000L which would mainly be restricted to within the gathering line right of way. The likelihood of such a consequence from occurring is considered highly unlikely (probability <10%) due to the multiple failsafe's installed on the gathering networks.The consequence is considered moderate, given the likely size of the spill.	Yes	Low
62			Personnel unauthorised access to sacred site.	A.4.1 Site selection and planning	•Restricted work areas are not located in close proximity to explorational activities (Elimination) •All staff to be inducted covering restricted work areas and cultural heritage (Administration) •Access off lease not permitted. (Elimination)	•Tamboran completes 6 monthly assurance programsto confirm access to sacred sites has not occurred.	• N/A- no access to sacred sites anticipated. (Elimination)	2	2	L	Yes	All sites of the proposed activity must have Traditional Owner clearance via the NLC. AAPA certificates are required for all activities to ensure sacred sites are not impacted by activities.The remote location of the activity, lack of sacred sites in the vicinity of the sites and contractual requirements prohibiting access reduce the likelihood down to "highly unlikely", with a probability lower than 10%.	Yes	Low
63			Sites disturbed directly by 2D seismic activities	A.4.1 Site selection and planning	•Exploration Agreements with Determined Traditional owners covering all proposed exploration activities. •All areas of the proposed activity to be cleared by NLC. (Elimination) •AAPA certificates for proposed work program have been granted (Elimination) •The location of seismic lines has considered proximity to sacred sites (Elimination) •Areas of cultural heritage to be avoided during the activity (Elimination) •Implementation of the unexpected finds protocol (Administration).	•Tamboran completes 6 monthly assurance programs to confirm access to sacred sites has not occurred.	•N/A- no access to sacred sites anticipated. (Elimination)	3	1	L	Yes	All sites of the proposed activity must have Traditional Owner clearance via the NLC. AAPA certificates are required for all activities to ensure sacred sites are not impacted by activities.The remote location of the activity, lack of sacred sites in the vicinity of the sites and contractual requirements prohibiting access reduce the likelihood down to "highly unlikely", with a probability lower than 10%.	Yes	Low
64			Accidental ignition during 2D seismic activities.	A 4.6 Fire management	•Bushfire management plan implemented to prevent and respond to bushfires- including establishment of communication and fire response protocols with pastoralists (Administration) •Bushfire awareness included in site inductions. (Administration) •Designated smoking areas on-site (Elimination) •Firefighting equipment to be available to deal with fires (Engineering). •Vehicles to be equipped with fire extinguishers. •Fire response to be implemented during seismic program, with spotters and fire trailers utilised to put out spot fires during work •Activities will comply with landholder and regional bushfire management plans. (Elimination) •Area in the vicinity of the seismic activity have had recent (within 1-2 years) fire activity, reducing the fuel load (Elimination)	•Annual fire preparedness assurance activities completed where activities are proposed during high fire risk periods (administration) •Daily monitoring of bushfires in the region during periods of high fire danger (administration) •Annual fire frequency mapping using the Northern Australia Fire Information fire history database (administration)	•Fire hazard reduction strategies (such as back burning) to be implemented to reduce the risk of fire ignition/ impact as required (Elimination) •Where a bushfire is started and cannot be controlled, Tamboran to engage with pastoralist to coordinate response activities	3	2	M	Yes	Fire is a common occurrence within the Barkly Region. A fire is likely to have a serious impact, with moderate term reversible impacts (years).With the appropriate controls, such as separation distances, firebreaks, and adherence to total fire bans, the likelihood of causing a fire from drilling, stimulation and well testing is anticipated to be highly unlikely, with a predicted occurrence of <10%.	Yes	Low
65			Contaminants in water and soil pass through the food chain and bioaccumulate in fauna (livestock and native animals) causing detrimental impacts to local species and communities that rely on the animals for food/ livelihood / spiritual connection.	A.4.7 Containment of Contaminants C.5.2 Management of produced water from petroleum wells C.8.2 Spill Management Plan	• Stakeholder engaging with NTH and community to provide descriptions of regulated activity and controls. •All chemicals stored in designated areas with secondary containment (Engineering) •Chemical risk assessments with no chemicals considered above low concern levels when used in accordance with standard procedures and controls (Elimination) •The site is earthen bunded to prevent offsite release of flowback.This is considered an additional level of containment, as the primary and secondary containment is the principle spill risk control. (Engineering) •Site earthen bunding will have a minimum bund wall height of 300mm capable of managing at least 110% of the largest wastewater tank volume. (Engineering) •The earthen bund will be constructed in a manner to withstand a tank failure scenario with appropriate compaction and stabilisation applied. (Engineering) •Wastewater evaporation to have drift controls to prevent drift of wastewater beyond the wastewater tank (engineering) •No offsite wastewater discharge (elimination) •Chemical mixing units and operating procedures designed to mitigated the formation of chemical airborne particulate matter (Engineering/ Administration) •Onsite burial of drilling waste can only occur where no material impacts to flora and fauna are anticipated (engineering) •Salt is the main hazard and does not bioaccumulate- UV and oxidation of organic compounds and metals in wastewater likely to degrade chemicals rapidly (within days)(Elimination) •Well pads fenced to prevent livestock accesses (engineering) •Sump fenced to prevent fauna access. (engineering) •Gathering lines designed, constructed, tested and operated in accordance with Code of Practice: Upstream Polyethylene Gathering Networks- CSG Industry, Version 5 (APGA 2019)	•Routine site weekly inspections to identify poor chemical handling or wastewater storage practices (engineering) •Monitoring of fauna interactionwith wastewater tanks and area surrounding the site (Administration) • monthly gathering line inspections •Gathering line leak detection used to identify leaks	•Where ongoing fauna interactions with wastewater or chemicals are identified through monitoring, additional controls shall be implemented as appropriate to reduce the potential for exposure (such as additional fencing, deterrents etc.) (Engineering) •All spills are to be cleaned up immediately, preventing the exposure to livestock and fauna	2	1	L	Yes	A chemical risk assessment and flowback characterisation program ensures all potential chemicals that are persistent, bio accumulative and toxic at high concentrations are identified and appropriate management strategies implemented. The risks associated with fauna ingestion of chemicals is well known and measures to prevent ingestion (such as fences and separation distances to activity) are deployed as standard practice. Tamboran has extensive operational experience in drilling and stimulating of conventional and unconventional petroleum wells with no evidence of impacts on biota from chemicals. Gathering lines will be designed, constructed, tested and operated in accordance with well accepted standards to prevent leaks and releases to the environment. Leak detection and routine inspections are utilised to identify leaks. Given the slime nature of wastewater, bioaccumulation is not considered likely based on the lack of palatability. Combined in the availability of habitat in the area which would-be impacted by a release/ spill- the risk is considered minor, with the likelihood remote.	Yes	Low
66			Personnel unauthorised access to sacred site during 2D seismic activities.	A.4.1 Site selection and planning	•Restricted work areas are not located in close proximity to explorational activities (Elimination) •All staff to be inducted covering restricted work areas and cultural heritage (Administration) •Access off lease not permitted. (Elimination)	•Tamboran completes 6 monthly assurance programsto confirm access to sacred sites has not occurred.	• N/A- no access to sacred sites anticipated. (Elimination)	2	2	L	Yes	All sites of the proposed activity must have Traditional Owner clearance via the NLC. AAPA certificates are required for all activities to ensure sacred sites are not impacted by activities.The remote location of the activity, lack of sacred sites in the vicinity of the sites and contractual requirements prohibiting access reduce the likelihood down to "highly unlikely", with a probability lower than 10%.	Yes	Low
67	**Community and economy**	Loss of visual amenity, experience and sense of place for landholder, community members and tourists.	Industrialisation of landscape.	A.4.1 Site selection and planning A.4.1.1 Well pad specific site selection	•Existing location used to reduce footprint, with multi- well pads needed to minimise the impact of a future development (if feasible) •Site is located away from and, environmental and community receptors and not clearly visible: slight glow may be experienced during well testing (similar to a small town) (Elimination) •Level of clearing for infrastructure is small (Elimination) •Progressive rehabilitation to occur when sites are no longer required for future operations (engineering) •Activity intensity is restricted to specific periods, with most activity restricted to the well pad. •Workers are flown in and out of Daly waters from Darwin. Buses are used to limit vehicle transport movements between the Daly Waters airport and remote camps- there is limited Drive In/Drive Out workers into the Beetaloo- except where local or regional contractors are utilised. •Camps utilised to minimise impact on local accommodation and tourism. •2D seismic acquisition only occurs during daylight hours (Elimination) •Clearing for 2D seismic lines is minimal (Avoid)	•Ongoing community engagement to monitor performance and identify potential impacts from activity on local amenity.	•N/A- site location and activity intensity is unable to be changed.	1	1	L	Yes	The proposed explorational activities are located away from major transport routes, homesteads and communities. The consequences of activities may result in minor changes in to aesthetics through visibility of exploration activities (flare glows at night, presence of workers and vehicles).The probability that the activity will result in an industrialisation of the landscape is considered remote, with a probability less than 1%.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
68			Increased traffic.	A.4.1 Site selection and planning	•Traffic impact assessment completed assessing the increased traffic levels as negligible: reflective of limited size and scope of activity. •Traffic impacts are expected to small and temporary with rig located onsite or moved via internal road. •Access route is away from Copee Hill and Hayfields Homesteads. •Capacity of road and level of service will not be impacted materially. •Workers are flown in and out of Daly waters from Darwin. Busses are used to limit vehicle transport movements between the Daly Waters airport and remote camps- there is limited Drive In/Drive Out workers into the Beetaloo- except where local or regional contractors are utilised.	•Ongoing community engagement to monitor performance and identify potential impacts from activity on traffic.	•Complaints regarding traffic will be dealt through Tamboran's complaint resolution process.Where valid complaints are received, additional controls will be implemented to address community complaints (such as changes to vehicle load movements etc.)	2	1	L	Yes	The increased traffic from the activity is likely to be short term and within the Level of service of the existing roads.Increases in traffic are anticipated to have a "moderate" consequence (increase in traffic observable, but temporary). Traffic issues were not previously identified during the well drilling and stimulation campaigns for the existing wells and the increase in traffic is approximately 2%. The likelihood of causing a loss of experience from the E&A activities is considered"Highly unlikely", with an anticipated probability of less than 10%.	Yes	Low
69			Light emissions impact on community receptor (such as pastoralist)	A.4.1 Site selection and planning	•Sites are located awayfrom homesteads that may be visible during flaring. This is likely to be consistent with a small town and only visible during the night. (Elimination) •Flaring is of short duration, generally less than 90 days. (Elimination) No complaints received from flaring activities to date.	•Ongoing pastoralist engagement to monitor performance and identify potential impacts from activity on local amenity. (Administration)	•Complaints regarding light emissions will be dealt through Tamboran's complaint resolution process.Where valid complaints are received, additional controls will be implemented to address community complaints (such as shrouds,Changes to flare configuration etc.)	1	1	L	Yes	The remote location and separation distances between receptors is likely to result in minor light emissions. Light may be visible from activities (such as flaring), but will not be of sufficient intensity to cause any material impact to the health and wellbeing of community members.The likelihood of impacts is a function of separation distance and is therefore predicted to be remote, with a probability less than 1%.	Yes	Low
70			Influx of workers to region	N/A	•Work temporary in nature and uses existing regional contractors where available (Elimination) •Engagement with the pastoralists and directly affected community completed to communicate scope of work (administration) •Site camps utilised to minimise workers within local community (Elimination)	•Ongoing community engagement to monitor performance and identify potential impacts from activity on local communities.	•Complaints regarding work influx are unlikely and will be dealt through Tamboran's complaint resolution process.Where valid complaints are received, additional controls will be implemented to address community complaints.	2	1	L	Yes	The limited scope and duration of activities reduces the risk and uncertainty associated with risk.Most workers will be located away from communities, meaning there is unlikely to be a major increase in people.	Yes	Low
71			Noise emissions from activities.	A.4.1 Site selection and planning A.4.2 Noise	•Sites are away from homesteads. Noise impacts will not reach community receptors, with QLD experience on rig and stimulation noise indicating noise levels approaching background levels approximately <2 km from the activity. (Elimination) •No complaints received from flaring activities to date (Administration).	•Ongoing pastoralist engagement to monitor performance and identify potential impacts from activity on local amenity. (Administration)	•Complaints regarding noise emissions will be dealt through Tamboran's complaint resolution process.Where valid complaints are received, additional controls will be implemented to address community complaints (such as shrouds, changes to flare configuration etc.)	1	1	L	Yes	The remote location and separation distances between receptors is likely to result in "minor" noise impacts. The likelihood of impacts is a function of separation distance and is therefore predicted to be remote, with a probability less than 1%.	Yes	Low
72			Noise emissions and vibration from 2D seismic activities.	A.4.1 Site selection and planning A.4.2 Noise	•Seismic located >10 km from pastoralist homestead. •Noise impacts will not reach community receptors (Elimination) •During detonation, a short sharp thud will be heard, and potential small level vibration field within 1 km of charge going off.	•Ongoing pastoralist engagement to monitor performance and identify potential impacts from activity on local amenity. (Administration)	•Complaints regarding noise emissions will be dealt through Tamboran's complaint resolution process.	1	1	L	Yes	The remote location and separation distances between receptors is likely to result in "minor" noise impacts. The likelihood of impacts is a function of separation distance and is therefore predicted to be remote, with a probability less than 1%.	Yes	Low
73		Reduction in land productivity.	Introduction and spread of weeds in the area.	A.4.5 Weed management	•All equipment and vehicles to be washed-down and to have a Biosecurity Declaration Certificate prior to access to site (Elimination) •Areas of proposed exploration have been surveyed and are deemed to have low weed abundance (elimination) •Activity will be restricted to defined well pads and camp pads (Elimination)	•6 monthly monitoring implemented around infrastructure to detect the spread/ introduction of weed species (administration) •Tamboran assurance activities to target equipment wash-down certificates to ensure standards are being met. (Administration)	•Where weed outbreaks are identified associated with Tamboran's activities, infestations will be treated in accordance with the Weed Management Plan	2	3	M	Yes	The area in the vicinity of the sites is free of weeds. Weeds are present across the broader property. Any introduction of weeds is likely to result in localised impact, with weed management requirements likely to reduce the consequence down to "moderate, short term.Due to the inherent nature of weed prevention the risk likelihood is considered unlikely, witha probability less than <30%.	Yes	Low
74			Over extraction of groundwater.	A.4.1.1 Well pad specific site selection requirements Groundwater monitoring: EMP section 3.5, section 3.27.1 and Table 34	•Groundwater extraction for activities to be restricted to the minimum water required. (Elimination) •Groundwater bores are metered for groundwater take. (Engineering) •All water take licenced in accordance with NT Water Act under Water Extraction Licence (WEL) GRF 10285 (Administration) •Drawdown from the activities and other users assessed by DEPWS as a part of WEL; impacts to closest receptor not anticipated (Administration/ Elimination) •Karst system is under allocated, with sufficient available capacity to support proposed water extraction requirements. (Elimination) •Closest receptor is >5 km from extraction point (Elimination)	•Continuous flow meters to monitor take and water balance implemented to ensure compliance with WEL (Administration) • Groundwater monitoring completed to identify impacts associated with water extraction (Engineering)	•Groundwater extraction to cease where sustained drawdown post pumping exceeds 1 m (Administration)	1	1	L	Yes	The extraction of groundwater for hydraulic fracturing activities requires all take to be licenced.The proposed take is assessed as a part of the licence application, with the assessment considering current and future water take levels.Based on this assessment, it was determined that the extraction rate would not impact upon adjacent users.The risk consequence is determined to be "serious"- given any impact is likely to cause pastoralist and broader community concern.The likelihood of such a consequence from occurring is considered remote (probability <1%) due to the quality of the Cambrian limestone aquifer, separation distance from surrounding users and under utilisation ofaquifer.	Yes	Low
75			Impact to surface hydrology changes water flows impacting the land use/productivity	A.4.3 Erosion and sediment control and hydrology A.4.1 Site selection and planning	•Well pad located away from watercourses and regional flow paths. (Elimination) •Well pads designed to divert stormwater around, without impeding natural surface water flows (Engineering) •gathering lines and access tracks not designed to impede water flow (elimination) •Stockpiled debris to be used to discourage water concentration, with vegetation establish on stockpiles to reduce exposed surfaces •Area is remote with closest watercourse being 450m away form Shenandoah N A and 12km from Shenandoah S C. (Elimination) •The well site is flat, with water to be diverted around the perimeter of the site. (Elimination) •reinstated gathering lines to be monitored for subsidence/ poor vegetation cover and repaired promptly.	•Erosion and Sediment Control Plan in place with routine pre and post wet season inspection and maintenance (administration)	•Maintenance to be undertaken on erosion and sediment controls to ensure ongoing functionality and the controls are adequate (Engineering)	1	1	L	Yes	The existing well pad will be utilised for all activities, with no additional construction required.The existing well pad has been located outside the major regional flow paths and designed to divert stormwater around the infrastructure.The consequence is anticipated to be minor, with the likelihood remote (based on the site being existing).	Yes	Low
76			Bushfire from accidental ignition by site activities (civil works, drilling, flaring grinding) or personnel.	A.4.6 Fire management	•Bushfire management plan implemented to prevent and respond to bushfires- including establishment of communication and fire response protocols with pastoralists (Administration) •Bushfire awareness included in site inductions. (Administration) •Designated smoking areas on-site (Elimination) •Firefighting equipment to be available to deal with fires (Engineering). •Fire breaks will be installed around infrastructure (Engineering) •Minimum of 45 m separation distances between flares and surrounding vegetation (Engineering) •Ignition sources placed outside of the hazardous area. (Elimination) •Intrinsically safe equipment used in hazardous area. (Elimination) •Hazardous area drawing will provide classification of hazardous zones while drilling. (Elimination) •No flaring during periods of total fire ban (Elimination) •Activities will comply with landholder and regional bushfire management plans. (Elimination)	•Annual fire preparedness assurance activities completed where activities are proposed during high fire risk periods (administration) •Daily monitoring of bushfires in the region during periods of high fire danger (administration) •Annual fire frequency mapping using the Northern Australia Fire Information fire history database (administration)	•Fire hazard reduction strategies (such as back burning) to be implemented to reduce the risk of fire ignition/ impact as required (Elimination) •Where a bushfire is started and cannot be controlled, Tamboran to engage with pastoralist to coordinate response activities	3	2	M	Yes	Fire is a common occurrence within the Barkly Region. A fire is likely to have a serious impact, with moderate term reversible impacts (years).With the appropriate controls, such as separation distances, firebreaks, and adherence to total fire bans, the likelihood of causing a fire from drilling, stimulation and well testing is anticipated to be highly unlikely, with a predicted occurrence of <10%.	Yes	Low
77			Poor rehabilitation/ reinstatement of exploration infrastructure.	A.4.8 Rehabilitation	•A site specific Rehabilitation Plan has been developed and will be implemented progressively Engineering) •Areas will have infrastructure and wastes removed, sumps and pits backfilled, topsoil respread and vegetation re-introduced. (Engineering) •Rehabilitation timing will consider seasonal constraints, with rehab completed prior to the wet season to maximise revegetation chance (Engineering) • Reinstated gathering lines will be inspected 6 monthly to identify and repair any subsidence/ poor vegetation cover. •Gathering lines to be removed of contaminants and left insitu with all surface infrastructure removed to reduce potential risks of subsidence, erosion and poor vegetation re-establishment.	•Rehabilitation monitoring to be undertaken to track rehabilitation progress (Administration)	•Maintenance will be undertaken periodically to fix any defects (Engineering)	2	2	L	Yes	Rehabilitation success will be determined through the timing of rehabilitation, with rehab activities undertaken before the wet season to maximise success.Ongoing monitoring and maintenance of rehabilitated areas will be critical to identify and repair areas where rehabilitated success is poor,Consequences are likely to be moderate, with impacts likely to have moderate, locally restricted and medium to long term (1-5 years).The likelihood is influenced by the requirement for security provisions, rehabilitation plan requirements and Code conditions.The likelihood is anticipated to be highly unlikely, with a probability below 10%.	Yes	Low
78			Loss of sense of place and connection to land	A.4.1 Site selection and planning A.4.3 Erosion and sediment control and hydrology A.4.8 Rehabilitation	• All exploration activities are undertaken under Exploration agreements with Native Title holders (administration) • Exploration agreements have specific environmental and reporting requirements • Native title holders receive royalties and employment from exploration activities • On country meetings held to discuss activities, risk and controls • Site inspections held with Native Title Holders to inspect activities • Cultural managers used or perform sacred site clearances and heritage surveys to identify features required to be protected. • Cultural managers used for pre-clearance surveys and during groundwater monitoring	•Routine meetings are held with Native Title Holders to discuss activities, with any concerns raised responded to.	•Complaints regarding Tamboran's activities will be dealt through Tamboran's complaint resolution process.Where complaints are received, Tamboran will investigate and work with the party to attempt to come to a amicable resolution.	2	1	L	Yes	Exploration Agreements under the Native title Act are required to be in force covering all exploration activities. These dictate ongoing engagement and consent processes with Native title holders.Tamboran provides information on their proposed activities, including the avoidance of impacts and risk mitigation strategies .The Code of practice outlines extensive controls which fundamentally protect the environment and therefore the interests of Native Title holders.		
79			Disruption of agricultural operations due to ongoing access, traffic, helicopter movements, gathering lines locations etc.	A.4.1 Site selection and planning A.4.2 Noise	•All activities require engagement with pastoralists (Administration) •Well site has been located to avoid disruption to agriculture operations and infrastructure. (Elimination) •Engagement will be undertaken in accordance with NT Petroleum (Environment) Regulations (Administration) •Traffic levels are anticipated to be small- as per Traffic Impact Assessment.(Elimination) •Helicopter movements to be restricted to wet season when landholder activities are minimal (Elimination) •Helicopter movements to be undertaken in consultation with leaseholder to avoid impacts to livestock, cattle yards, watering points, homesteads and other sensitive areas as advised by leaseholder. (Elimination) •2D seismic activities are of a limited size and scope of the activity (e.g. 10 vehicles for 30 - 45 days). •Detonation of explosives within limited area, with engagement with pastoralists undertaken to ensure activities do not impact on pastoral operations. •Gathering lines located below 750mm with no deep ripping or intensive agriculture in the area.	•Ongoing pastoralist engagement to monitor performance and identify potential impacts from activity on local amenity. (Administration)	•Complaints regarding Tamboran's activities will be dealt through Tamboran's complaint resolution process.Where complaints are received, Tamboran will investigate if additional controls are needed and implement to address the complaint (such as shrouds,Changes to flare configuration etc.) (administration/engineering)	1	1	L	Yes	Tamboran has extensive experience in co-existing its activities with agricultural users. Consultation with pastoralists is undertaken to ensure impacts on their activities are mitigated.These impacts are addressed in the compensation agreements and access guidelines. It is noted that there is an impact on stakeholder in regards to working with proponents to plan E&A activities.this is unavoidable and required to ensure the activities can be designed to accommodate the activities of both parties.Consequences are anticipated to be minor for E&A activities, with the likelihood unlikely. The likelihood is reduced through compensation agreements which consider the pastoralist time when negotiating agreements.	Yes	Low
80		Safety hazard to pastoralists, community (including native title holders) and tourists from activity	Unexploded ordinance impacts future pastoralist and native title holder activity	N/A	• The seismic charges are installed between 15-20m below ground- with no interaction with community members, pastoralists or native title holders. •All activities require engagement with pastoralists (Administration) •Activities are located away from the main pastoralist areas, with low likelihood of activity occurring in the region over the foreseeable future. • Should a seismic charge misfire, then a second charge will be detonated within 2m to instigate a sympathetic detonation or at least damage the explosive to speed up the bioremediation process. • The explosives are manufactured with freeze dried microorganisms which are activated when wet.These are likely to be activated in the wet season and will result in the bioremediation of any unexploded ordinance reducing the future hazard. • Where sympathetic detonation not be confirmed, a steel marker shall be errected to identify the locatoon of the potentially undetonated charge. • Records of suspended undetonated charges to be provided to pastoralists and DEPWS.	Records of misfires and the success of sympathetic detonations will be retained. (administration)	Should excessive misfires be recorded, the program will be stopped to review the root cause and implement corrective actions.	1	1	L	Yes	The use of explosive charged for seismic activities is a standard practice and is considered best practice in jurisdictions such as NZ to minimise land disturbance . The risk of unexploded ordinance to the safety of the community is considered low based on the consequence being minor and likelihood being remote.this is driven by the location of the dynamite (10-15m below ground level, the lack of future activity in the area, the use of sympathetic discharge and the microbial degradation of the explosive.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
81			Gathering line fire/explosion caused by bushfire	A 4.6 Fire management	• Gathering lines located in signed right of ways to identify ignition hazard • right of ways to be free of woody vegetation to reduce fuel load accumulation •Gathering lines not operated within 12 hours of a predicted fire • surface pipework's to be temporary •Permanent pipework to be buried •Gathering liens not to be located within 2km of sensitive receptors, like a house or community •HPV, valve pits and LPD's to be located in concrete rings as protection. • No gathering lines within 1km of a watercourse or stream • Th removal of surface pipelines where a local fire is present will be prioritised, subject to response prioritisation (i.e. there may be other higher priority action items such as the protection of people and community)	•Gathering lines to be inspected post fire or significant rainfall event prior to commencement of fluid transfer. •Monthly inspection for buried gathering lines, weekly for surface lines.	• All gathering lines to be rectified once any defect is identified. • All spills cleaned dup and reported a per spill management plan • Emergency response plan •Isolation valves located to isolate pipework.	1	2	L	Yes	10'000's of Km's of gathering lines have been operating in Queensland with impacts associated with fire rare. Management of woody vegetation and fuel loads reduces risk of fire, with LPD/HPV and valve pits the most exposed pieces of infrastructure.These are protected with concrete pipe rings. As gathering lines will not be operated during fire/ extreme weather, permanent lines are buried and the right of ways will be essentially a fire break, the impact is likely to be localised (restricted to a HPV/LPD) and minor in nature.the likelihood is considered Very unlikely based on QLD operational experience.	Yes	Low
82			Increased risk of vehicle accident	A.4.1 Site selection and Planning	•Traffic impact assessment completed, with traffic levels are anticipated to be small (Elimination) •Fatigue management policy implemented for transport companies, with breaks required every two hours (Administration) •Alcohol and drug policy implemented with zero tolerance (0.00% BAC and no illicit substances) (Elimination) •Workers are flown in and out of Daly waters from Darwin. Busses are used to limit vehicle transport movements between the Daly Waters airport and remote camps- there is limited Drive In/Drive Out workers into the Beetaloo- except where local or regional contractors are utilised. (Elimination) •The camp is located away from major roads with most movements internal between camp lease and drill site (Elimination) •Stuart Highway intersection design approved by DIPL with appreciate line of site provided for vehicles to identify turning vehicles. (Engineering)	•Ongoing community engagement to monitor performance and identify potential impacts from activity on local amenity. (Administration)	•Complaints regarding Tamboran's activities will be dealt through Tamboran's complaint resolution process.Where valid complaints are received, additional controls will be implemented to address community complaint (Administration)	3	1	L	Yes	E&A activities will increase traffic levels up to 44 vehicles per day during the peak.This traffic volume is well below the Level of Service for the highway, which is estimated to be above 1100 vehicles per hour. Accidents from truck turning into access tracks or from general vehicle accidents are anticipated to have a seriousconsequence, with an injury to community members/ tourist requiring hospitalisation.Smaller volumes of traffic are required for Beetaloo, combined with the lack of road users, traffic management plan for all access track turn ins, zero tolerance for alcohol and drugs and use of trained drivers, the likelihood is considered Remote, with a probability less than 1%.	Yes	Low
83		Labour competition with local businesses and agricultural procedures.	Exploration activities compete with agricultural industry for resources.	N./A	•Proposed activity is temporary with no major labour requirements- stakeholders engaged to ensure they know the temporal nature of work (Administration) •Local and regional contractors will be utilised where available (Elimination) •All work to be short-term with predominantly skilled workforce sourced regionally/interstate. •Contracts will be structured to reduce 'boom and bust' cycle (clear understanding of limited scope of work).	•Ongoing community engagement to monitor performance and identify potential impacts from activity on local amenity. (Administration)	•Complaints regarding Tamboran's activities will be dealt through Tamboran's complaint resolution process.Where valid complaints are received, additional controls will be implemented to address community complaint (Administration)	1	1	L	Yes	Labour competition is a consequence that may occur in a full scale shale development and is not anticipated to have a major impact during exploration.Exploration activities are generally short term campaigns and are completed similar to most small infrastructure projects (such as road upgrades). Local contractors are to be used where available, with a priority on using Traditional Owner businesses.The consequence of labour competition during E&A is minor, with a likelihood of remote (<1% probability).	Yes	Low
84	**Air quality**	Reduction in air quality associated with exploration emissions (Civil, Drilling, Stimulating and Well Testing).	Emissions from the combustion of diesel.	A.4.1 Site selection and planning D.5.1 Baseline assessment	•Low emission equipment to be utilised (Engineering) •All equipment to be maintained in accordance with the manufacturer's recommendations (Engineering) • Flares onsite to combust hydrocarbons (Engineering) •No environmental or community receptors within 8 km (Elimination)	•Equipment condition and maintenance to be built into contract (Administration) •Routine site inspections and assurance undertaken to ensure equipment is maintained and operated as per manufacturers requirements. (Engineering)	•All equipment defects identified by site inspection and assurances to be rectified promptly.(Engineering)	1	1	L	Yes	Impacts to environmental or community receptors are not anticipated, with the closest receptor at least 8 km away.Flares will be utilised to minimise the release of VOC's.The potential consequence from E&A activities is predicted to be minor.The likelihood is a function of source (lack of) and separation distance between the activity and receptors. The likelihood of a receptor being exposed to emissions from E&A activities above the NEPM guidelines are remote (<1%).	Yes	Low
85			Air emissions from gas and condensate flaring.	A.4.1 Site selection and planning D.5.1 Baseline assessment B.4.13 Hydraulic Stimulation and flowback operations D.5.8 Venting and flaring	•Flares have been designed and will be operated in compliance with the US EPA 40 CFR § 63.18 to achieve a 98% combustion efficiency (Engineering) •Emissions of NOx, CO and TVOC are small and not anticipated to reduce ambient air quality as there are no regional sources (Elimination) •Vertical flare stack used for gas- maximising dispersion.(Engineering) •Flares to be designed and operated to minimise smoking (Engineering) •Site located away from receptors (Elimination) •No environmental or community receptors within 8 km (Elimination)	•Flares will be inspected as a part of weekly routine site inspection to rectify any excessive smoke production from flares (noting condensate flaring may produce small quantities of ongoing smoke due to the higher molecular weight of the hydrocarbons). (Administration)	•Where excessive smoking of flares is identified, the flare operating status will be reviewed and optimise to reduce particulate generation (Engineering)	1	2	L	Yes	Risks associated with emissions from flares are well known within literature, and Australia and International policy/standards exist (such as NGERS and various US EPA technical guidance notes). The location of the activity is likely to limit the potential exposure to receptors, with consequences likely to beminor, localised and short term (days base on wind direction and atmospheric boundary conditions).The likelihood is predominantly reduced through the separation distance between the activity and receptors, with a likelihood of remote (<1% predicted).	Yes	Low
86			Air emissions from chemical releases during drilling and stimulation activities.	A.4.1 Site selection and planning B.4.16 Well site layout and housekeeping b.4.13 Hydraulic Stimulation and flowback operations	•National Occupational Health and Safety Codes: Code of Practice for the Control of Workplace Hazardous Substances. (Administration) •Chemical Risk Assessment completed on all chemicals used for stimulation (Elimination/Administration) •Chemical handling and mixing practices to reduce particulate emissions. (Engineering) •No environmental or community receptors within 8 km (Elimination)	•Routine site inspections and assurance undertaken to ensure ongoing chemical handling and mixing practices do not result in an offsite release of substances (Administration)	•Corrective actions implemented to address poor chemical handling and mixing practices. (Engineering)	1	1	L	Yes	Risks associated with air emissions from petroleum activities are well known, with various risk assessment and emissions estimation technical guidance notes available within Australia and internationally (such as the National Pollutant Inventory and the US EPA).Due to overriding occupational health safety requirements to limit worker exposure and lack of local receptors, the consequence is anticipated to be minor.The likelihood is reduced to remote, given the large separation distances between the activity and closest receptors.	Yes	Low
87		Reduction in air quality associated with 2D seismic activities	Emissions from the combustion of diesel, detonation of charges and dust from clearing.	A.4.1 Site selection and planning D.5.1 Baseline assessment	•Low emission equipment to be used where practicable (Engineering) •All equipment to be maintained in accordance with the manufacturer's recommendations (Engineering) •No environmental or community receptors within 8 km (Elimination) •Short term activity (e.g. 10 vehicles for 30 - 45 days)	•Equipment condition and maintenance to be built into contract (Administration) •Routine site inspections and assurance undertaken to ensure equipment is maintained and operated as per manufacturers requirements. (Engineering)	•All equipment defects identified by site inspection and assurances to be rectified promptly.(Engineering)	1	1	L	Yes	Impacts to environmental or community receptors are not anticipated, with the closest receptor at least 8 km away.Flares will be utilised to minimise the release of VOC's.The potential consequence from E&A activities is predicted to be minor. The likelihood is a function of source (lack of) and separation distance between receptors. The likelihood of a receptor being exposed to emissions from E&A activities above the NEPM guidelines are remote (<1%).	Yes	Low
88		Increased nuisance from dust andparticulate emissions associated with exploration activities caused impacts to regional ecosystems and fauna	Civil activities, drilling operations, well testing and 2D seismic activities.	A.4.1 Site selection and planning	•Water trucks will be used to decrease dust emissions. (Engineering) •Roads maintained to prevent bull dust generation (Engineering) •No environmental or community receptors within 8 km (Elimination)	•Routine site inspections and assurance undertaken to identify and rectify high dust emissions (Administration)	•Dust control to be implemented whereunacceptable dust from transport activities occur (Engineering)	1	5	M	Yes	Dust will be generated through transport movements along access tracks and around well pads.The consequence of dust is anticipated to be moderate, with localised, short term impacts to areas immediately adjacent to access tracks.The likelihood of the risk is reduced through the isolated location (lack of environmental or community receptors), regionally extensive vegetation communities (good outside refuge away from access tracks and use of dust suppression.As dust generation has been observed, and is commonly associated with dirt tracks, the likelihood of an impact is considered likely.	Yes	Low
89			Bushfire from accidental ignition by site activities (civil works, drilling, flaring, grinding), during 2D seismic clearing or by personnel.	A 4.6 Fire management	•Bushfire management plan implemented to prevent and respond to bushfires- including establishment of communication and fire response protocols with pastoralists (Administration) •Bushfire awareness included in site inductions. (Administration) •Designated smoking areas on-site (Elimination) •Firefighting equipment to be available to deal with fires (Engineering). •Fire breaks will be installed around infrastructure(Engineering) •Minimum of 45 m separation distances between flares and surrounding vegetation (Engineering) •Ignition sources placed outside of the hazardous area. (Elimination) •Intrinsically safe equipment used in hazardous area. (Elimination) •Hazardous area drawing will provide classification of hazardous zones while drilling. (Elimination) •No flaring during periods of total fire ban (Elimination) •Activities will comply with landholder and regional bushfire management plans. (Elimination) •Vehicles to be equipped with fire extinguishers. •Fire response to be implemented during 2D seismic program, with spotters and fire trailers utilised to put out spot fires during work •Activities will comply with landholder and regional bushfire management plans. (Elimination	•Annual fire preparedness assurance activities completed where activities are proposed during high fire risk periods (administration) •Daily monitoring of bushfires in the region during periods of high fire danger (administration) •Annual fire frequency mapping using the Northern Australia Fire Information fire history database (administration)	•Fire hazard reduction strategies (such as back burning) to be implemented to reduce the risk of fire ignition/ impact as required (Elimination) •Where a bushfire is started and cannot be controlled, Tamboran to engage with pastoralist to coordinate response activities (Administration/ engineering)	3	2	M	Yes	Fire is a common occurrence within the Barkly Region. A fire is likely to have a serious impact, with moderate term reversible impacts (years).With the appropriate controls, such as separation distances, firebreaks, and adherence to total fire bans, the likelihood of causing a fire from drilling, stimulation and well testing is anticipated to be highly unlikely, with a predicted occurrence of <10%.	Yes	Low
90	**Atmospheric processes**	Greenhouse Gas emissions from the activity have a direct and measurable adverse impact on climate	Combustion of diesel for all exploration activities, including 2D seismic.	A.4.1 Site selection and planning	•Australian emission standards for equipment ensures minimum operating efficiency (Engineering) •All equipment to be maintained in accordance with the manufacturer's recommendations (Engineering) •No environmental or community receptors within 8 km (Elimination)	•Equipment condition and maintenance to be built into contract (Administration) •Routine site inspections and assurance undertaken to ensure equipment is maintained and operated as per manufacturers requirements. (Engineering)	•All equipment defects identified by site inspection and assurances to be rectified promptly.(Engineering)	2	1	L	Yes	The risks associated with Greenhouse Gas generation through diesel combustion are well documented in literature and domestic/international greenhouse policy (such as NGERS and IPCC). The consequences of GHG generation from exploration activities is moderate, with less than 1% of the NT emissions generated. The likelihood of the level of GHG production being unsustainable is considered remote, with a probability less than 1%.	Yes	Low
91			Flaring of gas and condensate during well testing.	B.4.13 Hydraulic Stimulation and flowback operations D.5.8 Venting and flaring	•Venting to be minimised with all venting reported under NGERS. •Flares have been designed and will be operated in compliance with the US EPA 40 CFR § 63.18 to achieve a 98% combustion efficiency. •Emissions from source rock during drilling are negligible. •Condensate will be flare and/or transported offsite for sale if permissible. •Total worst case emissions from activity are not significant- being~1.3% of NT's Total GHG emissions and 0.05% of Australia's GHG emissions	•Flares will be inspected as a part of weekly routine site inspection to rectify any excessive smoke production from flares (noting condensate flaring may produce small quantities of ongoing smoke due to the higher molecular weight of the hydrocarbons). (Administration)	•Where excessive smoking of flares is identified, the flare operating status will be reviewed and optimise to reduce particulate generation (Engineering)	2	2	L	Yes	The risks associated with Greenhouse Gas generation through diesel combustion are well documented in literature and domestic/international greenhouse policy (such as NGERS and IPCC). The consequences of GHG generation from exploration activities is moderate, with less than 1% of the NT emissions generated. The likelihood of the level of GHG production being unsustainable is considered remote, with a probability less than 1%.The well testing will also allow for natural gas to be used as a transition fuel.	Yes	Low
92			Uncontrolled release of gas encountered during drilling, stimulation, barrier failure, operator error or vehicle collision under a multi-well scenario	B.4.1 Well integrity management B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and flow back operations D.5.8 Venting and flaring	•Drilling overbalanced to reduce the inflows of hydrocarbons (Engineering). •Blow out prevention in place to manage well failure and uncontrolled gas influxes (Engineering) •Blow out preventor pressure rating and testing •All equipment will be API compliant to handle expected conditions (Engineering) •Site manned during operation (Administration) •Well suspended with multiple cement and casing barriers in place- with 4 casing section utilised (conductor, surface, intermediate and production).(Engineering) •Barricading to be used to protect each exploration well from vehicle collision during multi-well drilling activities. (Engineering)	•Process monitoring to detect events that could potentially result in a uncontrolled release of gas (such as fluid balances, well head pressure etc.) (Engineering) •Routine (monthly) well inspections (Administration	•An emergency as diverter and flare to be used during drilling to manage gas ingress (Engineering) •Contracts in place with emergency well intervention specialists (such as Boots and Cootes) (administration) •Emergency response plan implemented (administration)	2	2	L	Yes	The Code and standard drilling, stimulation and well testing safety controls are designed to prevent the uncontrolled release of hydrocarbons.Flares are used during drilling and well testing to manage any encountered hydrocarbons The consequence are anticipated to be moderate, with impacts likely to be moderate, restricted in duration (minutes to hours).The likelihood is considered highly unlikely with a occurrence probability less than 10%, based on the well designed, construction and operations requirements mandated by the Code.	Yes	Low

Ref	Environmental Factor	Risk scenario description	Risk Source	Code of Practice (the Code)	Risk mitigation Measures			Residual Risk Rating			ALARP criteria achieved?	Residual risk ALARP and Acceptable Statement	Acceptable criteria achieved?	Scientific Uncertainty Ranking
					Prevent	Detect	Recover	Consequence	Likelihood	Risk Rating				
93			Uncontrolled release of gas from well due to sabotage.	D.5.8 Venting and flaring	•Multiple barriers used during well suspension/operation- including downhole suspension plugs, suspension fluid and surface valves (Engineering) •Sites manned during operation (Administration) •Security cameras located on sites (Engineering) •Sites locked (Engineering) •Valves locked (Engineering)	•Routine (monthly) well inspections (Engineering)	•Contracts in place with emergency well intervention specialists (such as Boots and Cootes) Administration) •Emergency response plan implemented(Administration)	2	2	L	Yes	The risks associated with Greenhouse Gas generation through well sabotage is anticipated to be moderate, with impacts likely to be restricted in duration (hours to days). The likelihood is considered remote (probability <1%), with the site remoted and multiple valves locked on the well to prevent tampering.	Yes	Low
94			Leak of gas from wells and/or gathering line	B.4.1 Well integrity management B.4.3 Well design and barriers D.5.4 Emission detection and management D.5.5 Leak remediation and notification	•Well design considers multiple (4) specifically-engineered cement and steel casing barriers in place between hydrocarbon-bearing zone and surface.This includes conductor casing, surface casing, intermediate casing and production casing intervals (Engineering) • Well design and Well Barrier Integrity Validation reports submitted to DITT as part of Well Operations Management Plan (WOMP). (Administration/ engineering) •Wells constructed and suspended with barriers in place and verified as per governing code (engineering) •Limited gas production time only to extended production test.(Elimination)	•Routine 6 monthly well leak detection (Engineering) •Routine (monthly) well inspections (Administration)	•Any leaking wells to be reported and remediated at a frequency consistent with the Code depending on severity(Engineering)	1	2	L	Yes	The consequence of a well leak are anticipated to be minor with impacts likely to be small (<1000L/hour) and restricted in duration (days to weeks).The likelihood is considered highly unlikely with a occurrence probability less than 10%, based on the well designed, construction and operations requirements mandated by the Code.Leak detection and reporting requirements are also controls to ensure any leaks are promptly identified and fixed.	Yes	Low
95	Cumulative risk	Cumulative impacts on groundwater quantity.	Groundwater take from surrounding land users exceeds the natural recharge rate of the Basin.	Water extraction licences under the NT Water Act	•Groundwater take authorised under a Water Allocation Plan which considers cumulative current and future groundwater users (Elimination) • Petroleum allocation of WAP is 8,000GL/year- 4% of total allocation. •Water Extraction Licence value of 450ML/year is 0.001% of total available resource The total quantity of • existing petroleum activity groundwater extraction licences for the region is 752.5 ML/year. •Cumulative impacts considered in the water extraction licence under the NT Water Act. (Elimination) •Groundwater extraction volumes are monitored and kept below WEL (Elimination) •Strategic Regional Environmental Baseline Assessment (SREBA) completed to collected baseline environmental data, with Environmental Impact Assessments completed to address cumulative impacts from industry (Administration/ Engineering/ elimination)	•Groundwater monitoring of control and impactmonitoring bores will detect localised groundwater depressurisation before regional impacts occur (Engineering)	•Where sustained groundwater depletion is observed in regional aquifers, alternative water supplies may be required, such as deeper aquifers with limited extraction (Elimination) •Water Act make good provisions to ensure any impacts on users from exploration activities are "made good"	2	1	L	Yes	The regional understanding of the CLA is sufficient to understand the risks associated with groundwater extraction. The absence of users and small exploration take reduces the uncertainty of the activity.This risk has been assessed as a part of the WEL application and approval.Due to the lack of receptors, the consequence is considered moderate (i.e. 1 user within 16km) and likelihood remote (probability less than 1%.	Yes	Low
96		Cumulative impacts on terrestrial ecology.	Impacts from exploration activities and existing agricultural activities results in impacts to vegetation communities, fragmentation and poses a threat to protected flora and fauna.	A.4.1 Site selection and planning A.4.1.1 Well pad specific site selection A.4.4 Biodiversity Protection	•Area has limited development with no widespread land clearing or other pressures from agriculture or other users. (Elimination) •Petroleum activity is limited in scale (0.0227% of total area) and will not material decrease availability of habitat across the region (Elimination) • Cumulative clearing impact from petroleum exploration order of magnitude lower than existing land users (~900 hectares versus ~26,000 ha) • Proposed sites are located in close proximity to existing access track to minimise amount of disturbance and habitat fragmentation (Elimination) •Low disturbance seismic proposed, with avoidance of land clearing prioritised to minimise disturbance and habitat fragmentation. •Strategic Regional Environmental Baseline Assessment (SREBA) completed to collected baseline environmental data, with Environmental Impact Assessments completed to address cumulative impacts from industry (Administration/ Engineering/ Elimination)	•Ongoing scouting and infrastructure design will be undertaken to ensure scope creep doesn't result in increased habitat fragmentation	•All disturbance to be rehabilitated to pre-existing levels.	2	1	L	Yes	The region has low land clearing pressure with no applications for large scale land clearing present. The level of disturbance proposed is small, with field ecological scouting confirming ecological communities present.	Yes	Low
97		Cumulative impacts on amenity.	Exploration activities further reduces amenity (visual, noise, traffic and lighting) through additional landscape modification, dust, noise, light and traffic.	A.4.1 Site selection and planning A.4.1.1 Well pad specific site selection	• Well sites are located in a remote/rural landscape, away from environmental and community receptors (Elimination) •Rig equipment located onsite/ within the adjacent property (Elimination) • Cumulative clearing impact from petroleum exploration order of magnitude lower than existing land users (~900 hectares versus ~26,000 ha) •Flaring may create a visible hue on the horizon consistent with that of a small town. impact will be temporary •Additional traffic volumes are anticipated to be small (44 additional vehicles during peak mobilisation) ,well below existing industries and will not impact on the level of service of the Stuart Highway. (Elimination) •A Traffic Management Plan covering the intersection upgrade work will be submitted to DPIL for approval prior to the commencement of works . (Elimination) •Low level of development activity within the region, with activity unlikely to cause declines in amenity. (Elimination)	•Community complaints regarding nuisance (including dust, traffic etc.) to be used to detect cumulative impacts (Administration)	•Complaints are to be investigated and additional controls implemented where appropriate. (Administration/ engineering)	1	2	L	Yes	The region is underdeveloped with the activity located away from major transportation routes, homesteads and communities. The activity is of a small size and unlikely to result in any loss of amenity. Any loss of amenity is therefore likely to be minor, with a likelihood of highly unlikely.	Yes	Low
98		Cumulative impacts on surface water quality.	Exploration activities in addition to existing surrounding land use (agriculture) reduces surface water quality.	A.4.1 Site selection and planning A.4.1.1 Well pad specific site selection A.4.3 Erosion and sediment control and hydrology	•No surface water take or wastewater releases permitted with controls in place to mitigate spills and offsite releases. (Elimination) •Area has limited development with no widespread land clearing pressures from agriculture or other users likely to reduce water quality. (Elimination) •Land clearing practices and erosion and sediment controls ensure impacts to surface water from sediment and changes in hydrology are reduced to ALARP. •Avoid traversing vehicles (access tracks, seismic) or establishing well pads on Palustrine Systems (depressions) or Flood Plain Systems where possible (Elimination). Where unavoidable, Tamboran to implement additional controls to ensure any impacts are of short duration and reversable. A Permit to Interfere with a Waterway under the Water Act 1992 would be obtained from DEPWS Water Resources as required (Administration/Engineering). It is noted that the regulated activities will either not cause a material change or alteration (Not Material) or occur generally in lower stream order 1 or 2 (Low). •No surface water take or wastewater releases permitted. (Elimination) •Strategic Regional Environmental Baseline Assessment (SREBA) completed to collect baseline environmental data, with Environmental Impact Assessments completed to address cumulative impacts from industry (Administration/ Engineering/ Elimination) •Strategic Regional Environmental Baseline assessment completed (Administration)	N/A- no increased impact o surface waters anticipated	N/A- no increased impact to surface waters anticipated	1	1	L	Yes	The region is underdeveloped with the activity located away from major flow pathways with limited topographic variation.. The activity is of a small size and unlikely to result in any material increase in sediment loads to surface waters.	Yes	Low
99		Cumulative impacts- greenhouse gas emissions from the Beetaloo have a direct and measurable adverse impact on climate	The release of GHG emissions during exploration activities materially increase Northern Territory's and Australia Greenhouse Gas emissions increasing climate change impacts on the environment	B.4.1 Well integrity management B.4.3 Well design and barriers B.4.13 Hydraulic Stimulation and flow back operations D.5.8 Venting and flaring	•Total greenhouse gas emissions for the Beetaloo Sub-basin are low compared to the total NT and Broader Australia Greenhouse gas emissions. •The percentage of total NT and Australian GHG emissions is estimated at 1.35% and 0.04% respectively. •Climate change is a global issue resulting from a culmination of human activities and natural processes across the planet. This activity will not cause climate change, but will contribute to the carbon budget of the atmosphere. •Management of climate related impacts are required at a national and internal level.Tamboran will abate a % of residual GHG emissions in alignment with the NT net zero by 2050 trajectory. For example, emission offsets will increase year on year by 3.7%based on a baseline FY of 2023 to achieve net zero by 2050 •All emissions over 100KTCO2 to be offset using ACCU's in accordance withthe NGERS Safeguard Mechanisms •Activities required to prove up natural gas resources, with all available technology used to reduced emission intensity of exploration activities •Flaring required to mitigate emissions from the activity versus venting (Engineering) •Full development (if technically and commercially viable) likely to provide a viable transition fuel with up to 50% emissions of coal (Engineering) •Full development to be scope 1 neutral •Strategic Regional Environmental Baseline Assessment (SREBA) completed , with an Environmental Impact Assessment completed to address cumulative impacts from industry (Administration/ Engineering/ elimination)	N/A- Greenhouse gas emissions are approved prior to commencement of activity	N/A- Greenhouse gas emissions are approved prior to commencement of activity	1	1	L	Yes	Tamboran has aligned its emission reductions strategies in accordance with the NT code or Practice, NT Large Emitters policy, Tn net zero objective and Commonwealth NGERS safeguard mechanism emission requirements. The role natural gas plays as a low carbon intensitytransition fuel to support renewable energy use is well known. Broad adoption of natural gas within the US has replaced coal in energy production and has been responsible for a continued decline in carbon emissions. The use of natural gas is one of the lowest carbon intensity fuels required to reduce carbon emissions int eh near term, with wide recognition of the importance of ensuring energy security during the energy transition..	Yes	Low