

DRAFT ENVIRONMENTAL SCOPING DOCUMENT

Proposal name:	Valhalla Gas Exploration and Appraisal Program
Proponent:	Bennett Resources Pty Ltd
Assessment number:	2281
Location:	The proposal area is located approximately 123 kilometres (km) south east of the town of Derby
Local Government Area:	Shire of Derby - West Kimberley
Public review period:	Environmental Scoping Document – 4 weeks Environmental Review Document – 8 weeks

1. Introduction

The Environmental Protection Authority (EPA) has determined that the above proposal is to be assessed under Part IV of the *Environmental Protection Act 1986* (EP Act).

The purpose of the Environmental Scoping Document (ESD) is to define the form, content, timing and procedure of the environmental review, required by s. 40(3) of the EP Act. This draft ESD has been prepared by the EPA in consultation with the proponent, decision-making authorities and interested agencies consistent with the EPA's *Procedures Manual*.

Form

The EPA requires that the form of the report on the environmental review required under s.40 (Environmental Review Document, ERD) is according to the [Environmental Review Document template](#).

Content

The EPA requires that the environmental review includes the content outlined in sections 2 to 6 of this ESD.

Timing

Table 1 sets out the timeline for the assessment of the proposal agreed between the EPA and the proponent.

Table 1 Assessment timeline

Key assessment milestones	Indicative Completion Date
EPA releases Draft Environmental Scoping Document	3 August 2021
Four Week public comment on ESD closes	31 August 2021
EPA approves Environmental Scoping Document	16 September 2021
Proponent submits first draft Environmental Review Document	10 Jan 2022
EPA provides comment on first draft Environmental Review Document <i>(6 weeks from receipt of ERD)</i>	25 Feb 2022
Proponent submits revised draft Environmental Review Document	21 April 2022
EPA authorises release of Environmental Review Document for public review <i>(2 weeks from EPA approval of ERD)</i>	30 May 2022
Proponent releases Environmental Review Document for public review for 8 weeks	15 June 2022
Close of public review period	15 August 2022
EPA provides Summary of Submissions <i>(3 weeks from close of public review period)</i>	6 September 2022
Proponent provides Response to Submissions	30 October 2022
EPA reviews the Response to Submissions <i>(4 weeks from receipt of Response to Submissions)</i>	30 November 2022
EPA prepares draft assessment report and completes assessment <i>(6 weeks from EPA accepting Response to Submissions)</i>	15 Jan 2023
EPA finalises assessment report (including two weeks consultation on draft conditions) and gives report to Minister <i>(6 weeks from completion of assessment)</i>	1 Mar 2023

Procedure

The EPA requires the proponent to undertake the environmental review according to the procedures in the *Administrative Procedures* and the *Procedures Manual*, including requirements for public review. In addition, the environmental review

should be undertaken to address the recommendations of the *Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia* and the Government's Policy Decisions detailed in the *Implementation Plan, Implementation of the Government's response to the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia*.

This draft ESD will be released for public review for a period of four weeks. Once approved, the final ESD will be available on the EPA website (www.epa.wa.gov.au) upon endorsement and must be appended to the PER document.

2. The proposal

The subject of this ESD is Bennett Resources Pty Ltd's Valhalla Gas Exploration and Appraisal Program. Bennett Resources is proposing to undertake an unconventional exploration and appraisal drilling and hydraulic fracture stimulation (HFS) program within Petroleum Exploration Permit EP 371 (EP 371) in the Canning Basin, located in the Shire of Derby-West Kimberley in Western Australia. The proposal comprises the construction of up to twenty (20) exploration and appraisal wells at ten (10) sites, to be drilled to depths in the order of 2000 m to 4000 m below ground level, access tracks, accommodation camps and HFS operations. The program is expected to be completed in a staged manner over seven (7) years.

The regional location of the proposal is shown in Figure 1 and the project area encompassing the physical elements of the proposal is delineated in Figure 2.

The key characteristics of the proposal are set out in Tables 2 and 3. The key proposal characteristics may change as a result of the findings of studies and investigations conducted and the application of the mitigation hierarchy by the proponent.

This is the first proposal to undertake hydraulic fracture stimulation in Western Australia since the Government accepted in-principle the recommendations of the *Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia* (2018).

It has been referred to the EPA in accordance with regulation 2C of the *Environmental Protection Regulations 1987* which have been amended to require referral of all onshore oil and gas exploration and production proposal involving hydraulic fracture stimulation.

The hydraulic fracture stimulation moratorium on all onshore petroleum titles existing as of 26 November 2018 has been lifted, including EP 371.

Table 2 Summary of the proposal

Proposal title	Valhalla Gas Exploration and Appraisal Program
Proponent name	Bennett Resources Pty Ltd
Short description	The proposal is to undertake an unconventional exploration and appraisal drilling and Hydraulic Fracture Stimulation (HFS) program within existing Petroleum Exploration Permit EP 371 (EP 371) in the Canning Basin, within the Shire of Derby-West Kimberley in Western Australia. The proposal comprises the construction of up to 20 exploration wells at 10 sites, to be drilled to depths in the order of 2000 m to 4000 m below ground level, access tracks and accommodation camps, and HFS operations.

Table 3 Location and proposed extent of physical and operational elements

Element	Location	Proposed extent
<i>Physical elements</i>		
Clearing for wells, access tracks and accommodation camps	Figure 2	No more than 109 hectares
Gas Exploration Wells	Figure 2	No more than 20 wells at 10 drill sites
<i>Operational elements</i>		
Water abstraction for process water and domestic supply	Figure 2	40 ML per well via groundwater extraction bores
Gas exploration method		Unconventional (hydraulic fracture stimulation)
Well Design		Vertical wells with horizontal HFS wellbore sections
Hydraulic fracture stimulation intervals		Up to 50 intervals per horizontal well
Flowback water retention ponds	Figure 2	One pond per drill site with a capacity of approximately 160,000 m ³

Well test flare pit	Figure 2	One per drill site
Project life		7 years

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3. Preliminary key environmental factors and required work

The preliminary key environmental factors for the environmental review are:

1. Inland Waters
2. Terrestrial Fauna
3. Subterranean Fauna
4. Flora and Vegetation
5. Social Surroundings
6. Terrestrial Environmental Quality
7. Air Quality
8. Greenhouse Gas Emissions
9. Human Health

Table 3 outlines the work required for each preliminary key environmental factor and contains the following elements for each factor:

- **EPA factor** and **EPA objective** for that factor.
- **Relevant activities** – the proposal activities that may have a significant impact on that factor.
- **Potential impacts and risks** to that factor.
- **Required work** for that factor.
- **Relevant policy and guidance** – EPA (and other) guidance and policy relevant to the assessment.

Table 4 Preliminary key environmental factors and required work

Inland Waters	
EPA objective	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.
Relevant activities	Groundwater abstraction will be required to support the proposal, drilling and hydraulic fracture stimulation activities.
Potential impacts and risks	<ul style="list-style-type: none"> • Groundwater drawdown of aquifers associated with water abstraction. • Drawdown impact on water dependent ecosystems. • Contamination of aquifers due to well integrity failure. • Contamination of aquifers through unplanned fracture heights. • Contamination of aquifers from accidental release or leakage from storage ponds at the surface of drilling fluids, hydraulic fracture

	<p>stimulation chemicals, liquid hydrocarbons or produced or formation water.</p> <ul style="list-style-type: none"> • Changes to surface water flows from infrastructure such as roads, camps and drill pads
Required work	<ol style="list-style-type: none"> 1. Characterise the surface water and groundwater systems in a local and regional context and describe recharge and discharge mechanisms, aquifer connectivity, surface water/groundwater interaction and water chemistry. This should include identification and mapping of groundwater and surface water dependent ecosystems, and detail of the location of wells in relation to surface water features (e.g. Le Lievre Swamp, permanent/semi-permanent pools etc). 2. Undertake baseline groundwater level and water quality monitoring at representative sites that reflect the expected conditions of each well, including a comprehensive list of analytes including geogenic chemicals, radon and methane concentrations, for a minimum of 24 months prior to commencing the proposal that is at least consistent with the <i>Guideline for groundwater monitoring in the onshore petroleum and geothermal industry</i> (Department of Mines and Petroleum and Department of Water, 2016). 3. Analyse, describe and assess surface water and groundwater impacts, including direct, indirect and cumulative impacts, from the project. This should include, but not be limited to: <ol style="list-style-type: none"> a. changes to groundwater levels and surface water flows associated with the proposal; b. changes to water quality; c. the nature, extent and duration of impacts; and d. impacts on environmental values of ground and surface water dependent ecosystems. 4. Discuss the proposed management, monitoring and mitigation to ensure impacts on inland water quality and environmental values are not greater than predicted as a result of implementing the proposal. This should include but not be limited to: <ol style="list-style-type: none"> a. ecotoxicology testing on produced or flowback water to better assess the potential impacts; b. a groundwater level and groundwater quality monitoring plan for the duration of the petroleum development activity and post closure, including concentrations of methane and of chemical constituents that are indicative of brine incursions; c. surveillance monitoring of groundwater level and groundwater quality for the duration of petroleum development activity; d. testing for, and assessment of the risk from a comprehensive list of analytes in groundwater, likely in produced and flowback water,

including geogenic chemicals, technologically enhanced naturally occurring radioactive materials and radon;

- e. a site water balance, accounting for water produced, evaporated and disposed of, to enable detection of significant leakage of fluids and determine whether remedial action to track any contaminants is warranted; and
- f. proposed management of flowback water, including volumes of water that can be expected to be produced. If open air pits are proposed, risks to groundwater resources arising from leaky pit membranes should be addressed, and the monitoring required to identify and remediate leakages. If re-injection is proposed, the depth of re-injection and detailed construction details of injection wells should be provided.

Chemicals

- 5. Identify all chemicals intended to be used as ingredients in drilling and hydraulic fracture fluids.
- 6. Provide the Chemical Abstracts Service (CAS) number for the chemicals, and evidence that the chemicals are approved for their intended use in Australia and listed on the:
 - a. Australian Inventory of Chemical Substances (AICS);
 - b. Australian Pesticides and Veterinary Medicines Authority (APVMA);
 - c. Therapeutic Goods Administration (TGA); or
 - d. Food Standards Australia and New Zealand (FSANZ) inventories.
- 7. Provide material safety data sheets (MSDS) for the chemicals identified.
- 8. Confirm whether any chemicals intended to be used contain Benzene, Toluene, Ethylbenzene and Xylene (BTEX).
- 9. Identify if chemicals proposed to be used are known or suspected carcinogens, mutagens, developmental toxicants and endocrine disruptors. Use of chemicals with these properties should be minimised or avoided in all operations.
- 10. Identify the cumulative, short and long-term public health and environmental risks from chemicals used in drilling and fracturing fluids and chemicals expected to be present in produced and flowback water.
- 11. The Western Australian Department of Health (DoH) should review and provide advice on the information and risk assessments provided for chemicals proposed to be used in hydraulic fracture stimulation, or expected to be present in produced or flowback water.

Geotechnical risks

12. Undertake and provide a comprehensive geotechnical risk analysis, including:

- a. definition of subsurface state of stress;
- b. definition of the structural context;
- c. identification of any hydrogeologically active faults or fracture zones;
- d. assessment of well-seal effectiveness;
- e. appropriate expertise; and
- f. delineation of potential high risk zones

13. Provide details of an appropriate early warning system mechanism to prevent adverse geo-mechanical events reaching a size of any consequence to land or hydrogeology.

Well Integrity

14. Well design, construction, stimulation, operation and decommissioning are all addressed by *International Standards Organisation (2017; ISO 165301)*, which encompasses each phase of the life of any oil and gas well. The proposal must meet or exceed ISO 165301. The following should be provided:

- a. details of the well integrity management system over the entire proposal lifecycle;
- b. a risk assessment process for well barrier integrity, identifying appropriate remedial action should a well barrier be compromised; and
- c. details of a well integrity testing and validation program.

15. Provide confirmation that well design, construction and testing will be assessed by an independent, certified well examiner, reporting to the regulator as a required part of commissioning, licensing, and decommissioning.

16. Demonstrate how the mitigation hierarchy of avoid, minimise, mitigate has been applied during the planning and design stages of the Project.

17. Demonstrate and document in the ERD how the EPAs objective for this factor can be met.

Decommissioning

18. Include details of the entire life cycle of oil and gas wells, from establishment to decommissioning, including all supporting activities related to hydraulic fracture stimulation. Rehabilitation,

	<p>decommissioning and well-monitoring post-decommissioning should include evaluating factors such as:</p> <ol style="list-style-type: none"> life cycle of well from establishment to decommissioning; land use post-decommissioning, developed in consultation with relevant stakeholders; disposal of contaminated wastes, including the management of potentially radioactive drill cuttings and wastewater in a manner that is consistent with the requirements of the Radiological Council; storage pond and site rehabilitation; well-monitoring and groundwater monitoring post-decommissioning to ensure no leakage, fugitive emissions, contamination; and monitoring trigger-levels for intervention and commitment to immediate remediation if contamination is detected.
<p>Relevant policy and guidance</p>	<p><i>EPA Policy and Guidance</i></p> <p>Environmental Factor Guideline – Inland Waters (EPA, 2018).</p> <p><i>Other policy and guidance</i></p> <p><i>Guideline for groundwater monitoring in the onshore petroleum and geothermal industry</i> (Department of Mines and Petroleum and Department of Water, 2016)</p> <p>Western Australian Department of Health process for providing advice to the Environmental Protection Authority on human health risk assessments for hydraulic fracturing proposals (Government of Western Australia, September 2020). https://www.hydraulicfracturing.wa.gov.au/wp-content/uploads/2020/10/206571_HHRA-Position-Paper_WEB.pdf</p> <p>groundwater monitoring guidance for hydraulic fracturing sites, NT government– https://depws.nt.gov.au/__data/assets/pdf_file/0009/618957/Preliminary-Guideline-Petroleum-Well-Water-Quality-Monitoring.pdf</p>

Terrestrial Fauna	
<p>EPA objective</p>	<p>To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.</p>
<p>Relevant activities</p>	<p>The proposal involves the clearing of 109 hectares of fauna habitat for well pads, access tracks and accommodation camps.</p>

Potential impacts and risks	<ul style="list-style-type: none"> • Death, injury or displacement of native fauna species from construction, operation and vehicle strikes. • Habitat destruction and fragmentation from clearing. • Habitat degradation as a result of introduction and/or spread of non-indigenous species (weeds) and unplanned fire events. • Secondary impacts from dust and noise.
Required work	<p>19. In accordance with the requirements of EPA Guidance, conduct a desktop study to identify and characterise the fauna and fauna habitats to inform local and regional context; and based on the results of the desktop study:</p> <ol style="list-style-type: none"> a. conduct a Basic survey and fauna habitat assessment; and/or b. conduct a Detailed survey; and/or c. conduct targeted surveys for significant fauna that may be directly or indirectly impacted. <p><i>Note: The desktop study, surveys and ERD should consider vertebrates and short-range endemic, and/or other significant, invertebrates. Survey design should ensure that adequate local and regional contextual data are collected and should consider cumulative impacts. Surveys should include sites in both impact and non-impact (reference) areas.</i></p> <p>20. Demonstrate how surveys are relevant, representative and consistent with current EPA policy and guidance and this Environmental Scoping Document.</p> <p>21. Provide a map of the survey effort applied in relation to the fauna habitats, the study area, Development Envelope, identifying the direct and indirect impact areas.</p> <p>22. Identify and describe the fauna assemblages present and likely to be present within the development envelope that may be impacted by the proposal.</p> <p>23. Identify and describe the characteristics of the fauna habitats identified by the desktop study and surveys, including a map their extents in relation to the study area, the project area and direct and indirect impact areas. Describe significant habitats, including but not limited to: refugia, breeding areas, key foraging habitat, movement corridors and linkages.</p> <p>24. Identify significant fauna and describe in detail their known ecology, likelihood of occurrence, habitats and known threats. Map the locations of significant fauna records in relation to the fauna habitats, the study area, the Development Envelope, and direct and indirect impact areas.</p> <p>25. Identify, describe and quantify the potential residual impacts (direct, indirect and cumulative) to fauna assemblages, habitats and significant species that may occur following implementation of the</p>

	<p>proposal, after considering and applying avoidance and minimisation measures, in a local and regional context. Provide a table of the proportional extents of each habitat within the study area and Development Envelope, and the predicted amount to be directly and indirectly impacted</p> <p>26. Outline and justify the proposed avoidance and mitigation measures to reduce the potential impacts of the proposal. If any significant species are expected to be impacted, include proposed management and/or monitoring plans that will be implemented pre- and post-construction to demonstrate and ensure residual impacts are not greater than predicted. Management and/or monitoring plans may be required and if so, are to be presented in accordance with the EPAs Instructions.</p> <p>27. Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model (p. 11) and Western Australian Environmental Offsets Template (Appendix 1) in the <i>WA Environmental Offsets Guidelines</i> (2014) and include reference to the Commonwealth Assessment Guide for any Matters of National Environmental Significance (MNES).</p> <p>28. Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the <i>WA Environmental Offsets Policy</i> and <i>WA Environmental Offsets Guidelines</i> and, where impacts relate to EPBC Act-listed taxa, the <i>Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy</i>. Spatial data defining the area of significant residual impacts should be provided.</p> <p>29. Demonstrate and document in the ERD how the EPAs objective for these factors can be met.</p>
<p>Relevant policy and guidance</p>	<p><i>EPA Policy and Guidance</i></p> <ul style="list-style-type: none"> • <i>Statement of Environmental Principles, Factors and Objectives</i>, EPA, 2016 • <i>Instructions on how to prepare an Environmental Review Document</i>, EPA, 2016 • <i>Environmental Factor Guideline – Terrestrial Fauna</i>, EPA, 2016 • <i>Technical Guidance: Sampling methods for terrestrial vertebrate fauna</i>, EPA, 2016 • <i>Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment</i>, EPA, June 2020 • <i>Technical Guidance: Sampling of short range endemic invertebrate fauna</i>, EPA, 2016 • <i>Instructions and Form: IBSA Data Packages</i> • <i>Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans</i>

	<p><i>Other policy and guidance</i></p> <ul style="list-style-type: none"> • <i>WA Environmental Offsets Policy</i>, Government of Western Australia, 2011 • <i>WA Environmental Offsets Guidelines</i>, Government of Western Australia, 2014 • <i>Western Australian Environmental Offsets Template, 2014</i> • <i>Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy</i>, Department of Sustainability, Environment, Water, Population and Communities, October 2012 <p>Relevant recovery plans, conservation advices and/or threat abatement plans for conservation significant species that are known to occur or are likely to occur in the vicinity of the proposal area.</p>
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Flora and Vegetation	
EPA objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Relevant activities	The proposal includes clearing of up to 109 hectares of native vegetation for well pads, access tracks and accommodation camps.
Potential impacts and risks	<ul style="list-style-type: none"> • Loss and fragmentation of native vegetation from clearing. • Degradation or loss of vegetation ecology and biodiversity as a result of the introduction of non-indigenous species (weeds), dust and unplanned fire events.
Required work	<p>30. Identify and characterise the flora and vegetation of areas that may be directly or indirectly impacted by the proposal, in accordance with <i>Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment</i>. Surveys should be designed to inform local and regional context. Specimens of significant flora collected during surveys should be vouchered at the WA Herbarium.</p> <p>31. Demonstrate how surveys are relevant, representative and demonstrate consistency with current EPA policy and guidance. Ensure database searches and taxonomic identifications are up-to-date. If multiple surveys have been undertaken to support the assessment, a consolidated report should be provided including the integrated results of the surveys. All surveys should be appended to the environmental review documentation.</p> <p>32. Provide a figure depicting survey effort applied in relation to the study area and development envelope, identifying the direct and indirect impact areas.</p>

	<p>33. Determine whether any flora species recorded are significant, and provide an analysis of local and regional context, (refer to <i>Environmental Factor Guideline – Flora and Vegetation</i> for definition of significant flora).</p> <p>34. Determine whether any vegetation identified is significant, and provide an analysis of local and regional context, (refer to <i>Environmental Factor Guideline – Flora and Vegetation</i> for definition of significant vegetation).</p> <p>35. Provide figures depicting the recorded locations of flora and vegetation in relation to the development envelope in accordance with EPA <i>Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment</i>.</p> <p>36. Assess the potential direct and indirect impacts of the construction and operational elements of the proposal on identified environmental values. Describe and assess the extent of cumulative impacts as appropriate.</p> <p>37. Provide a quantitative assessment of impact:</p> <ul style="list-style-type: none">a. For significant flora, this includes:<ul style="list-style-type: none">i. number of individuals and populations in a local and regional context;ii. numbers and proportions of individuals and populations directly or potentially indirectly impacted; andiii. numbers/proportions/populations currently protected within the conservation estate (where known).b. For all vegetation units (noting threatened and priority ecological communities and significant vegetation) this includes:<ul style="list-style-type: none">i. area (in hectares) and proportions directly or potentially indirectly impacted; andii. proportions/hectares of the vegetation unit currently protected within conservation estate (where known). <p>38. Describe the application of the mitigation hierarchy in the proposal design, construction, operation and decommissioning. Detail actions undertaken to avoid, minimise and mitigate proposal impacts. If any conservation significant species are expected to be impacted include management and/or monitoring plans to be implemented pre and post-construction to demonstrate that residual impacts are not greater than predicted.</p> <p>39. Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model (page 11) and the Western Australian Environmental Offsets Template (Appendix 1) in the <i>WA Environmental Offsets Guidelines</i> (2014) and include reference to the Commonwealth Assessment Guide for any MNES.</p>
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	<p>40. Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the <i>WA Environmental Offsets Policy</i> and Guidelines. Spatial data defining the area of significant residual impacts for each environmental value should also be provided (e.g. vegetation type, vegetation condition, specific fauna species habitat).</p> <p>41. Demonstrate how the EPAs objective for this factor has been addressed.</p> <p>Note: <i>Survey reports provided should be accompanied by IBSA Data Packages prepared following EPA Guidance.</i></p>
<p>Relevant policy and guidance</p>	<p><i>EPA Policy and Guidance</i></p> <ul style="list-style-type: none"> • <i>Statement of Environmental Principles, Factors and Objectives.</i> EPA, 2020 • <i>Instructions on how to prepare an Environmental Review Document.</i> EPA, 2016 • <i>Environmental Factor Guideline – Flora and Vegetation.</i> EPA, 2016 • <i>Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment.</i> EPA, 2016 • <i>Instructions and Form: IBSA Data Packages</i> • <i>Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans.</i> <p><i>Other policy and guidance</i></p> <ul style="list-style-type: none"> • <i>Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy,</i> Department of Sustainability, Environment, Water, Population and Communities, October 2012 • Relevant recovery plans, conservation advices and/or threat abatement plans for conservation significant species that are known to occur, or are likely to occur in the vicinity of the proposal area. • <i>Western Australian Environmental Offsets Policy,</i> September 2011 • <i>Western Australian Environmental Offsets Guidelines,</i> August 2014

Social Surroundings	
EPA objective	To protect social surroundings from significant harm.
Relevant activities	Construction of well pads, access tracks and accommodation camps to accommodate drilling and hydraulic fracture stimulation activities, and transportation and vehicle movements to and from site.
Potential impacts and risks	<ul style="list-style-type: none"> • Increased noise, dust, traffic and vibration impacts from transport, site preparation and hydraulic fracture stimulation operations; • Dust deposition on native vegetation; • Disturbance to heritage sites; and

	<ul style="list-style-type: none"> • Reduced visual amenity.
Required work	<p>42. Characterise the surrounding land use and amenity values in, and adjacent to the Proposal Area with a focus on the sensitive receptors and important areas for human use that could be affected by noise and dust emissions, traffic and amenity issues. Include relevant maps to show the locations of the sensitive receptors likely to be affected by the proposal.</p> <p>43. Provide a collation of baseline information and processes to ensure the documentation and systematic monitoring of matters relating to amenity and aesthetics.</p> <p><u>Noise</u></p> <p>44. Undertake a site-specific noise assessment in accordance with EPA and contemporary guidance. Demonstrate that noise can be managed such that it complies the Environmental Protection (Noise) Regulations 1997 at sensitive receptor locations.</p> <p>45. Undertake and provide baseline site-specific noise level data.</p> <p>46. Provide predictive modelling of noise emissions and impacts.</p> <p>47. Provide ongoing monitoring and management covering the entire lifecycle of the proposal.</p> <p>48. Include an assessment of the cumulative impact of noise from hydraulic fracture stimulation and associated activities, on places within proximity to people and domestic animals and provide management options to minimise noise.</p> <p><u>Traffic</u></p> <p>49. Identify the types and sizes of trucks, the road upgrades required to accommodate operations and ensure the safety of other road users. Describe how BNR will engage with local government to ensure public roads are maintained to provide for the ongoing safety of road users</p> <p>50. Provide baseline road use statistics measuring volumes of vehicle movement and type and provide details of monitoring of road use, throughout the lifecycle of the proposal.</p> <p>51. Reduce emissions from traffic by ensuring the regular maintenance of all vehicles.</p> <p><u>Health</u></p> <p>52. Provide a peer-reviewed, site-specific human health risk assessment, addressing potential short and long-term health impacts of the proposal that addresses health risks from:</p> <ol style="list-style-type: none"> airborne chemicals; chemicals proposed to be used in drilling and hydraulic fracture stimulation;

- c. fluids and those expected to be present in produced or flowback water;
- d. storage and handling of drilling and hydraulic fracture fluids; and
- e. storage and disposal of drilling and hydraulic fracturing flowback fluids (including wastewater).

Note: peer-reviewed, site-specific human health risk assessments will be provided to the Department of Health for comment.

- 53. Undertake a comprehensive local social impact analysis prior to commencement of activities, to understand and measure the social dimensions of change and its links to mental health and wellbeing, due to impacts from changes to the physical or biological surroundings.
- 54. Determine impacts to human health in relation to worker accommodation (particularly dust, water supply, wastewater disposal etc) by using the Department of Health scoping tool.

Dust

- 55. Undertake and provide baseline dust monitoring [minimum 12 months] prior to regulated activities.
- 56. Identify cumulative impacts from dust on local and regional ecosystems and public health.
- 57. Propose measures to minimise the generation of dust throughout all operations when compared to baseline monitoring.

Heritage

- 58. Characterise and describe the social, cultural and heritage values within the Proposal area and any sensitive receptors that may be directly or indirectly impacted as a result of this Proposal. Identify sites of social significance within a regional context, in consultation with the Traditional Owners.
- 59. Conduct investigations, including ethnographic and archaeological surveys in consultation with the Traditional Owners, to determine the significance of potential impacts (direct, indirect and cumulative) to social surroundings as a result of this Proposal.
- 60. Proposals likely to impact on Aboriginal heritage or significant sites must include an Aboriginal Heritage Management Plan developed in consultation with the Traditional Owners and the Department of Planning, Lands and Heritage. The Aboriginal Heritage Management Plan must:
 - a. include input from Traditional Owners whose land is under consideration for petroleum development;

	<p>b. detail the role of the Traditional Owners in monitoring the condition and protection of their cultural heritage and significant sites; and</p> <p>c. be reviewed and deemed acceptable by the Department of Planning, Lands and Heritage.</p> <p>61. Detail how cultural orientations will be made available to the proposal employees and contractors to raise cultural awareness, including issues specific to Aboriginal heritage, and be undertaken by local Traditional Owner groups or their approved cultural awareness providers.</p> <p>62. Describe and assess the potential impacts (direct, indirect and cumulative) to social surroundings as a result of changes to the environment from the Proposal giving consideration to Traditional Owners and Pastoral Stations and their activities on the land.</p> <p>63. Apply the mitigation hierarchy and discuss proposed objectives/outcomes, monitoring, management and mitigation measures including decommissioning and rehabilitation outcomes to be implemented to appropriately avoid and minimise impacts to social surroundings.</p> <p>64. Demonstrate and document how the EPA's objective for this factor can be met.</p>
<p>Relevant policy and guidance</p>	<p><i>EPA Policy and Guidance</i> Environmental Factor Guideline – Social Surroundings (EPA, 2016).</p> <p><i>Other policy and guidance</i> Environmental Protection (Noise) Regulations 1997. Guideline for managing the impacts from dust and associated contaminants from land development sites, contaminated sites remediation and other related activities (DWER, 2011) https://www.der.wa.gov.au/images/documents/your-environment/air/publications/Guideline_for_managing_impacts_of_dust.pdf</p> <p>Western Australian Department of Health process for providing advice to the Environmental Protection Authority on human health risk assessments for hydraulic fracturing proposals (Government of Western Australia, September 2020). https://www.hydraulicfracturing.wa.gov.au/wp-content/uploads/2020/10/206571_HHRA-Position-Paper_WEB.pdf</p> <p><i>Mine sites, exploration camps and construction villages - Scoping Tool: Public Health Considerations (Department of Health, May 2011).</i></p>

Peer Review	<i>Commission, in consultation with the Department of Water and Environmental Regulation and include in the PER, a peer review of the site-specific human health risk assessment.</i>
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Terrestrial Environmental Quality	
EPA objective	To maintain quality of land and soils so that environmental values are protected.
Relevant activities	Clearing of native vegetation and disturbance to soils from infrastructure, drilling activities and hydraulic fracture stimulation operations.
Potential impacts and risks	<ul style="list-style-type: none"> • Erosion or scouring from a reduction in soil stability during civil works; and • Contamination of land and soils from surface spills of fuel and chemical storage leaks and waste products, including produced or flowback water being released into the receiving environment.
Required work	<p>65. Present a desktop soil quality assessment within the vicinity of the well pads.</p> <p>66. Include in the ERD, figures of the mapped soil units and soil profile.</p> <p>67. Describe the proposed management, monitoring and mitigation methods to be implemented to address direct and indirect impact on soils/lands/receiving environment. This description is to include soil handling methods to mitigate erosion, compaction and contamination and soil quality monitoring to inform site reinstatement activities.</p> <p>68. Develop a suitable soil quality monitoring program for each well, documented within the ERD that includes:</p> <ul style="list-style-type: none"> • A comprehensive list of analytes proposed to be collected, • A scientifically justified baseline monitoring program (including extent and duration of the program), • Trigger and threshold contingency actions. <p>69. Predict residual impacts after considering the mitigation hierarchy.</p> <p>70. Provide a waste management strategy, including methods for segregating wastes and appropriate disposal arrangements with licenced facilities. Wastes associated with hydraulic fracture stimulation requiring evaluation and management include drilling fluid, rock cuttings, flowback fluid and produced formation water.</p>
Relevant policy and guidance	<p><i>EPA Policy and Guidance</i></p> <p>Environmental Factor Guideline - Terrestrial Environmental Quality (EPA, 2016).</p> <p><i>Other policy and guidance</i></p>

	<p>Environmental Protection Regulations 1997.</p> <p>Water retention pond design as per the former Department of Water, water quality protection note 26</p> <p>Chemical and hazardous liquid material storage in accordance with the NT Code of Practice as per Australian Standards (AS1904[2004]) recommendations</p>
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Air Quality	
EPA objective	To maintain air quality and minimise emissions so that environmental values are protected.
Relevant activities	Clearing of native vegetation and disturbance to land from infrastructure, drilling activities and hydraulic fracture stimulation operations.
Potential impacts and risks	<ul style="list-style-type: none"> • Dust generation from clearing, stimulation fleet and vehicles on unsealed roads; • Exhaust emissions from light and heavy vehicles, equipment and generators; and • Emissions from drilling and hydraulic fracture stimulation operations.
Required work	<p>71. Undertake and provide baseline air quality monitoring for volatile organic compounds and dust for a minimum of 12 months prior to commencing the proposal.</p> <p>72. Provide a site-specific air quality risk assessment.</p> <p>73. Describe the proposed management, monitoring and mitigation methods to be implemented to address direct and indirect impact on air quality, including undertaking ongoing monitoring of dust and volatile organic compounds.</p>
Relevant policy and guidance	<p><i>EPA Policy and Guidance</i></p> <p>Environmental Factor Guideline – Air Quality (EPA, 2020).</p> <p><i>Other policy and guidance</i></p> <p>Air Quality Modelling Guidance Notes (Department of Environment, March 2006). https://archive.org/download/AIRQUALITYMODELLINGGUIDANCENOTES_MAR2006WEB/AIRQUALITYMODELLINGGUIDANCENOTES_MAR2006WEB.pdf</p> <p><i>A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities</i> (Department of Environment and Conservation, March 2011)</p>

	<p>https://www.der.wa.gov.au/images/documents/your-environment/air/publications/Guideline_for_managing_impacts_of_dust.pdf</p> <p>National Environment Protection (Air Toxics) Measure https://www.nepc.gov.au/nepms/air-toxics</p> <p>National Environment Protection (Ambient Air Quality) Measure https://www.nepc.gov.au/nepms/ambient-air-quality</p> <p>National Environment Protection (Diesel Vehicle Emissions) Measure https://www.nepc.gov.au/nepms/diesel-vehicle-emissions</p>
Peer Review	<i>Commission, in consultation with the Department of Water and Environmental Regulation, and include in the PER, a peer review of the site specific air quality risk assessment.</i>

Greenhouse Gas Emissions	
EPA objective	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change.
Relevant activities	Clearing of native vegetation and disturbance to land from infrastructure, drilling activities and hydraulic fracture stimulation operations.
Potential impacts and risks	<ul style="list-style-type: none"> • Exhaust emissions from light and heavy vehicles, equipment and generators; • Emissions from drilling and hydraulic fracture stimulation operations; and • Clearing of vegetation and site development.
Required work	<p>74. Provide credible estimates of scope 1, scope 2 and scope 3 greenhouse gas emissions (annual and total) in tonnes of carbon dioxide equivalent (CO₂-e) over the life of the proposal. Detail methods used to estimate emissions.</p> <p>75. Provide a breakdown of estimated scope 1 and scope 2 greenhouse gas emissions in tonnes of CO₂-e by all sources. Consider all proposed activities in determining the sources of emissions (e.g. clearing of land, site preparations, drilling operations, hydraulic fracture stimulation operations including flaring, potential leakage etc).</p> <p>76. Provide calculations and calculation methodology for determining estimated emissions of Co₂-e for all sources.</p> <p>77. Benchmark the proposal's emissions against other hydraulic fracture stimulation exploration projects. Information which supports that the identified projects are comparable to the proposal should be included.</p>

	<p>78. Provide a greenhouse gas management plan, in accordance with EPA guidance, which demonstrates the proposal's trajectory towards net zero emissions by 2050. The plan should include at a minimum:</p> <ol style="list-style-type: none"> a. information required by 74 to 77 above. b. a graph and table showing regular targets reflecting an incremental reduction in emissions towards net zero emissions by 2050. Where the proposed emissions reduction targets do not demonstrate a trajectory towards net zero by 2050, articulate clearly a compelling reason why it is not possible to achieve this. c. mitigation (avoidance, reduction, offset) measures to be implemented with associated timeframes and evidence to demonstrate that the interim and long-term targets will be met. Where it is proposed that, following implementation of the avoidance and reduction measures, authorised offsets will be applied to meet the targets, evidence which supports that the mitigation measures are capable of achieving the stated targets is not required. d. analysis of other potential abatement measures (e.g. renewables) relevant to the proposal that are not proposed to be implemented which provides the rationale to support that these measures are unable to be implemented. e. reporting requirements for publicly and periodically reporting against the stated targets. <p>79. Undertake and provide baseline measurements and monitoring for greenhouse gases, for a minimum of 12 months prior to any regulated activities.</p> <p>80. Provide a monitoring and reporting program measuring atmospheric concentrations and process leakage of methane over every well's entire life cycle, with recognition that any detected leaks must be fixed by the operator.</p>
<p>Relevant policy and guidance</p>	<p><i>EPA Policy and Guidance</i></p> <p>Environmental Factor Guideline – Greenhouse Gas Emissions (EPA, 2020).</p> <p><i>Other policy and guidance</i></p> <p>Ambient air quality in the Surat Basin, Queensland Overall assessment of air quality in region from 2014 -2018.</p> <p>https://gisera.csiro.au/wp-content/uploads/2018/09/G3-final-AQ-assessment-report.pdf</p> <p>Methane and Volatile Organic Compound Emissions in New South Wales:</p> <p>https://www.epa.nsw.gov.au/~/_media/EPA/Corporate%20Site/resources/air/methane-volatile-organic-compound-emissions-nsw-3063.ashx</p>

	<p>Pre-Exploration Measurement and Monitoring of Background Landscape Methane Concentrations and Fluxes in the Beetaloo Sub-Basin, Northern Territory.</p> <p>https://gisera.csiro.au/wp-content/uploads/2019/09/GHG5-Milestone-4-Final-Report.pdf</p>
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Human Health	
EPA objective	To protect human health from significant harm.
Relevant activities	Drilling and hydraulic fracture stimulation activities.
Potential impacts and risks	<ul style="list-style-type: none"> • Potential impacts from radiation being brought to the surface in flowback water from hydraulic fracture stimulation operations; and • Storage of flowback water in evaporation ponds.
Required work	<p>81. Conduct a desktop assessment of the radionuclides and metals likely to be present in the geology of the proposal area based on an interpretation of the site geology, exploration drilling data previously collected, and publicly available geophysical mapping. The assessment should explain if naturally occurring radionuclides and metals are likely to be of environmental significance or detrimental to human health during the development of the project and throughout operations.</p> <p>82. Conduct an assessment of potential impacts to human health.</p> <p>83. Outline the outcomes/objectives, management, monitoring, trigger and contingency actions to ensure impacts (direct and indirect) are not greater than predicted.</p> <p>84. Provide information on wastewater management on site.</p> <p>85. Discuss the proposed management, monitoring and mitigation methods to be implemented demonstrating that the design of the proposal has addressed the mitigation hierarchy in relation to impacts on human health.</p> <p>86. Provide a statement of how the proponent considers the EPA's objective for this factor has been addressed.</p>
Relevant policy and guidance	<p><i>EPA Policy and Guidance</i></p> <p>Environmental Factor Guideline – Human Health (EPA, 2016).</p>

Subterranean Fauna

EPA objective	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.
Relevant activities	Disturbance to land from infrastructure, drilling and hydraulic fracture stimulation activities.
Potential impacts and risks	<ul style="list-style-type: none"> • Storage of flowback water in evaporation ponds • Clearing of vegetation and site development • Drawdown impacts on habitat • Contamination of habitat due to well integrity failure.
Required work	<p>87. Conduct a desktop assessment of the subterranean fauna and their habitat to inform local and regional context.</p> <p>88. Undertake an assessment of potential impacts to Subterranean Fauna in accordance with EPA guidance.</p> <p>89. Conduct an assessment of potential impacts from HFS activities to subterranean fauna. The assessment should explain if drill fluids or other chemicals of environmental significance are detrimental to subterranean fauna or their habitat.</p> <p>90. Discuss the proposed management, monitoring and mitigation methods to be implemented demonstrating that the design of the proposal has addressed the mitigation hierarchy in relation to impacts on subterranean fauna.</p> <p>91. Outline the outcomes/objectives, management, monitoring, trigger and contingency actions to ensure impacts (direct and indirect) are not greater than predicted.</p> <p>92. Provide a statement of how the proponent considers the EPA's objective for this factor has been addressed.</p>
Relevant policy and guidance	<p><i>EPA Policy and Guidance</i></p> <p>Environmental Factor Guideline – Subterranean Fauna (EPA, 2016).</p>

Index of Biodiversity Surveys for Assessments

Each time a biodiversity survey report is submitted (at any point in the assessment and compliance process under Part IV of the EP Act) it should be accompanied by an electronic appendix known as the IBSA data package. More information about IBSA is available on the EPA's website.

4. Other environmental factors or matters

The EPA has not identified any other environmental factor or matter relevant to the proposal.

It is also important that the proponent be aware that other factors or matters may be identified during the course of the environmental review that were not apparent at the time that this ESD was prepared. If this situation arises, the proponent must consult with the EPA to determine whether these factors and/or matters are to be addressed in the ERD, and if so, to what extent.

5. Stakeholder consultation

The proponent must consult with stakeholders who are affected by, or are interested in the proposal. This includes the decision-making authorities (see section 6), other relevant state (and Commonwealth) government agencies and local government authorities, the local community and environmental non-government organisations.

The proponent must document the following in the ERD:

- identified stakeholders
- the stakeholder consultation undertaken and the outcomes, including decision-making authorities' specific regulatory approvals and any adjustments to the proposal as a result of consultation; and
- any future plans for consultation.

6. Decision-making authorities

At this stage, the EPA has identified the authorities listed in Table 5 as decision-making authorities (DMAs) for the proposal. Additional DMAs may be identified during the course of the assessment.

Table 5 Decision-making authorities

Decision-making authority	Relevant legislation
1. Minister for Environment	<i>Biodiversity Conservation Act 2016</i>
2. Minister for Water	<i>Rights in Water and Irrigation Act 1914</i>
3. Minister for Aboriginal Affairs	<i>Aboriginal Heritage Act 1972</i>
4. Minister for Mines and Petroleum	<i>Petroleum and Geothermal Energy Resources Act 1967</i> <i>Petroleum and Geothermal Energy Resources (Environment) Regulations 2012</i> <i>Resource Management and Administration Regulations 2012</i> <i>Petroleum and Geothermal Energy Resources (Management of Safety) Regulations 2010</i>

5. Department of Mines, Industry Regulation and Safety	<i>Dangerous Goods Safety Act 2004</i>
6. Department of Water and Environmental Regulation	<i>Environmental Protection Act 1986</i>
7. Shire of Derby-West Kimberley	<i>Planning and Development Act 2005</i> <i>Building Act 2011</i> <i>Health Act 1911</i>

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Figure 1 – Regional location

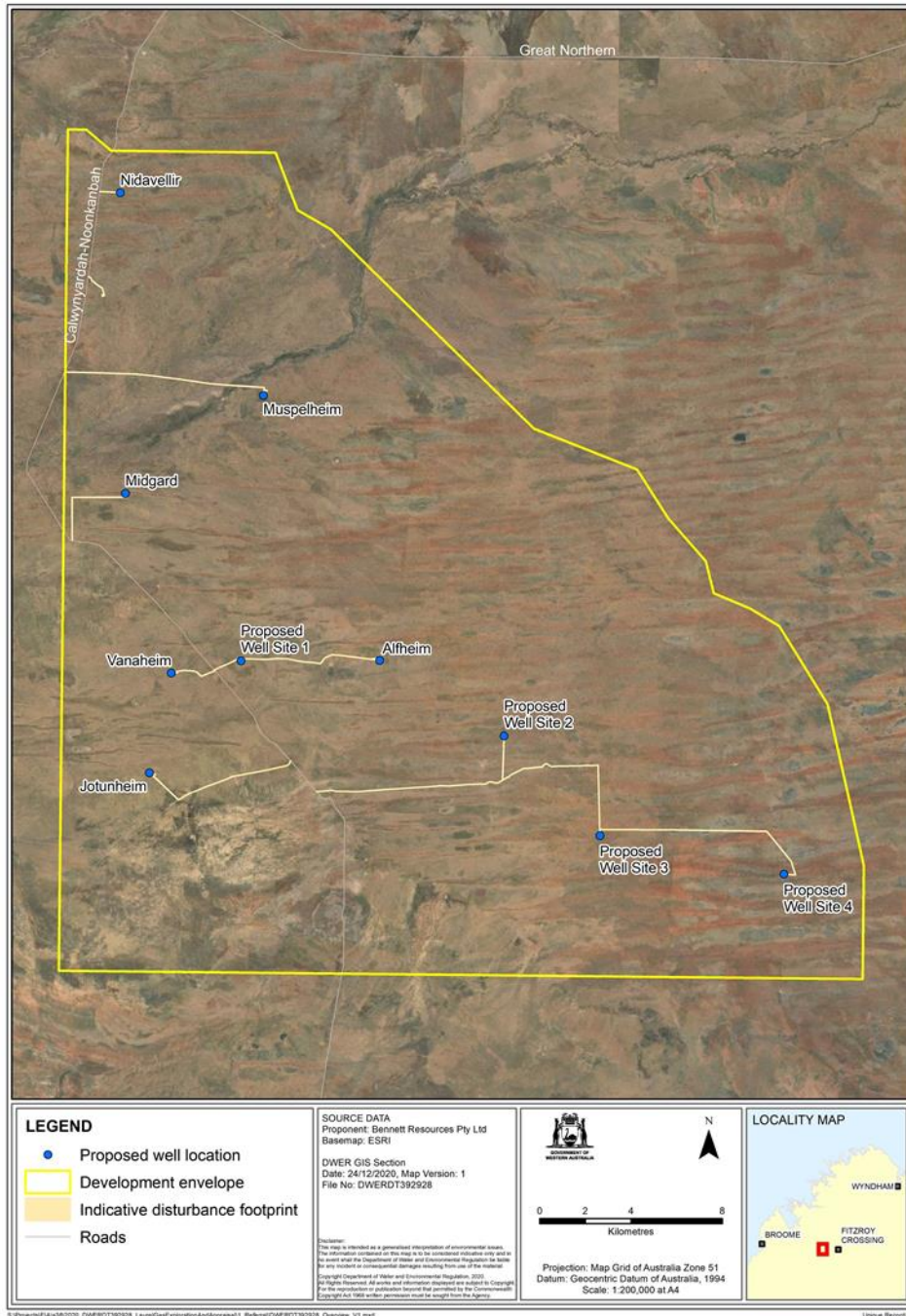


Figure 2 – Proposed Drilling sites