# Submission on the proposed declared areas of land as reserved blocks (no-go zones) for hydraulic fracturing under the Petroleum Act

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## About Protect Country Alliance

The Protect Country Alliance is a network of landholders, Traditional Owners, communities, and civil society groups working together to protect land, water and public health from the risks of shale oil and gas fracking in the Northern Territory.

The Alliance brings together landholders and representatives from urban, regional and remote communities, industry sector representatives including pastoral, farming and tourism and social justice and environment organisations.

This submission has been prepared on behalf of our members who hold interests in land subject to exploration permits for shale oil and gas, and who are currently not protected by the 'no-go-zones' proposed by the Northern Territory Government.

## Understanding of the land identified as proposed no go zones under consideration

The scientific inquiry into hydraulic fracturing in the Northern Territory, conducted over a 16 month period in 2017-18, identified a raft of environmental, social, cultural, and economic risks associated with this type of mining. Its Terms of Reference required the Inquiry panel to identify, if possible, how these risks could be reduced or mitigated.

The Inquiry made 135 recommendations designed to reduce the risks of fracking to 'acceptable levels'. One of those recommendations required the NT Government to develop a criteria for establishing 'no-go-zones' to identify where drilling and fracking would pose an unacceptable risk and to put those areas off-limits to future petroleum exploration. These areas would become "petroleum reserves" under the Petroleum Act, and become permanent fracking "no go" zones.

The consultation paper 'Proposed reserved blocks (no-go zones) for petroleum activities in the Northern Territory' states that; *"The NTG has used the recommendations of the Final Report of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory to determine which areas should be declared reserved blocks"*

*"The Inquiry's criteria were set out in Recommendation 14.4, which states: That prior to the grant of any further exploration approvals, the following areas must be declared reserved blocks under section 9 of the Petroleum Act, each with an appropriate buffer zone:*

- *Areas of high tourism value;*

- *Towns and residential areas (including areas that have assets of strategic importance to nearby residential areas);*
- *National parks;*
- *Conservation reserves;*
- *Areas of high ecological value;*
- *Areas of cultural significance; and*
- *Indigenous Protected Areas."*

*"The Inquiry also recommended that exploration permits should not be granted in areas that do not contain petroleum potential in Recommendation 14.3, which states: That Government not approve any application for an exploration permit in relation to areas that are not prospective for onshore shale gas or where co-existence is not possible. Priority must be given to the areas identified in Recommendation 14.4."*

The mapping produced by the NT Government to establish the proposed boundaries for 'no-go' zones is a preliminary amalgamation of predetermined available spatial data, including:

- current petroleum reserves
- areas that have no petroleum potential;
- sites of conservation significance registered with Department of Environment and Natural Resources ;
- declared national parks and reserves; and
- declared indigenous protected areas (IPA's)

Also outlined in the consultation paper: *"Other areas that have assets of strategic importance to residential areas, such as airports and future town water supplies, will also be declared a reserved block." As stipulated in the Inquiry's Recommendation 10.2, a 2km buffer will be established around these areas.*

Of concern, the Northern Territory Government's proposed no-go zones for petroleum activities fails to address in full the condition in the Recommendation 14.4 that requires declared reserved blocks under section 9 of the Petroleum Act are to have "an appropriate buffer zone" applied.

To ignore this requirement denies Northern Territory residents the right to be consulted on critical no-go-zones proposals. There is also nothing specific mentioned about this in the Petroleum Act.

There is no timeframe established for these consultations to occur, and given the short window of consideration for the present no-go-zones process it is likely to be some time post the closure of this consultation period.

It is our view that exploration should not be able to proceed until properly considered no-go-zone boundaries have been fully established and given effect to.

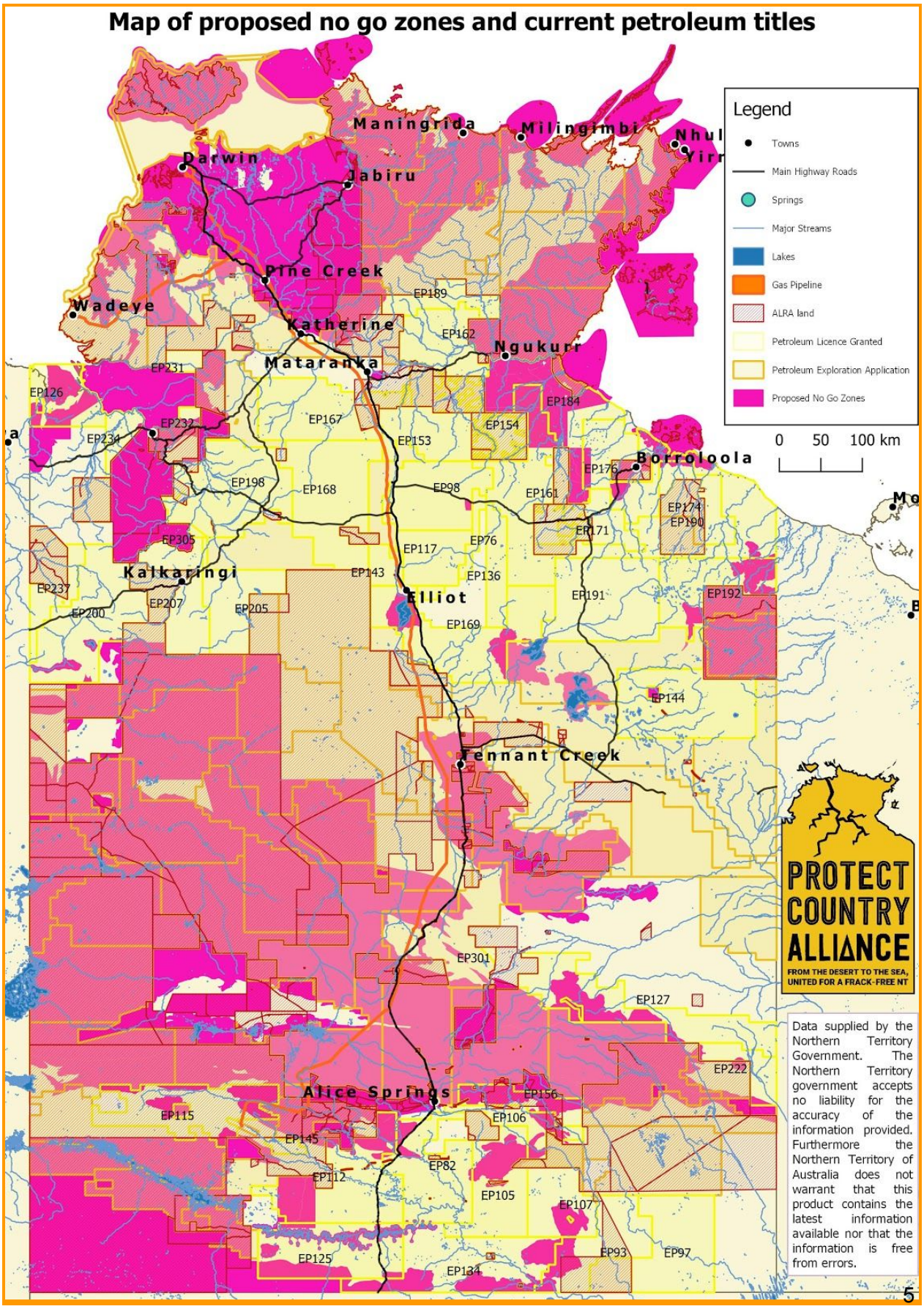
As stated in the Scientific Inquiry final report
*"Recommendation 14.4 is prospective in nature and does not apply to land already the subject of a granted exploration permit. Consideration must be given to how the areas identified in Recommendation 14.4 can retrospectively be made no go zones. The Panel recognises that this may give rise to complex legal issues that involve questions of potential sovereign risk and the payment of compensation to existing EP holders by the Government.*
*Recommendation 14.5 That the Government immediately considers and implements mechanisms to retrospectively apply Recommendation 14.4 to granted exploration permits.*

To date, clarification of this process or mechanisms to retrospectively apply Recommendation 14.4 have not been developed. However there are existing mechanisms in the Petroleum Act to remove exploration permits on renewal of existing permits. And Petroleum companies can relinquish titles at any time.

According to NTG petroleum title data 100 of the 117 current exploration permits have actually expired, including those in the Beetaloo Basin that have recently been approved for civil works, and have current EMP's being processed for drilling and hydraulic fracturing activities. And before no go zones with an appropriate buffer have been determined.

This failure to appropriately assess and apply restrictions on petroleum exploration areas prior to fracking activities being advanced undermines genuine attempts to safeguard the environment and the valuable natural and cultural assets the no-go-zones criteria is designed to protect.

No exploration works or activities should be commence or be considered until the proposed fracking no go zones have been finalised.


Map of proposed no go zones and current petroleum titles
Legend
Towns
Main Highway Roads
Springs
Major Streams
Lakes
Gas Pipeline
ALRA land
Petroleum Licence Granted
Petroleum Exploration Application
Proposed No Go Zones
0 50 100 km
Maningrida
Milingimbi
Darwin
Jabiru
Pine Creek
Wadeye
Katherine
Ngukurr
Mataranka
Borroloola
Kalkaringi
Elliot
Tennant Creek
Alice Springs
EP189
EP162
EP231
EP126
EP232
EP234
EP167
EP153
EP154
EP184
EP176
EP198
EP168
EP98
EP161
EP174
EP190
EP305
EP171
EP117
EP76
EP143
EP136
EP237
EP207
EP205
EP200
EP191
EP192
EP169
EP144
EP301
EP127
EP222
EP156
EP115
EP106
EP145
EP82
EP112
EP105
EP107
EP125
EP134
EP93
EP97
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## Limitations of the land identified as proposed no go zones under consideration

The consultation paper acknowledges that this is a ‘quick and broad assessment’. Disappointingly, no further work has been done on identifying land that needs to be included in these no go zones since the moratorium was lifted over a year ago, when the same proposed no go zones boundaries were first presented.

Despite the acknowledgement by the NT Government of a lack of existing data on the ground and surface water systems and environment in the Beetaloo basin region, no strategic regional environmental baseline assessments (SREBA) have been carried out in areas where unconventional gas exploration is to imminently commence.

The draft no-go-zones boundaries fail to adequately reflect the NT Government’s own established criteria for protection of ecologically and culturally significant areas, groundwater dependent ecosystems, local communities, and access to safe drinking water.

Traditional Owners are also rightly asserting that in order to enact proper no go zones, a broader approach to cultural risk assessment and a regional cultural mapping initiative is needed to recognise and understand the connections between water, sacred sites and songlines in the Beetaloo Sub-basin.

## No buffer zones have been applied

It is not clear from the recommendations, nor in the consultation paper, what the requirements and conditions for applying “an appropriate buffer zone” around declared reserved blocks. But whatever they may be, they definitely have not been identified or considered leading up to this consultation.

The only discussion of buffer zones has been in relation to the 2km buffer around assets of strategic importance to residential areas, such as airports and future town water supplies. And considering horizontal drilling has been now identified by fracking implementation updates to be able to travel up to 7km horizontally underground, this should be revisited. Areas identified in the proposed no go zones currently include sites of ecological significance with groundwater dependent ecosystems, or sites of ecological significance with large catchments. Considering the interplay of water systems in the NT, broader water catchment and groundwater recharge areas may need to be considered in the proposed no go zones.

## Ecosystem services at risk from fracking

Fire carbon projects are growing in north Australia, providing career pathways and jobs for people living in remote locations, as well as revenue for community development. This important

ecosystem service also restores biodiversity. The potential expanse of the unconventional shale gas exploration, indicated by area's absence of proposed no go zones and existence of granted exploration licences and applications for exploration licences, ignores this conflict of interest. This is particularly evident on a large scale in central Arnhem Land.

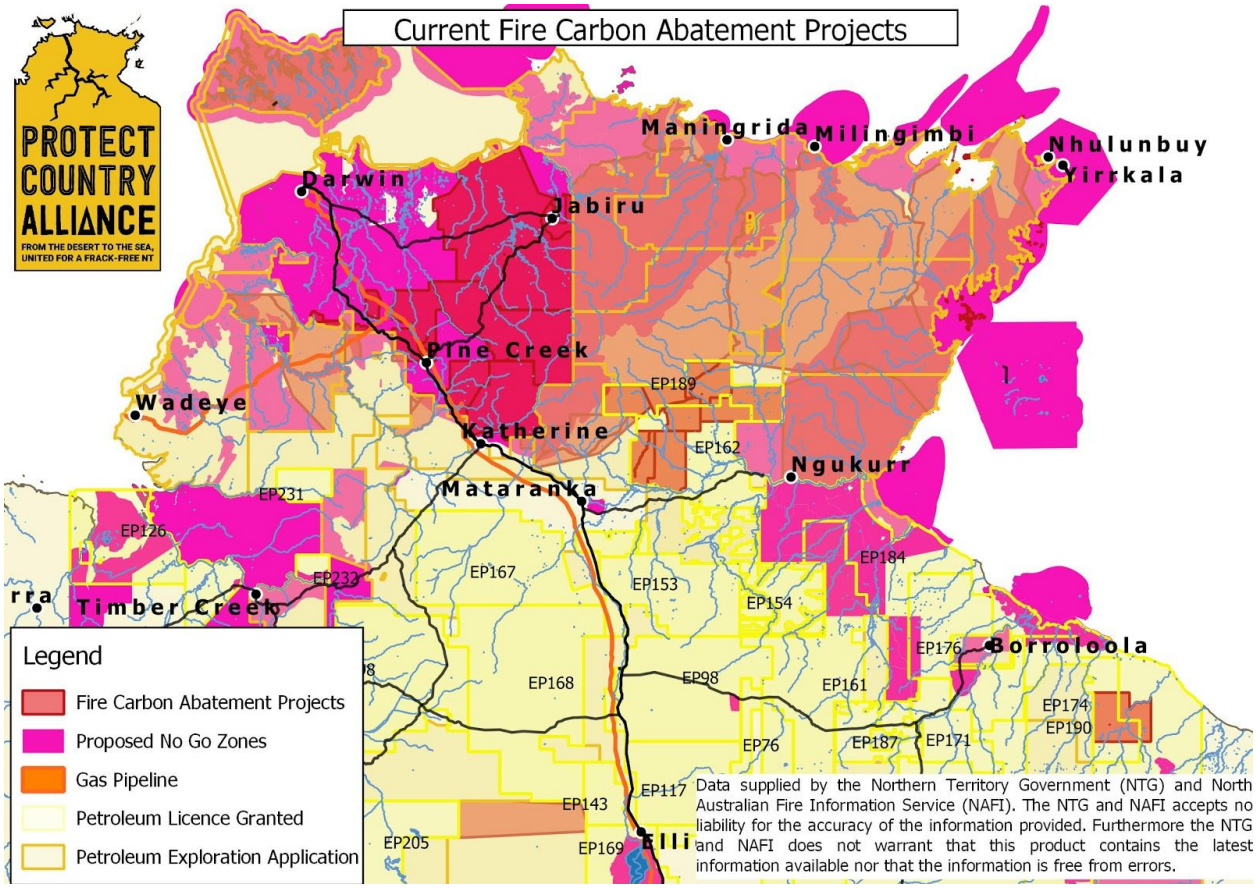
It is uncertain whether unconventional petroleum resource extraction will impact on ecosystem services by restricting access to the local managers of ecosystem services. Gasfield infrastructure could block roads and restrict no fly zones. In particular for fire carbon abatement projects, the spread of unconventional gas wells may impede strategic landscape scale fire management leaving large tracts of country open and less secure for wildfires. This would have a downward negative impact on biodiversity conservation and financially secure carbon projects.

Payment for ecosystem services is often one of the few sustainable and long term enterprise opportunities for remote communities marginalised by distance from economic centres, poor access and limited land tenure.

As well as economic and environmental benefits, there are significant social and cultural returns, such as maintaining connection to Country, and creating meaningful sustainable livelihoods on remote Aboriginal land (Robertson, 2019). With the immense greenhouse gas emissions predicted to be produced from extraction to production of unconventional shale gas, it also undermines the important carbon abatement successes across the landscape, as well as not being practically compatible to coexist.

It is acknowledged that being on Aboriginal land under the Aboriginal Land Rights Act, it will be a final decision made by the custodians of the land if they wish to pursue unconventional gas mining over current ecosystem services. We note that right is limited only to the exploration phase, despite requests for another decision making opportunity by Traditional Owners prior to production licences being granted.

However, it is imperative that the preliminary proposed no go zones include the exclusion of exploration activities in areas where there are currently fire carbon abatement projects are active. And an assessment may also need to be made to identify other areas that may be suitable in the future for this type or other paying ecosystem services.

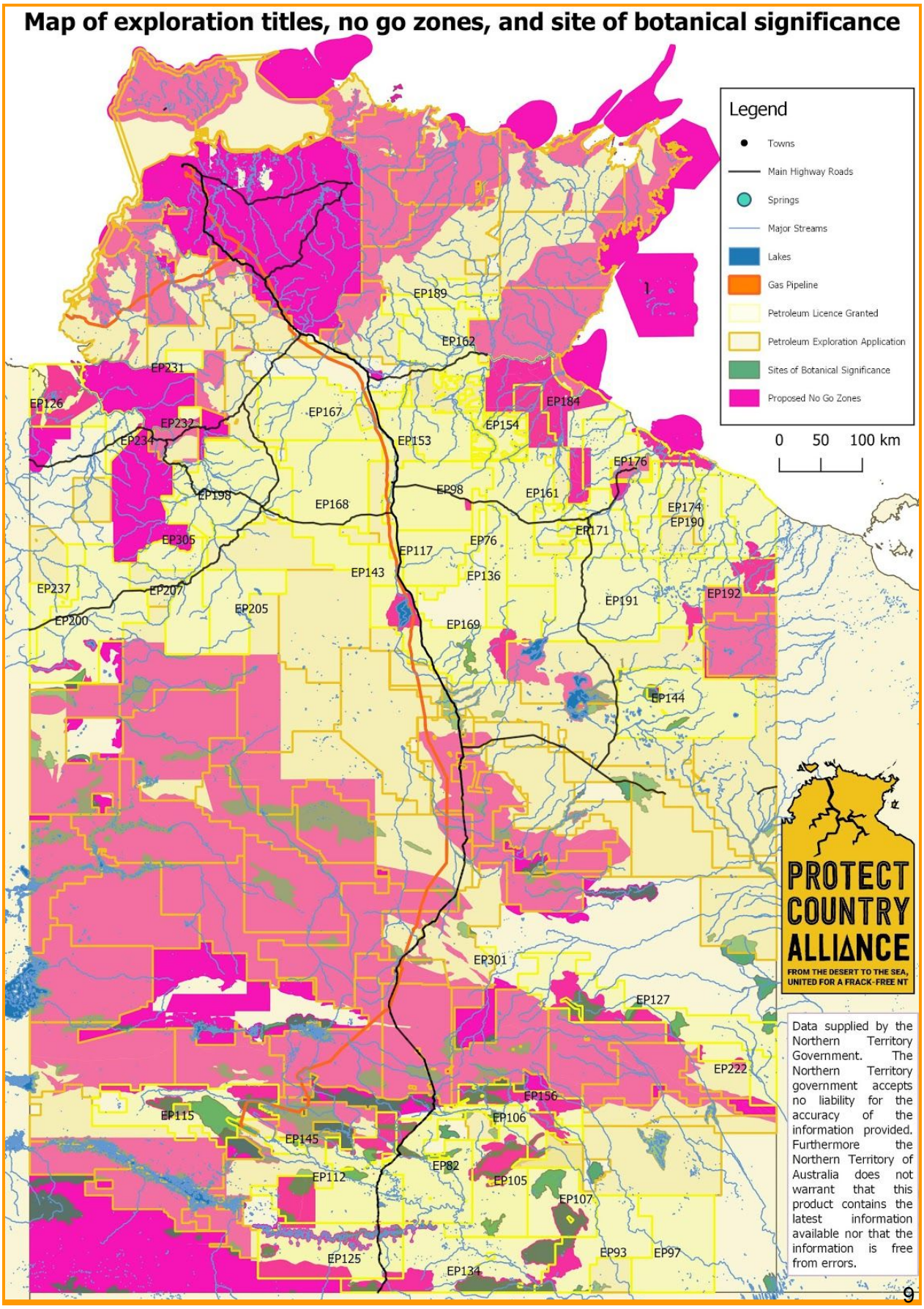



## Existing conservation areas not represented

There are some other existing areas that are distinct and widely known areas with existing conservation activities, ecosystem services, and ecologically significant that have not been incorporated into this version of the proposed fracking no go zones open for consultation.

## Sites of Botanical significance

Whilst sites of conservation significance registered by the NTG Department of Environment and Natural Resources have been included in the proposed no go zones, sites of botanical significance also registered by the same department have not been included. Significant plants, and plant communities are not  exempt from impacts of unconventional gas mining, with a potentially large network of clearing required. These sites of botanical significance shown in the map below are found in areas with current petroleum titles.


Map of exploration titles, no go zones, and site of botanical significance
Legend
Towns
Main Highway Roads
Springs
Major Streams
Lakes
Gas Pipeline
Petroleum Licence Granted
Petroleum Exploration Application
Sites of Botanical Significance
Proposed No Go Zones
0 50 100 km
EP189
EP162
EP231
EP126
EP167
EP232
EP234
EP153
EP154
EP184
EP176
EP198
EP168
EP98
EP161
EP174
EP190
EP305
EP171
EP76
EP117
EP143
EP136
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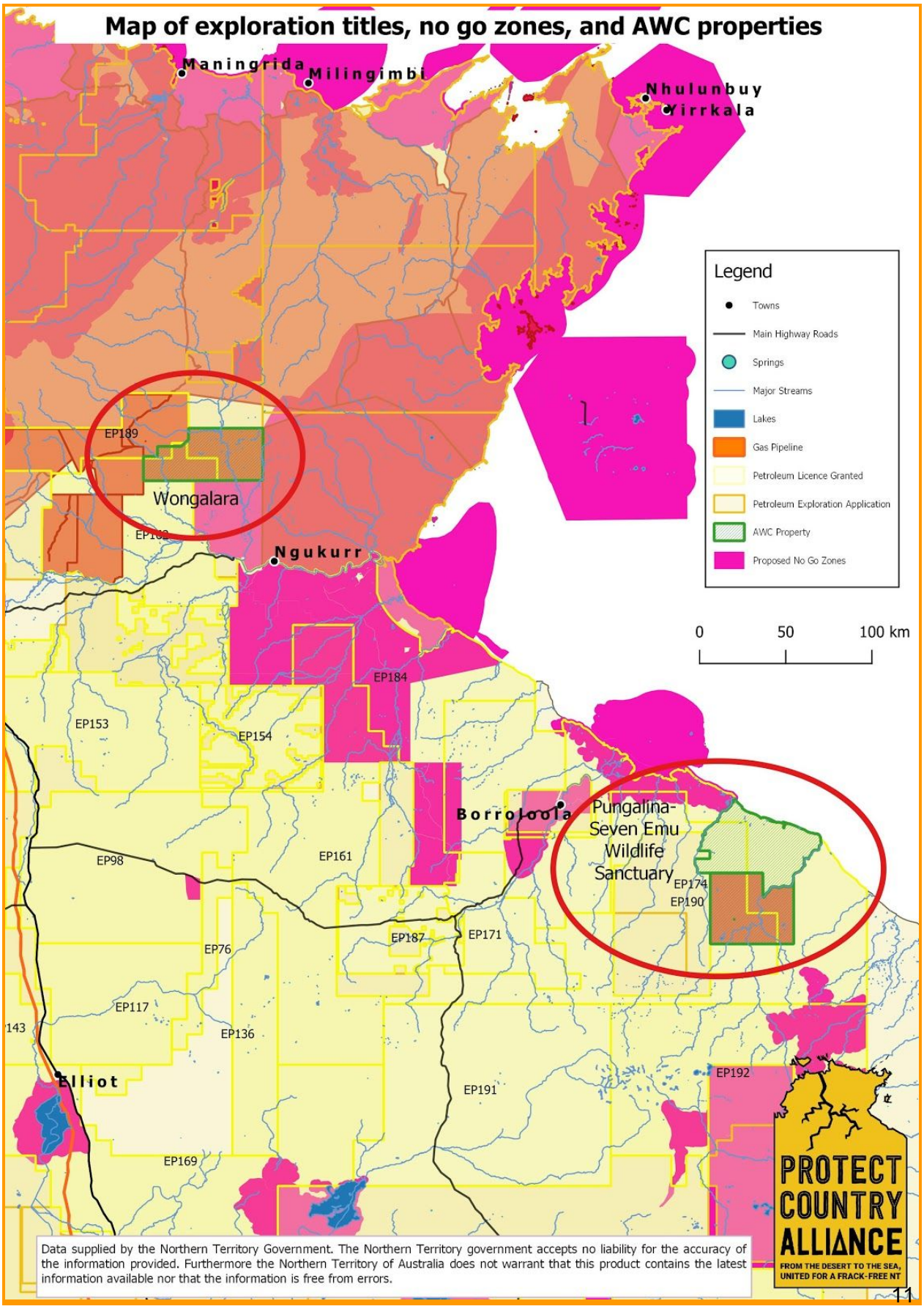
## Australian Wildlife Conservancy properties

Australian Wildlife Conservancy (AWC) manages more land than any other non-government conservation organisation in Australia, with 28 properties located in key regions including the Kimberley, the Top End, Cape York, Kati Thanda-Lake Eyre and the southwestern forests (AWC, 2019). Two properties in the Northern Territory, Pungalina-Seven Emu Wildlife Sanctuary and Wongalara currently have granted exploration permits, are not included in the proposed no go zones, and are not on NT Aboroginal Land Rights Act land. Both properties also have active fire carbon projects.

As stated on the Australian Wildlife Conservancy website:

- “Pungalina-Seven Emu Wildlife Sanctuary protects an area of extraordinary conservation value, including 100km of the nationally significant Calvert River, and 55 kilometres of pristine Gulf of Carpentaria coastline. The property captures a remarkable ecological gradient which extends from the ocean and its adjacent lowland plains to the top of the rugged sandstone plateau which dominates the Gulf region.”
- “Wongalara protects over 190,000 hectares of southern Arnhem Land, and includes the largest feral herbivore-free area on mainland Australia. It is an important refuge for species declining elsewhere across northern Australia.”

Unconventional gas exploration would be in conflict and not compatible with the current conservation activities and should be considered in the proposed declared areas of land as reserved blocks.


Map of exploration titles, no go zones, and AWC properties
Maningrida
Milingimbi
Nhulunbuy
Yirrkala
Legend
Towns
Main Highway Roads
Springs
Major Streams
Lakes
Gas Pipeline
Petroleum Licence Granted
Petroleum Exploration Application
AWC Property
Proposed No Go Zones
0
50
100 km
EP189
Wongalara
Ngukurr
EP184
EP153
EP154
Borroloola
Pungalina-
Seven Emu
Wildlife
Sanctuary
EP174
EP190
EP98
EP161
EP187
EP171
EP76
EP117
EP136
Elliot
EP191
EP192
EP169
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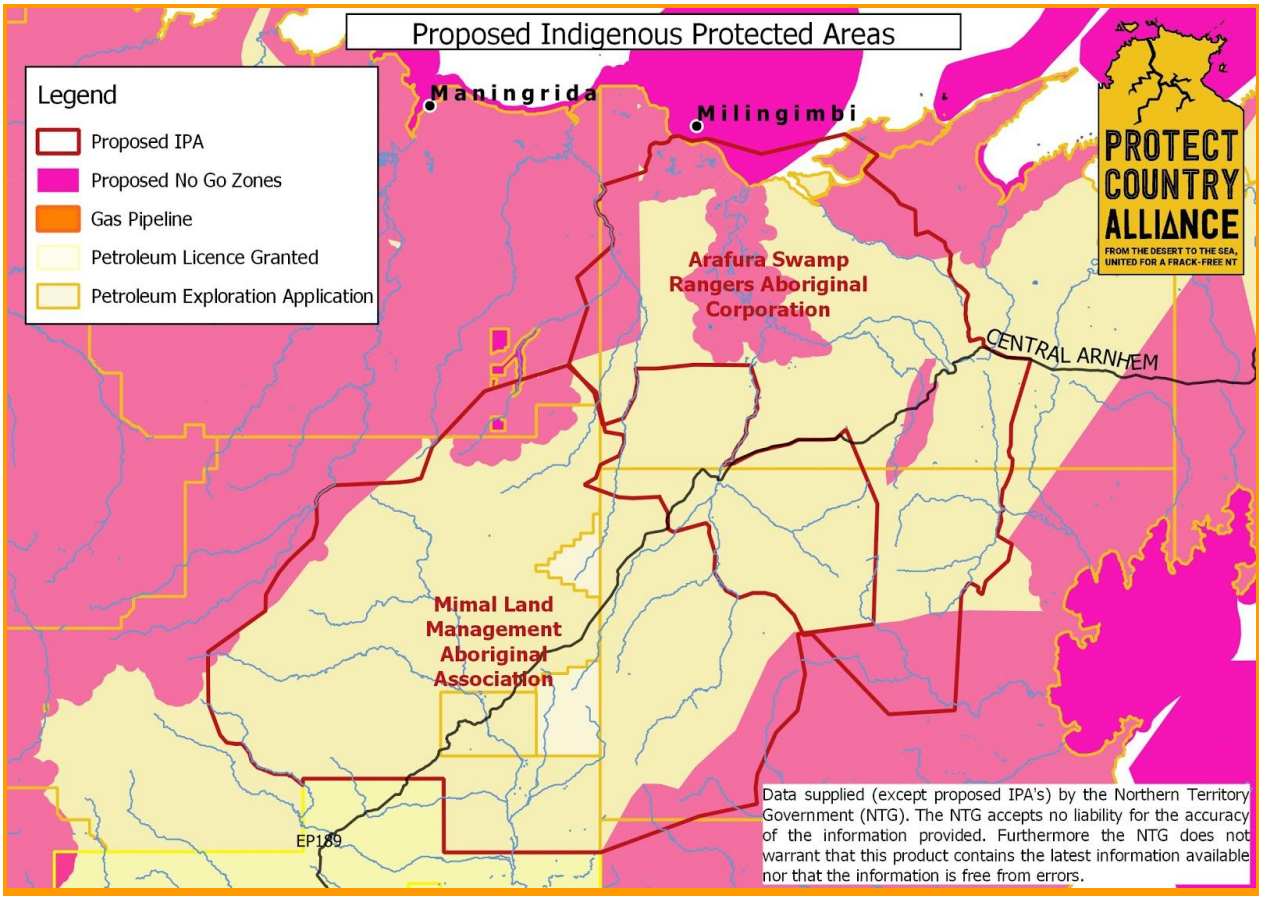
## Currently proposed Indigneous Protected Areas

The proposed no go zones released in this consultation include Indigenous Protected Areas (IPAs), but have not considered any IPAs that are currently proposed. Two known proposed IPAs are the Mimal IPA and the Arafura Swamp IPA. There may be more. These are located in Central Arnhem Land along the Central Arnhem Hwy. As well as having fire carbon projects, these areas should be included in the petroleum reserves. There are currently exploration licences granted and being applied for in these areas.

**MAP OF PROPOSED IPAs, NO GO ZONES AND Granted and Application Petroleum Titles**




## Risks of fracking and protection of water

Many risks to water were identified during the Scientific Inquiry into Hydraulic Fracturing, and mitigations measures were reviewed and recommendations made. The final report concludes that if all 135 recommendations are followed, the risks posed by hydraulic fracturing in the Northern Territory would be reduced to ‘acceptable levels.’

The NT Government accepted the findings of the Scientific Inquiry into Hydraulic Fracturing as impetus to lift the moratorium on unconventional gas mining in the NT, and committed to implementing all of the recommendations in full. However, the current process of implementing these recommendations and applying them to risk management of the fracking industry demonstrates there are still many risks left unmanaged.

There are still many unknowns about the risks of depletion and pollution of the water systems in areas where shale gas exploration will initially occur. Hence, the need to protect significant areas from these activities altogether which can initially be achieved through this process of identifying no go zones with an appropriate buffer. This process was envisaged by the Pepper Inquiry panel to be undertaken thoroughly, and prior to the issuing of further exploration proposals, as this submission recommends.

The Northern Territory from the north to the south traverses distinct climatic zones, from tropical monsoonal in the north, to arid and semi-arid regions in the north. The wet season monsoons in the north (October to April) saturates the landscapes recharging aquifers, inundating floodplains and water runs thoroughly through the network of streams, billabongs, and water holes. This monsoon influences the south with intermittent rain. Average rainfall ranges from around 2,000 mm per year in the north, to approximately 150 mm per year in the Simpson Desert (Final Report of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, 2018).

It is rare to find water features and ecosystems in the landscape that are completely closed systems. Groundwater can discharged to streams, surface water recharges groundwater, groundwater and surface water can feed springs, and the landscape floods most monsoon seasons, blanketing and interconnecting networks of rivers and streams. These water systems can be connected over large regions, such as in the Beetaloo Sub-basin.

For example, highlighted in the Scientific Inquiry into Hydraulic Fracturing final report was how the Daly and Roper river are important groundwater dependent ecosystems. Their flows are sustained by groundwater discharged by the Cambrian Limestone Aquifer. And concerns were raised that although this surface water system, the Roper River, is outside the Beetaloo Sub-basin, this system could be influenced by any shale gas industry in the Beetaloo Subbasin that shares the same groundwater system (Somers submission 377, 2017).

The interconnection of water systems across the landscape and the potential for pollution to travel widely through these systems has been witnessed with the PFAS contamination from the RAAF Base in Katherine. Significant concentrations of PFAS have been found in water samples all the way down Daly River, and down into groundwater aquifers affecting drinking water and town water supplies.

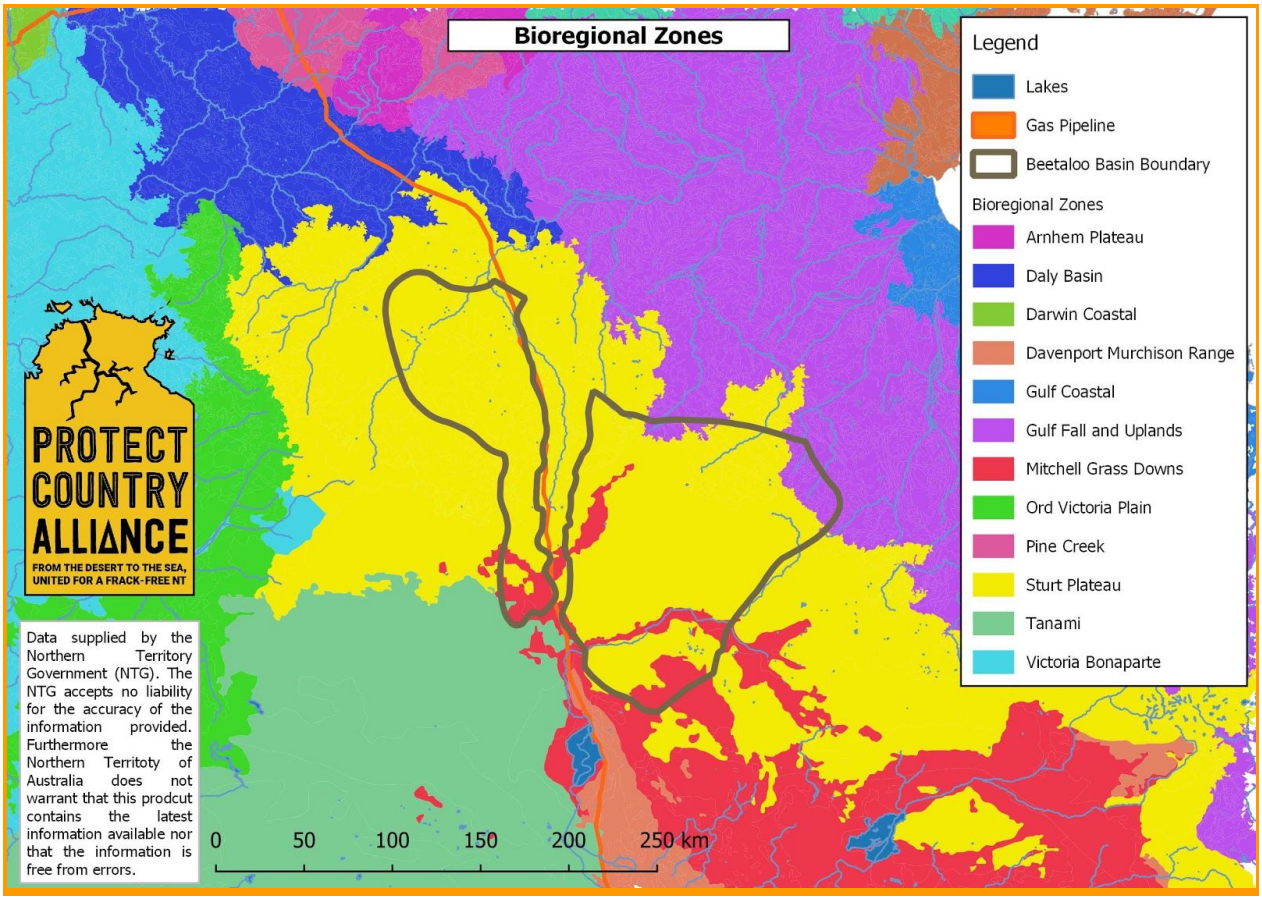
The primary focus of exploratory hydraulic fracturing will firstly occur in the Beetaloo Sub-basin. The Cambrian Limestone Aquifer, the most extensive and highest yielding aquifer in the NT, underlies this region and flows north west toward Mataranka, where the aquifer discharges into

the Roper River. This is supporting significant groundwater dependent ecosystems including those found at Elsey National Park and Red Lily/57 Mile Waterhole. The Velkerri Formation represents the primary unconventional gas target in the Beetaloo Basin, however there is potential and evidence of fluid and hydrocarbon migration to other formations including the Roper Group (Fulton and Knaption, 2015).

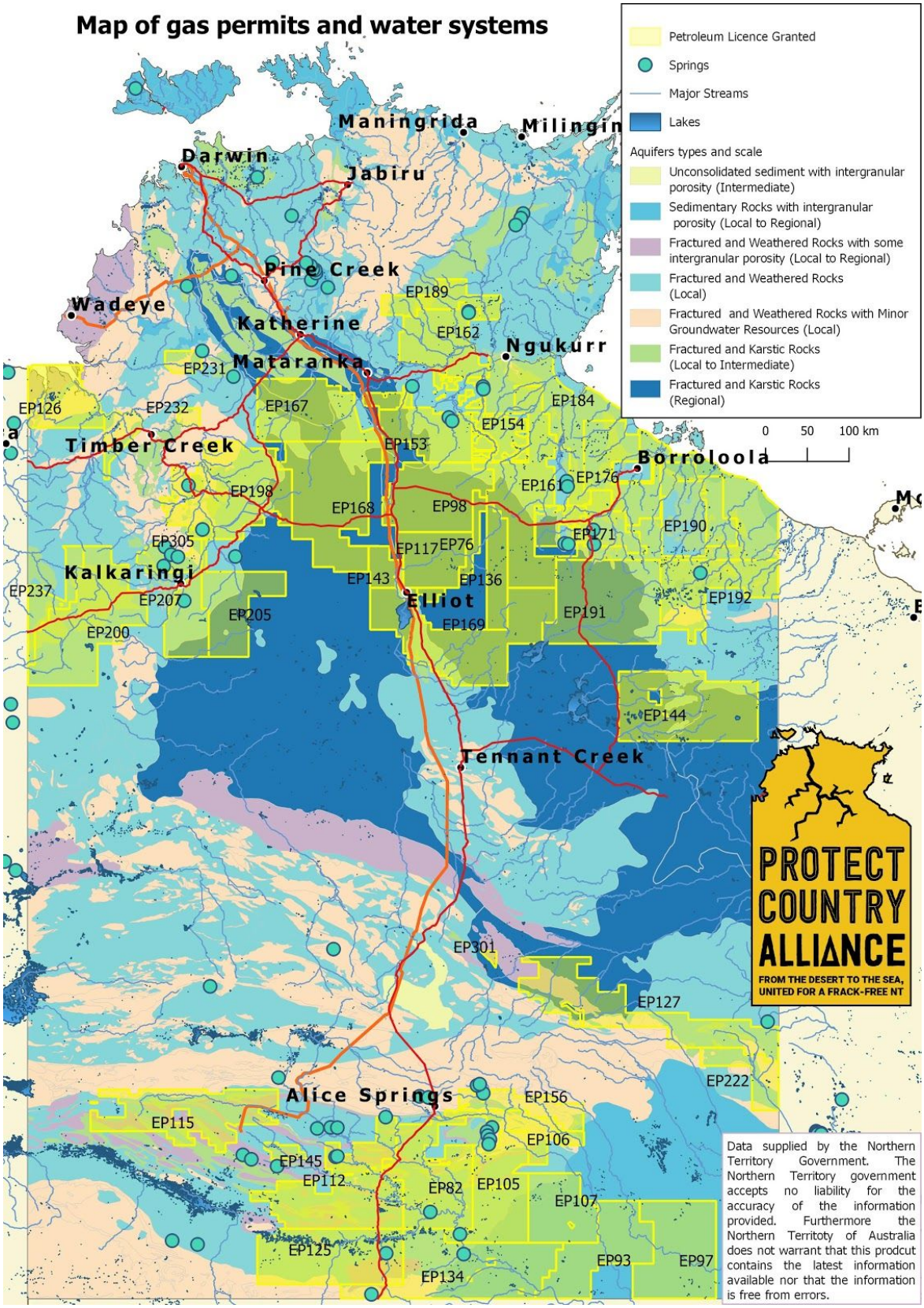
The southern portion of the Beetaloo Sub-basin is part of the larger Sturt Plateau bioregional zone, with an extensive area of surface water draining from the Gulf country and Barkly Tablelands towards the nationally significant  Lake Woods wetlands. Further south in the Sturt Plateau there are a number of small wetlands and lakes associated with the intermittent, land locked drainage systems (Fulton and Knaption, 2015).

Considering the regional nature and interplay of surface and groundwater water systems in the Sturt Plateau, and the presence of sites of conservation significance connected through these water systems, it is essential that more detailed regional assessment of these water systems is undertaken before no go zones can be finalised, and before exploration can commence.

**Map of Sturt Plateau Bioregional Zone**



**MAP of aquifers, streams, lakes, granted exploration**



## Waste Water Management under the Code of Practice and current EMPs

One of the most important recommendations to ensure water and the ecosystems surrounding are kept safe from the harmful and toxic chemicals used for hydraulic fracturing was Recommendation 7.12 outlined “to reduce the risk of contamination of surface aquifers from on-site spills of wastewater” that “enclosed tanks must be used to hold all wastewater”.

However, what has transpired since is a significant alteration of this requirement in the recently released Code of Practice. The Code of Practice now outlines for the management of wastewater, flow back fluid the following:

*C.4.2.2 Mandatory requirements*
*(a) All produced water and flowback fluid must be held in above-ground enclosed tanks at all times following release from the petroleum well other than in the following circumstances:*
*i. it is being treated for reuse or disposal*
*ii. it is being reused as explicitly authorised in an approved wastewater management plan (see Section C.7.1)*
*iii. it is being disposed of as explicitly authorised in an approved waste management plan (see Section C.7.1)*
*iv. it is being removed from site for lawful disposal elsewhere*

These new loopholes are divergent from the Fracking Inquiry’s recommendation, done for convenience, to cut costs, and limit the number of trucks on the road carrying harmful waste. So essentially, there is a huge problem here coming up with a safe solution of dealing with the massive volumes of very toxic flowback fluid generated accompanying hydraulic fracturing. Neither solution, more trucks or open tanks is acceptable.

The NTG have failed to adopt this Recommendation, and a reassessment of the risks needs to be undertaken considering this mitigation measure is no longer in practice. This causes considerable concern of pollution to surface and groundwater, making it even more imperative the interconnection and interplay of water systems is more understood before exploration can commence. It means that areas that are to be declared no go zones need to have an appropriate buffer zone identified to ensure it is safe from the possibility of things such as water pollution and other effects of unconventional gas mining and exploration.

**Risks contained in Origin EMP should be resolved before finalisation of no-go-zones or further exploration approvals are granted.**

On 6 June 2019, Origin Energy received approval to begin civil works under its Environmental Management Plan (EMP) for an exploration frack well at KYALLA 117 N2 on Hayfield cattle station in the Beetaloo basin.

The EMP is for one of the nine exploration wells Origin wants to frack across its permit acreage on cattle stations in the Beetaloo basin, before deciding whether to move to production fracking gasfields with hundreds of gas wells.

Origin is proposing to drill, stimulate and test a petroleum exploration well on the nominated lease area within Exploration Permit 117. This well is anticipated to target the Kyalla Shale.

The full EMP allows for • Drilling of an exploration well; • Hydraulic fracture stimulation of an exploration well; • Completion and workover maintenance of an exploration well; • Well testing of an exploration well; • Well suspension and decommissioning of an exploration well; • Construction and operation of a temporary camp; • Installation of up to two water extraction bores; • Routine maintenance and monitoring activities; and • Any other minor works ancillary of the above.

They are planning to drill down about 2kms and then horizontally for up to 3kms. After drilling the well, the high pressure hydraulic fracturing will start. They use high pressure pumps and create fracking flowback wastewater that comes back up the well when they are finished.


**Figure 13: Amungee NW-1 Well Testing image.**

Origin's draft plan involves storage of at least 6 million litres of this highly polluted fracking waste fluid on site over the Wet season at the Kyalla frack site.

| Wastewater Storage (onsite) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jun | July | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec |
| Mud Sumps Free water | ML | 0.3 | 1.1 | 1.4 | 1.1 | 0.8 | 0.6 | 0.5 | 0.5 | 0.6 | 0.6 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Wastewater Tanks | ML | 0.0 | 0.0 | 0.0 | 5.6 | 5.3 | 5.1 | 5.1 | 5.2 | 5.4 | 5.5 | 5.3 | 5.1 | 5.0 | 4.8 | 4.6 | 4.3 | 4.0 | 3.6 | 0.0 |
| Total Wastewater kept onsite | ML | 0.3 | 1.1 | 1.4 | 6.7 | 6.2 | 5.7 | 5.6 | 5.8 | 6.0 | 6.1 | 5.7 | 5.3 | 5.0 | 4.8 | 4.6 | 4.3 | 4.0 | 3.6 | 0.0 |

The waste-water ponds would be uncovered for evaporation purposes. A temporary soft cover would be utilised only in advance warning of storms. These 'covers' have never been tested for NT weather conditions - this appears to be the first time the product has been used.

In the event of flooding or spills, or if the proposed temporary soft covers failed in a severe weather event, this water could flow downstream towards Elliott and Lake Woods and spread throughout much of the catchment area.

Origin anticipates that a potential load fluid recovery of between 20- 80% of injected stimulation

fluid over the well testing duration. For each of the proposed wells, this may equate to 4-16 million litres of flowback fluid to be recovered.

Flowback fluids will be stored in open-top tanks as much as possible, to maximise evaporation. Where a significant rainfall event is predicted, the total volume of flowback stored on-site will be transferred to the covered storage tanks within 72 hours and prior to the onset of the event.

There are real risks in the Wet season that it will not be possible to transfer the dangerous and toxic fluid in time before a storm. This process increases the risks of spills and flooding throughout the catchment area for Lake Woods.

**The process outlined in the Origin EMP is at odds with the NT Fracking Inquiry recommendation 7.12**. The Inquiry stated that: ***"enclosed tanks must be used to hold all wastewater."***

Below is an image of enclosed tanks from a USA report referenced by the NT Fracking Inquiry in making this recommendation for storage.

IMAGE: Bill Hughes, OVEC/ohvec.org

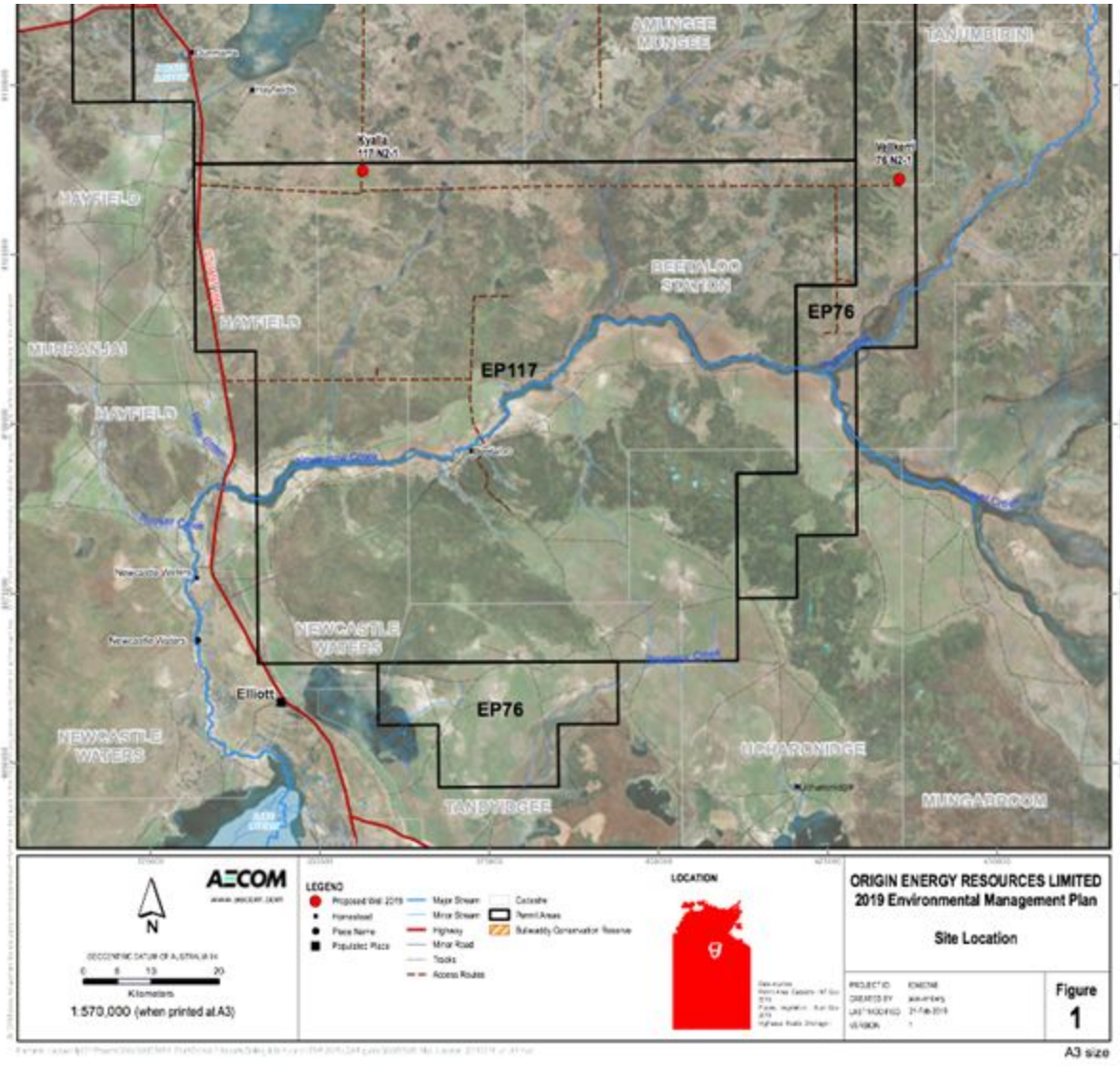
Storage Tanks on Well Pad

In contrast, here is a photo from the Origin EMP of what they are planning. It's not a closed tank, or an open one. It's a series of open-air wastewater dams and a couple of sludge pits/sumps.

**Figure 17: Open top tank configuration example from Amungee NW-1H.**

The EMP says this Kyalla frack well is one well is one of 9 exploration wells planned. Up to 500 wells are planned in the coming years if the drilling program is successful meaning the cumulative impacts of fracking exploration activity would be significant, but has not been considered as part of the current no-go-zones process.

The below map gives an indication of the waterways nearby, that flow into Newcastle Waters and the proposed ‘no-go-zone’ of Lake Woods. Lake Woods is internationally significant area for biodiversity and has critical significance to Traditional Custodians. The left hand red dot is the proposed Kyalla well.




**Chemical risk to Lake Woods catchment area and proposed ‘no-go-zone’ site**

Over the dry and wet seasons, Origin are proposing to have open air wastewater storage for drilling muds and frack fluid flowback. This means that the chemicals will not only be used down the well in the high pressure fracking process, but also will pose a risk at the surface when in open storage as flowback fluid.

Many of the data sheets for the chemicals Origin plans to use are data deficient, stating that there is “no data available”. Some had been accessed by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS), but the assessments by NICNAS are effectively useless. This is because mixtures of drilling or fracking chemicals were not assessed

by NICNAS, only individual active ingredients. This is despite the call by the World Health Organisation and other researchers to assess the cumulative load of chemicals used and what happens to them when they mix in the wastewater from flowback.

Importantly, sublethal toxicity effects of contaminants such as endocrine disruption were not considered nor were the effects of mixtures of contaminants as the ecotoxicological data to do that is not available.

The storage of highly-toxic chemicals and waste byproducts on site are a significant risk for the health of ecologically and culturally significant areas in the Beetaloo basin.

**Significant birdlife habitat occurs in exploration permit areas not protected with no-go-zone status**

Origin has said through their consultant AECOM that the Gouldian Finch is likely to occur in the area of the frack site, plus 9 other nationally listed threatened bird species. Some of the other species include:

Crested Shrike-tit (Falcunculus frontatus whitei), Grey Falcon, Northern Shrike-tit, Painted Honeyeater (Grantiella picta), Grantiella picta Painted Honey Eater - possible, Rostratula australias Australian Painted Snipe - (wet season only).

The limited records are likely due to the fact that there have been no proper Gouldian Finch surveys and limited wildlife surveys undertaken in the Beetaloo basin region.

The Origin EMP has not considered the risk that the Gouldian Finch or any of the other birds who are known to frequent the area. These birds could drink from the open wastewater tanks and drilling mud sumps. This wastewater has been measured at previous Origin sites in the NT to contain traces of BTEX, naturally occurring radioactive materials, plus the cocktail of toxic fracking fluids.

The EMP does not explore the risk to birds from drinking this water. It has been a very dry wet season. This could further exacerbate the risk towards the end of this year as the birds are more desperate for watering sites.

Further studies are needed to determine the impacts on wildlife from proposed ‘go-zones’ for fracking. Also of concern is the proximity of these toxic ponds to areas of international significance for birds. Birdlife International says: Lake Woods supports more than 20,000 and up to 116,000 waterbirds when fully inundated (Jaensch and Bellchambers 1997; Wetlands International, unpublished data provided by R. Jaensch).

- Sixty-seven species of waterbird have been recorded, and 23 of these have bred, in the site (Jaensch and Bellchambers 1997; Australian Wetlands Database 2001).
- Australasian Darters, Little Black Cormorants, Great Egrets, Intermediate Egrets, Straw-necked Ibis and Royal Spoonbills breed in colonies ranging in size from several hundred to several thousand birds (Jaensch and Bellchambers 1997; R. Jaensch pers. comm. 2007).
- The site is the only known inland breeding location, and possibly the only breeding location in the Northern Territory, for Great Egret (R. Jaensch pers. comm. 2007).
- Australian Pelicans (8000), Oriental Pratincoles (6000+) and Little Curlews (700+) have been recorded in substantial but sub-threshold numbers (DEWHA 2007; R. Jaensch pers. comm. 2007).
- Grey Teal (5000), Great Egrets (3000), Intermediate Egrets (2000) and Glossy Ibis (3300) have been recorded in moderate numbers (DEWHA 2007). Small numbers of Freckled Duck (e.g. 35 birds in March 1994) occur and may breed in the IBA (Jaensch 2003b).
- The nationally vulnerable Australian Painted Snipe has been recorded on a single occasion (Jaensch 2003a) but could be more common than the single record indicates, based on the extent of suitable habitat and the high potential for the species to be overlooked by observers (R. Jaensch pers. comm. 2007).
- Yellow Chats are abundant and breed in Lignum shrubland (Jaensch and Bellchambers 1997; DEWHA 2007).
- The globally near threatened Australian Bustard and biome-restricted Yellow-tinted Honeyeater are occasionally recorded in the area (Atlas of Australian Birds database).

## Deficiency in understanding of groundwater and surface water dependent ecosystems

It was stated in the findings of the Scientific Inquiry into Hydraulic Fracturing for the NT, that the Department of Environment and Natural Resources (DENR) suggested that groundwater dependent surface ecosystems are unlikely to occur in the Beetaloo Sub-basin because the groundwater table is generally greater than 30m deep.

However, there has been an unnamed sandstone unit identified in the Georgina Basin above the known Anthony Lagoon formation that is likely to be continuous in the region (seen in yellow in the north south cross-section of Georgina Basin below (Tickell and Bruwer, 2019). The NTG assessment of the Georgina Basin identified the aquifer “encountered in RN039070 from 0 to 207m encountered multiple water intersections with airlift yields up to 15 L/s. The highest yields were towards the lower half of the unit. The bore was cased to 186 m with an open hole in the lower section of the sandstone and the top of the Anthony Lagoon Formation” (Tickell and Bruwer, 2019).

Due to lack of data no further assessment was undertaken in that study (Tickell and Bruwer, 2019). Also it appears from the below cross section that the other formations below have

contact with the surface. Despite this advise form DENR, the Scientific Inquiry into Hydraulic Fracturing panel was unable to identify any “systematic survey to locate groundwater dependent surface ecosystems in this region and that it is possible that some may be present”. Furthermore, it was in the panels view that is that “there is considerable likelihood of groundwater dependent (including stygofauna) or groundwater influenced ecosystems associated with springs, sinkholes, caves and preferential groundwater flow pathways in the Beetaloo Sub-basin.” Such groundwater systems are likely to be susceptible to groundwater depletion and/or possible contamination from hydraulic fracturing activities.

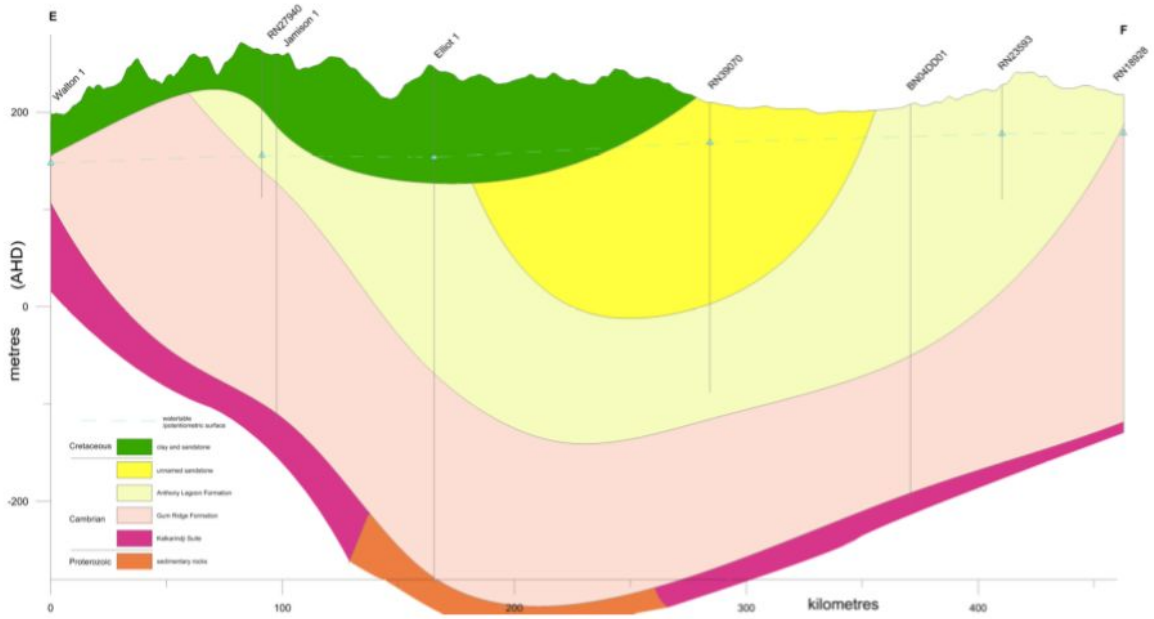


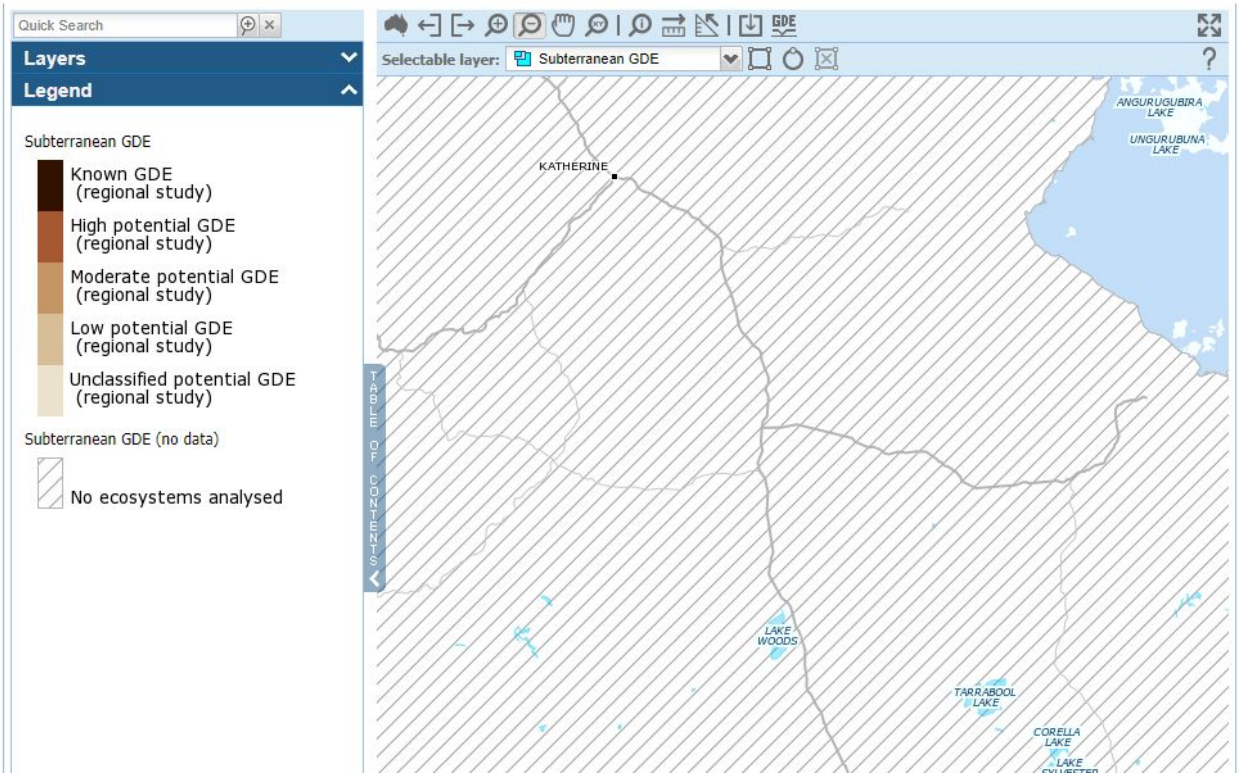

**Figure 5 Georgina Basin north-south cross-section EF**

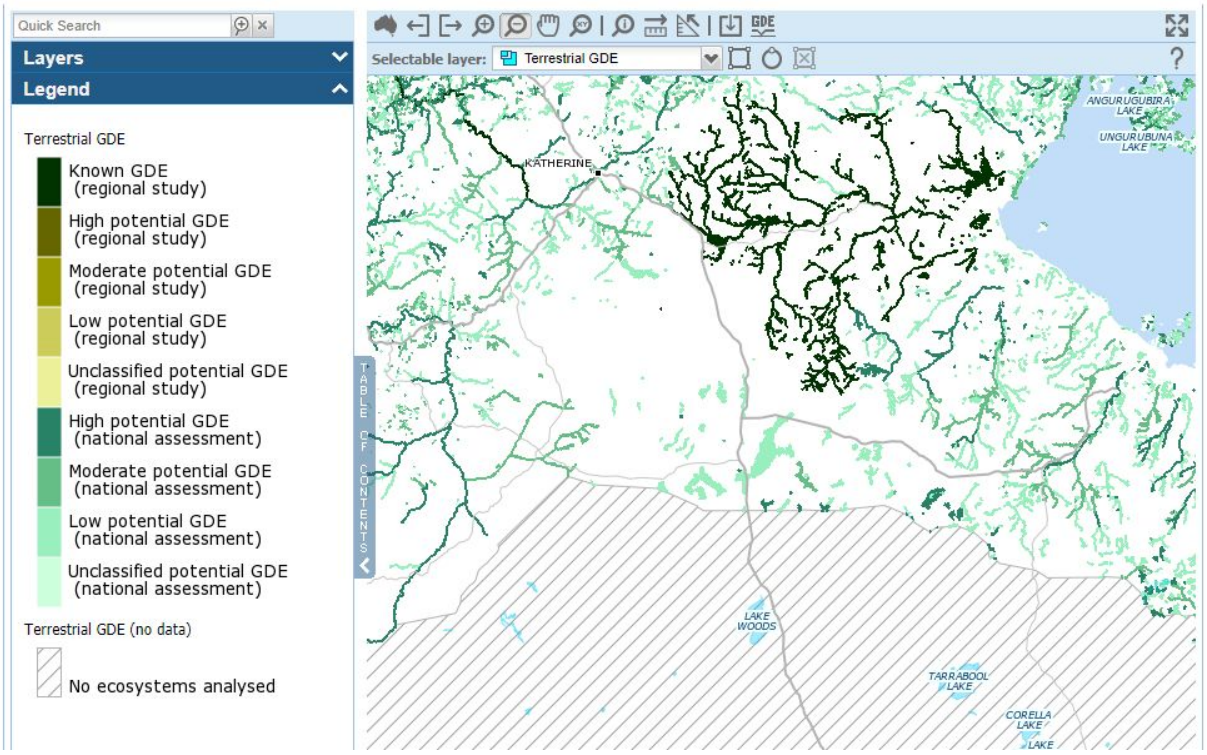
Tickell and Bruwer, 2019

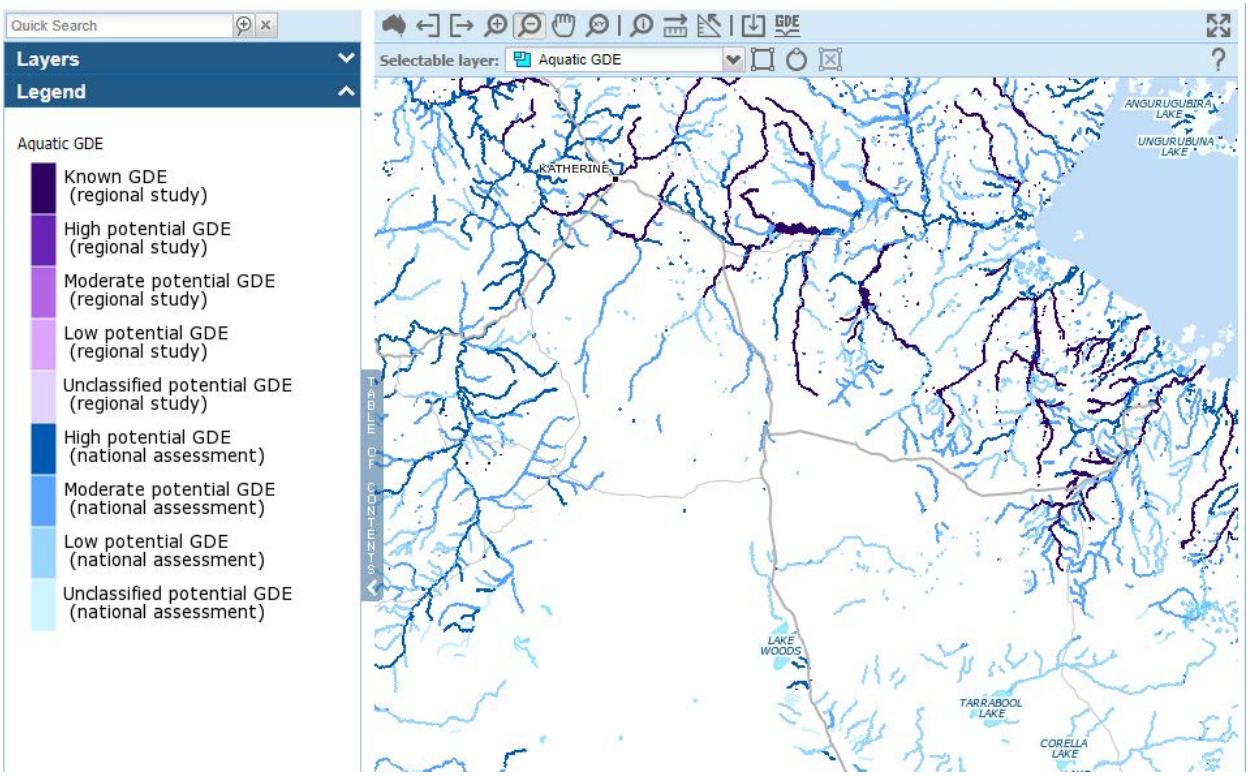
There are known groundwater and surface water dependent ecosystems associated with the groundwater discharging from out of this region through surface and groundwater to significant sites identified as no go zones, namely Mataranka Thermal Pool and Lake Woods. This will be explored in more detail as focus study areas in this submission report.

The Bureau of Meteorology has an online publicly available atlas of groundwater dependent ecosystems. This atlas identifies areas with potential for groundwater dependent ecosystems whether they be subterranean, surface (terrestrial), aquatic. It is a broad assessment. The map images below captured from this atlas shows no assessment at all has been in the Beetaloo Sub-basin subterranean ecosystems, and nor anywhere in the NT. Terrestrial groundwater systems have been assessed in the tropical monsoonal climate regions, but not in the more arid regions and the southern region of the Beetaloo Sub-basin. The atlas shows however that there

is a low to moderate potential from terrestrial groundwater dependent ecosystems in northern section of the Beetaloo Sub-basin.






This Bureau of Meteorology mapping highlights the need for more understanding of the water system in this region and how they interplay, especially with associated known sites of ecological, and cultural significance. We highly recommended a SREBA to understand these

water systems and their dependent ecosystems is undertaken prior to no go zones being finalised and prior to any further exploration activities.

## Biodiversity issues

The distribution of threatened species and critical habitats needs to be known to identify areas of high ecological value and to ensure conservation of biodiversity. It was acknowledged in the Scientific Inquiry that the regions around the Beetaloo basin and many areas of the NT are data deficient in relation to biodiversity and associated aquatic systems, and terrestrial systems.

It is likely that the ancient water systems associated with the spring structures throughout the Beetaloo area and aquifers are going to support vegetation systems that have evolved in these unique spots and are dependent on, or sensitive to, the water flows and the chemistry of that water. Similarly there are almost certainly fauna especially stygofauna that are in the same situation.

The Arid zone in Australia has one of the worst extinction records in the world in relation to small mammals and fracking increases the risk in relation to biodiversity decline. The importance of refuge locations for these species needs to be factored into the No Go Zones process.

Conservation and ecological significant areas should include ‘refugia’, defined as habitats that convey spatial and temporal resistance and/or resilience to biotic communities affected by disturbances (Sedell et al., 1990) or as places or times where the negative effects of disturbance are lower than those in the surrounding area (or time). There is a distinguishing point around time scale in relation to differences between refugia and refuges and whilst the issues with fracking apply to both long term and short term in this we refer mostly to the shorter-term ecological refuges and longer term evolutionary refuges as per Davis et al (2013).

Ecological refuges are vital locations for the conservation management of irruptive dryland mammal species. Local populations of such species outside of refuges appear to go extinct as the landscape dries following each boom period. (Pavey et al 2017).

Aquatic refuges are particularly at risk because fracking is going to remove significant volumes of water from the aquifers that support their water sources and from the potential leakage of methane and chemicals. Ecological refuge aquatic biota is extremely vulnerable to changes in local conditions because population extinction risks cannot be abated by the dispersal of individuals from other sites. Conservation planning must incorporate a high level of protection for aquifers that support refugial sites (Davies et al 2013).

Understanding the role of ecological refuges is an important part of strategies to stem further global biodiversity loss (Reside et al 2017) and protecting these locations is critical to an effective No Go Zone policy. Again it is imperative a SREBA needs occur before exploration to identify these locations and apply appropriate protections.

Efforts need to be made to identify ecological refuges and water dependent systems. This work can be partially done by analysis of existing Satellite and related imagery. There is no evidence of this in the No Go Zone proposal to date. Further work is required.

## Protection of water supplies

Recommendations for identifying the no go zones states to be included are “other areas that have assets of strategic importance to residential areas, such as airports and future town water supplies, will also be declared a reserved block,” and a 2km buffer be applied around these. Considering town water supplies are generally from groundwater, this spatial condition does not seem to relate to protecting water supplies in their entirety. This should be rectified.

The groundwater recharged by surface water associated with the Beetaloo Sub-basin flows northerly towards Daly River Basin and discharges into the Roper Rover too, and has an association with the plentiful Tindall Limestone aquifer. The main fractured and karstic aquifers in the Beetaloo, is high yielding, regional, and extensive.

There is potential to pollute and/or deplete  many remote towns’ and communities’ groundwater. Future town and community water supplies need to be protected per the recommendation.  This would necessitate some analysis of current and future needs from groundwater sources and connectivity to aquifers proposed to be used by the petroleum industry. Not enough is known about connectivity between groundwater and surface water resources making this recommendation almost impossible to implement without a significant SREBA.

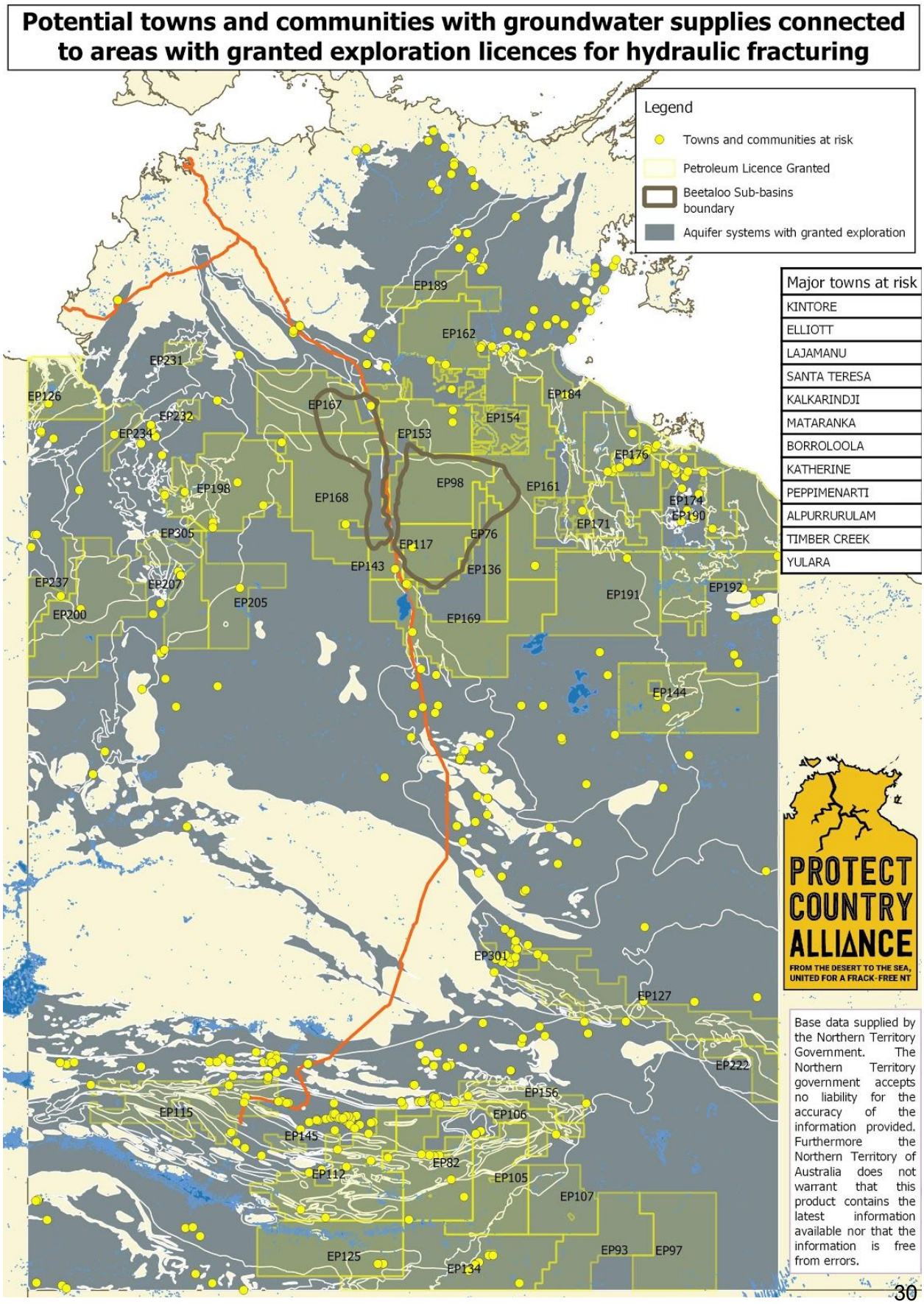
“Potable water supply is precarious in most areas of the NT, and especially for residents of remote Indigenous communities. Under the current legislative framework, there is no right to drinking water in the NT” (Howey and Grealy, 2019). So remote communities, especially Aboriginal communities, are extremely vulnerable in this setting.

A quick spatial analysis is shown in the map below to identify towns and communities with groundwater supplies connected to areas with granted exploration licences for hydraulic fracturing. This was a simple analysis firstly identifying aquifer systems that come into contact with a granted exploration licence area.

You can see the spatial extent of the groundwater supplies that would come into contact with hydraulic fracturing activity is far greater and different than the area that the activity is occuring. Towns and communities were then identified that lay directly over these aquifers systems,

assuming the water supply for these places would primarily be groundwater. This is just a quick overview that would need to be validated and refined, yet it communicates the point that this spatial condition outlined in this recommendation is unlikely to  protect water supplies accessed through groundwater bores from contamination due to hydraulic fracturing across a groundwater system.

375 Aboriginal communities were identified in this preliminary assessment, and the following major towns intersected aquifers that come in to contact with areas with granted exploration licences: Kintore, Elliott, Lajamanu, Santa Teresa, Kalkarindji, Mataranka, Borroloola, Katherine, Peppimenarti, Alpurrurulam, Timber Creek, Yulara, Alice Springs, Kulpitjata, Amoonguna, Hermannsburg, Ngukurr.


Potential towns and communities with groundwater supplies connected to areas with granted exploration licences for hydraulic fracturing
Legend
Towns and communities at risk
Petroleum Licence Granted
Beetaloo Sub-basins boundary
Aquifer systems with granted exploration
Major towns at risk
KINTORE
ELLIOTT
LAJAMANU
SANTA TERESA
KALKARINDJI
MATARANKA
BORROLOOLA
KATHERINE
PEPPIMENARTI
ALPURRURULAM
TIMBER CREEK
YULARA
EP189
EP162
EP231
EP126
EP232
EP234
EP167
EP153
EP154
EP184
EP176
EP198
EP168
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EP97
PROTECT COUNTRY ALLIANCE
FROM THE DESERT TO THE SEA, UNITED FOR A FRACK-FREE NT
Base data supplied by the Northern Territory Government. The Northern Territory government accepts no liability for the accuracy of the information provided. Furthermore the Northern Territory of Australia does not warrant that this product contains the latest information available nor that the information is free from errors.

## Focus study areas for this submission

There are two known sites of conservation significance, Lake Woods and Mataranka Thermal Pools, that have interconnected water system within the Beetaloo Basin. These hydrological systems are where hydraulic fracturing activities are planned.

During the wet season the landscape regularly floods with surface water draining southwest across the Beetaloo Basin, flowing Newcastle Creek to inundate Lake Woods. Lake Woods recharges the network of aquifers that lay beneath the Beetaloo Basin, that flow to the north discharging into the Roper River, and feeding the springs in that region including those connected to the Mataranka Thermal Springs. This is discussed in more detail below.

To fully protect these sites of conservation significance, an extension of the proposed no go zones is recommended. This interconnection of water systems in the region means risks of pollution on the surface or underground, and depletion of groundwater as a result of unconventional gas exploration activities in the Beetaloo Basin will highly likely impact these sites of conservation significance.

Recommendation 7.5 in the Scientific Inquiry into Hydraulic Fracturing stipulates:
*"That before any further production approvals are granted, a regional water assessment be conducted as part of a SREBA for any prospective shale gas basin, commencing with the Beetaloo Sub-basin. The regional assessment should focus on surface and groundwater quality and quantity (recharge and flow), characterisation of surface and groundwater-dependent ecosystems, and the development of a regional groundwater model to assess the effects of proposed water extraction of the onshore shale gas industry on the dynamics and yield of the regional aquifer system."*

It is important to note that the recommendation only requires this level of understanding for production and not exploration, nor for identifying sites of ecological significance that may need to be considered in the proposed petroleum reserves. So, to date this SREBA has not been undertaken.

A plan for implementing the recommendations from the Final Report of The Scientific Inquiry into Hydraulic Fracturing (Final Report) was released on 17 July 2018. The summary of progress on this status made public on the NTG Onshore Gas web page and currently (21/06/2019) states:

*"The Department of Environment and Natural Resources has started developing a regional groundwater model for the Beetaloo Sub-basin, as part of the Strategic Regional Environmental Baseline Assessment (SREBA), to be completed before any production approvals are granted.*

*The groundwater model will be further developed in cooperation with the Commonwealth Government's Geological and Bioregional Assessment of the Beetaloo Sub-basin.*

*The Department of Environment and Natural Resources will undertake similar water assessments of other areas prospective for gas activities as they are identified for potential development."*

We want to reiterate the point that such SREBA studies must be used to not only determine baselines, but to help identify clear areas of hydrological, ecological, cultural and economic connections across these natural systems. This information is required to fully inform a proper regional environmental assessment and determination of no go areas.

## Lake Woods and Newcastle Waters catchment area

*"Since we were very young, we've been taught to look after country and that's what we have always done. Fracking will destroy our country, country that has dreaming stories and important plants and trees that help us survive. One of the areas under threat provides bush medicine that has helped me with kidney problems.*

*The targeted areas have very strong traditional law and companies that want to be there need to have more discussion with traditional owners, especially around our sacred sites. Many of these sacred sites are not publicly known or protected through these no-go areas.*

*The NT government needs to start listening to the people. If they destroy this country, then we have nothing."* Heather Wilson, Elliott region senior Traditional Owner.

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Lake Woods is an international site of conservation significance. It lies immediately west of the Stuart Highway, approximately 7km south of the town of Elliot and only 20km to the southwest of the southern boundary of the Beetaloo Basin. This site of conservation significance is registered with the NTG Department of Environment and Natural Resources and has been used to define the proposed petroleum reserved area to protect this important ecological asset.

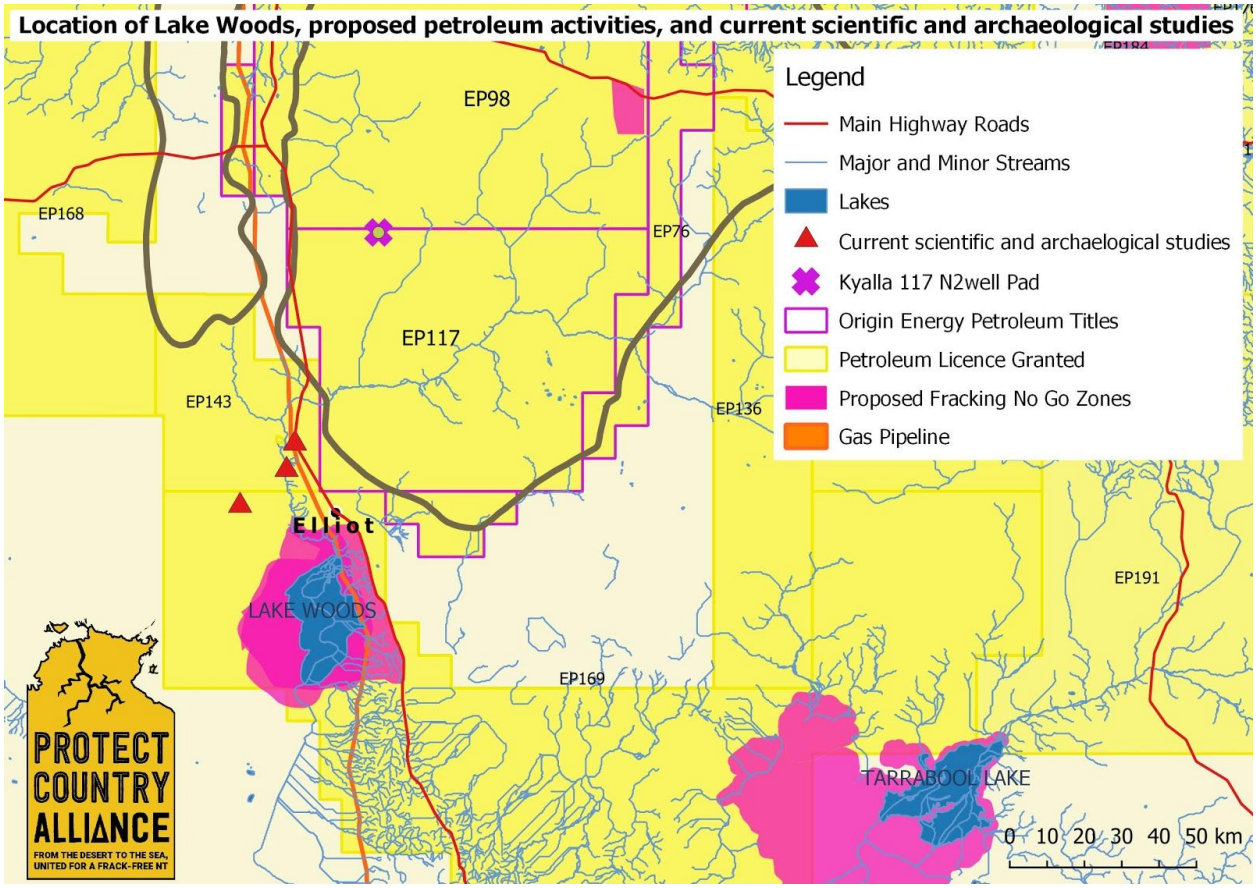
Lake Woods tenure is pastoral leasehold land associated with two pastoral properties. There are currently granted petroleum licences covering and surrounding the site, and Origin have already submitted an Environmental Management Plan to commence exploration activities 80 km to the north north east of the Lake, within drainage lines entering Newcastle Creek, which is the main drainage line entering Lake Woods in the north east.

Surface in-flows from the north east and Newcastle Creek are variable in volume each year from the monsoon systems in the north, but the creek flows and the catchment has large floods that cause partial inundation of the Lake most years. Major floods filling the lake to capacity have occurred at least three times in the past 15 years, in 1993, 2001 and 2006 (NTG, 2019).

The mapping of the proposed no go zones for this consultation has been given no consideration and has overlooked that the current boundary around Lake Woods is  only inclusive of the dry lake-bed extent.

Over the dry and wet seasons, Origin are proposing to have open air wastewater storage for drilling muds and frack fluid flowback at the proposed Kyalla 117 N2 Well Pad site discussed in detail earlier. This means that the chemicals will not only be used down the well in the high pressure fracking process, but could also pose a risk to the landscape and wildlife at the surface when in open storage as flowback fluid.

There are also other large wetlands and lakes of high conservation significance to the east south east also connected to the drainage catchment from Beetaloo Basin and Barkly Tablelands including the Lake Sylvester system, Tarrabool Lake and Eva Downs Swamp (NTG, 2019).




## Ecological, cultural, and historical significance

The four relevant criteria for the classification of the Lake Woods wetlands as nationally important are described by  Environment Australia (2001) as:

- It is a good example of a wetland type occurring within a biogeographic region in Australia.
- It is a wetland, which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex.
- It is a wetland, which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail.
- The wetland supports 1% or more of the national population of any native plant or animal taxa.

Lake Woods has not had any formal assessment but is likely to meet at least five of the criteria for listing as a Wetland of International Importance under the Ramsar Convention, including Criterion (NTG, 2019):

- Rare or unique example of a wetland type;
- Supports threatened species or communities;
- Provides refuge or supports a critical life-cycle stage for important species;
- Important wildlife aggregation site with >20,000 waterbirds; and
- Criterion 6: regularly supports >1% of the individuals in a population.

Lake Woods is listed as a wetland of national significance in the Directory of Important Wetlands in Australia (NTG, 2019).

There are times in the past that Lake Woods was much larger than present, indicated by the presence of old shoreline ridges. The historical spatial expanse of Lake Woods contains much historical and cultural evidence, and is highly valuable for scientific, archaeological, and climatic studies (CABAH, 2019). Investigations are presently underway outside the extent of the proposed no go zones around Lake Woods by the Centre of Excellence for Australian Biodiversity and Heritage (CABAH) and archaeological investigations (as seen in the map above).

According to the Heritage Branch of the NT, the Lake Woods study area appears to have had minimal archaeological surveys conducted around it (CABAH, 2019).

Mike Smith an archaeologist conducting surveys in 1986 suggested that ‘a freshwater lake the size of the Pleistocene Lake Woods would certainly attract people to its shores’ (CABAH, 2019). New artifacts were identified and sites submitted for listing in a renaissance visit with traditional owners was undertaken in September 2018, before in recent surveys in May 2019 were undertaken (CABAH, 2019).

Studies being conducted during archeological digs in 2019 indicate that potentially thousands of undocumented heritage sites are located within the catchment of Lake Woods. The potential archaeological significance of the Lake Woods system, and associated lakes in the Barkly region need to be more considered and significant buffer zone needs to be applied to the

current no go zones to ensure they have little disturbance, and are accessible for further cultural and heritage studies.

Traditional Owners and Aboriginal communities living near Lake Woods and the interconnected waters of Newcastle Waters place an enormous value on these water systems. These areas have been integral to culture, life and connection for many generations. The current proposed no go boundary around just the dry lake bed extent of Lake Woods is completely inadequate to protect the numerous and varied values of the lake and surrounding region.

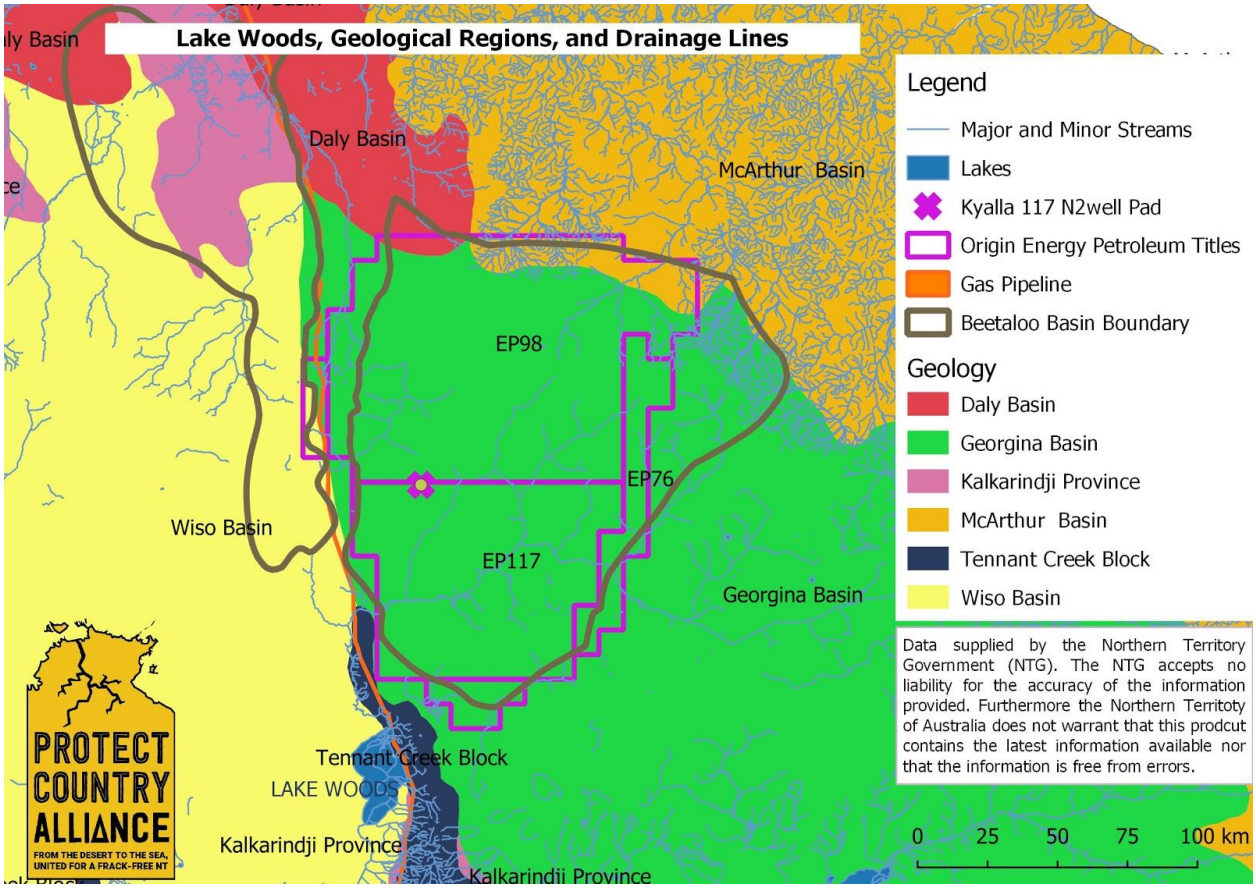
*"Our communities are concerned about the impact that water extraction for gas fracking could have on our sacred sites and culture. Taking too much water out of the underground for drilling could dry up our soaks, springs and rivers that rely on underground water for their flow. If too much water is drained out our plants, medicine, animals and people would suffer.*

*With climate change the heat will continue for longer, drying up our surface water, and low rainfall means our underground water won't fill up as fast.We don't think these risks have been properly considered in the NT Government's no go zones."* Shannon Dixon, Mudburra/Jingulu Traditional Owner, Marlinja 2019.

## Significance of Land and Waterways Connected to Lake Woods

A present study of  Lake Woods suggests it is not a hydrologically closed system. The catchment includes several major geological provinces, the Tomkinson Province making up the Ashburton Range, as well as the Wiso, Georgina and Carpentaria basins (McArthur River) (Caritat et al, 2019).

The Lake is predominantly recharged by surface water flow from Newcastle Waters Creek following monsoonal rainfall, with subordinate replenishment of lake waters via runoff from numerous small creeks draining the rocky slopes of the Ashburton Range (Caritat et al, 2019). Hydrographs of Newcastle Creek indicate regular flooding by several metres at the end of a west season, draining off the Barkly Tablelands, an area approximately 19000km², or some say greater than 20,000 km². Which of this drainage area directly contributes to Lake Woods is unknown (Caritat et al, 2019).




Importantly, in turn, Lake Woods recharges underlying aquifers, particularly the porous Cambrian Montejinni Limestone of the Wiso Basin, but also to the west extensively in the Georgina Basin, interacting mostly with Anthony Lagoon formation aquifers. Lakes Woods, Tarrabool and Sylvester and other small seasonal lakes in this region are all ‘losing waterbodies’ whereby lake water is lost to the underlying groundwater systems rather than being recharged by it. In comparison, in more arid parts of Australia, the opposite is usual, with groundwater typically discharging to salt lakes (Caritat et al, 2019).

The limestone aquifers in the Wiso flow towards the northwest from Lake Woods and are likely to have correlation with the groundwater in the Cambrian Tindall Limestone of the Daly River Basin (Caritat et al, 2019). There is a level of uncertainty regarding Anthony Lagoon Formation aquifers, their connectivity, and therefore extent, so the groundwater systems can only be treated collectively as though they are a single entity (Tickell and Bruwer, 2019). The aquifers of the Anthony Lagoon Formations overlay the fractured and karstic aquifers of the Gum Ridge formation. It is unclear if there connectivity between the aquifers in the Gum Ridge and Anthony Lagoon formations, but some tests aimed at determining this suggests it is likely and possible these aquifers interact but would be dependent on weathering and depth conditions, and should be tested and assessed on a site-by-site basis (Tickell and Bruwer, 2019).

The Anthony Lagoon Formation does not extend northwards into the Daly Basin as the Gum Ridge Formation does, however observations suggests connection between the two aquifers because there is the lack of groundwater discharge features observed within the Basin. That infers that groundwater from the Anthony Lagoon Formation passes into Gum Ridge Formation to ultimately discharging into the Roper River at Mataranka (Tickell and Bruwer, 2019).

A possible mechanism for the connection may be that the siltstone beds are locally fractured enough to form pathways for leakage between the aquifers (Tickell and Bruwer, 2019). Groundwater is accessed for irrigation in the Beetaloo Basin from both formations. The groundwater in both formations flows north east.

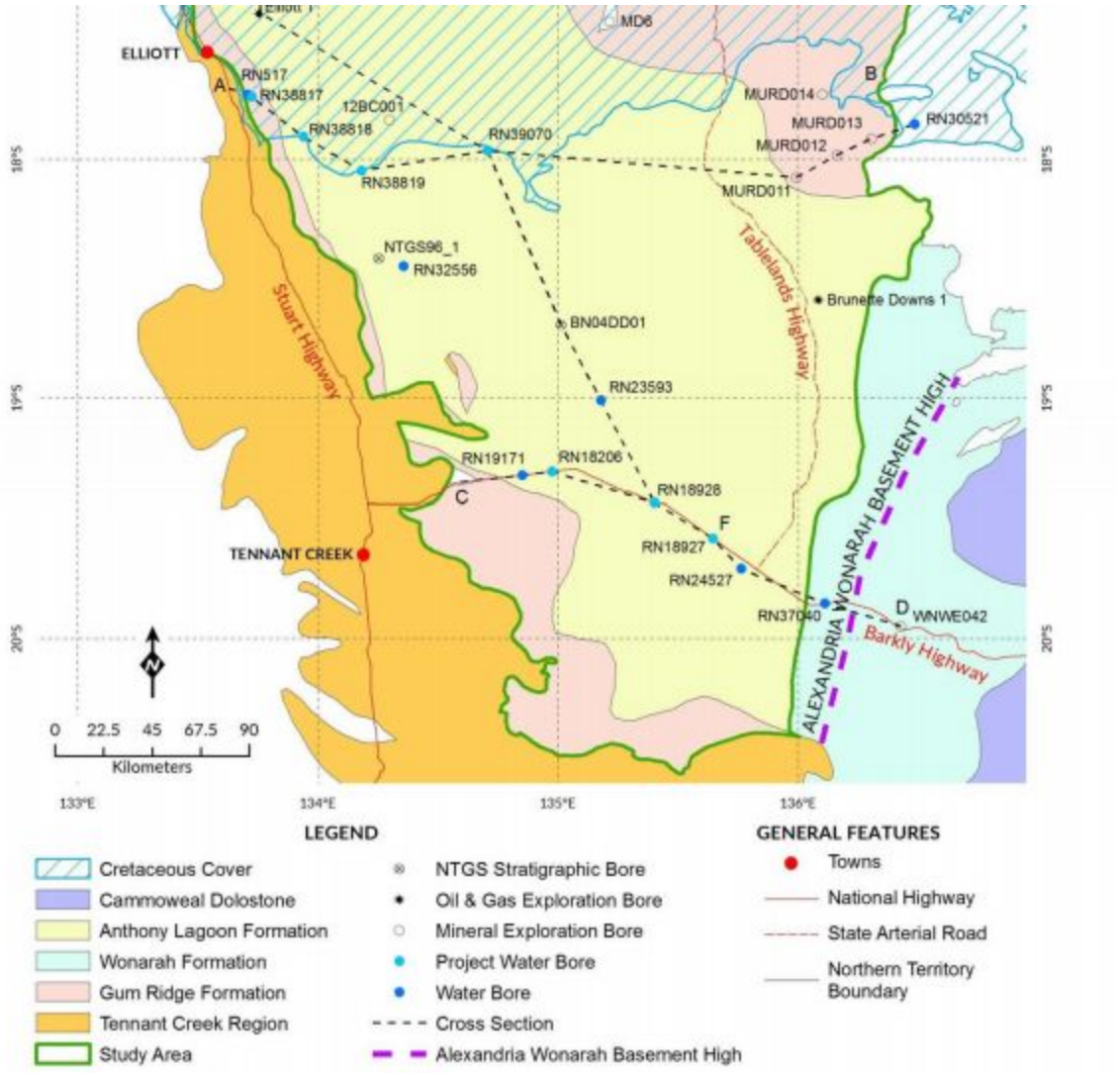



**Figure 2 Interpretative geology and cross-section locations**

*From: Tinkell and Bruwer, 2019*

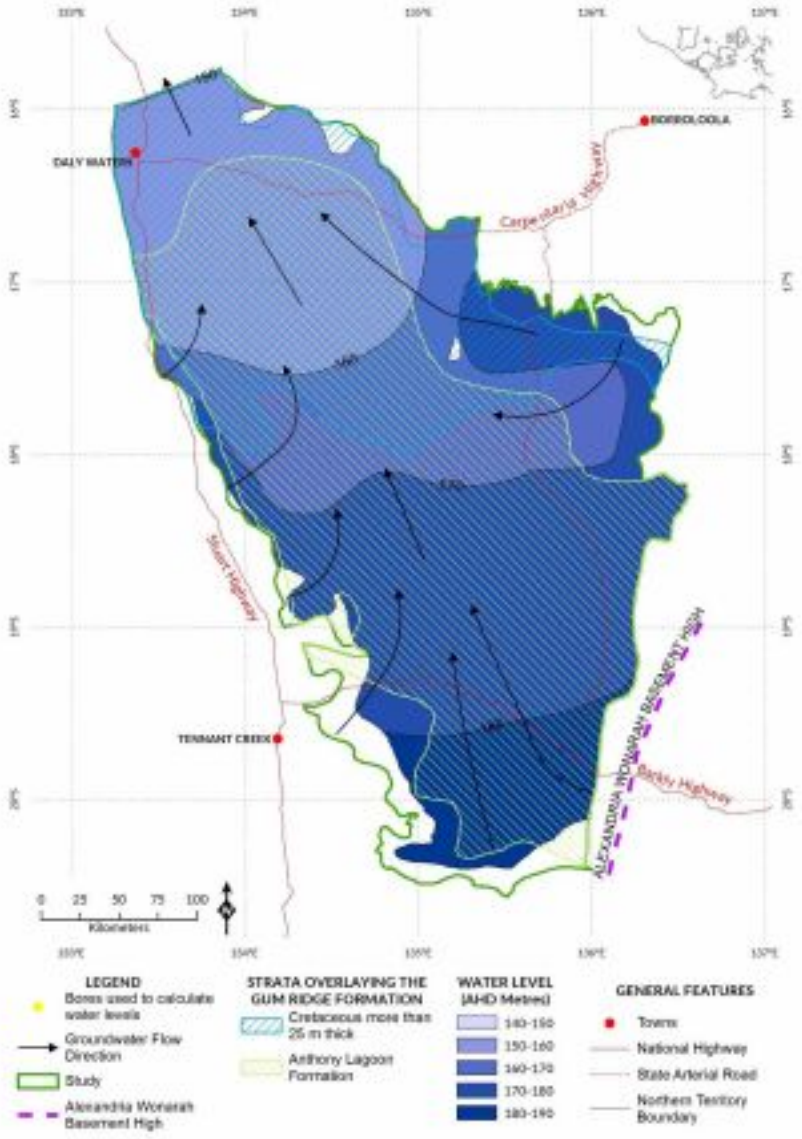



**Figure 13** **Regional groundwater level contours in the Gum Ridge Formation**

*From: Tickell and Bruwer, 2019*

## Proposed extension of proposed No Go Zones for this site

To have any scientific credibility the no go zones around Lake Woods needs to be enlarged to reflect the seasonal maximum (not the dry lake-bed extent) of Lake Woods to ensure no direct disturbance occurs.

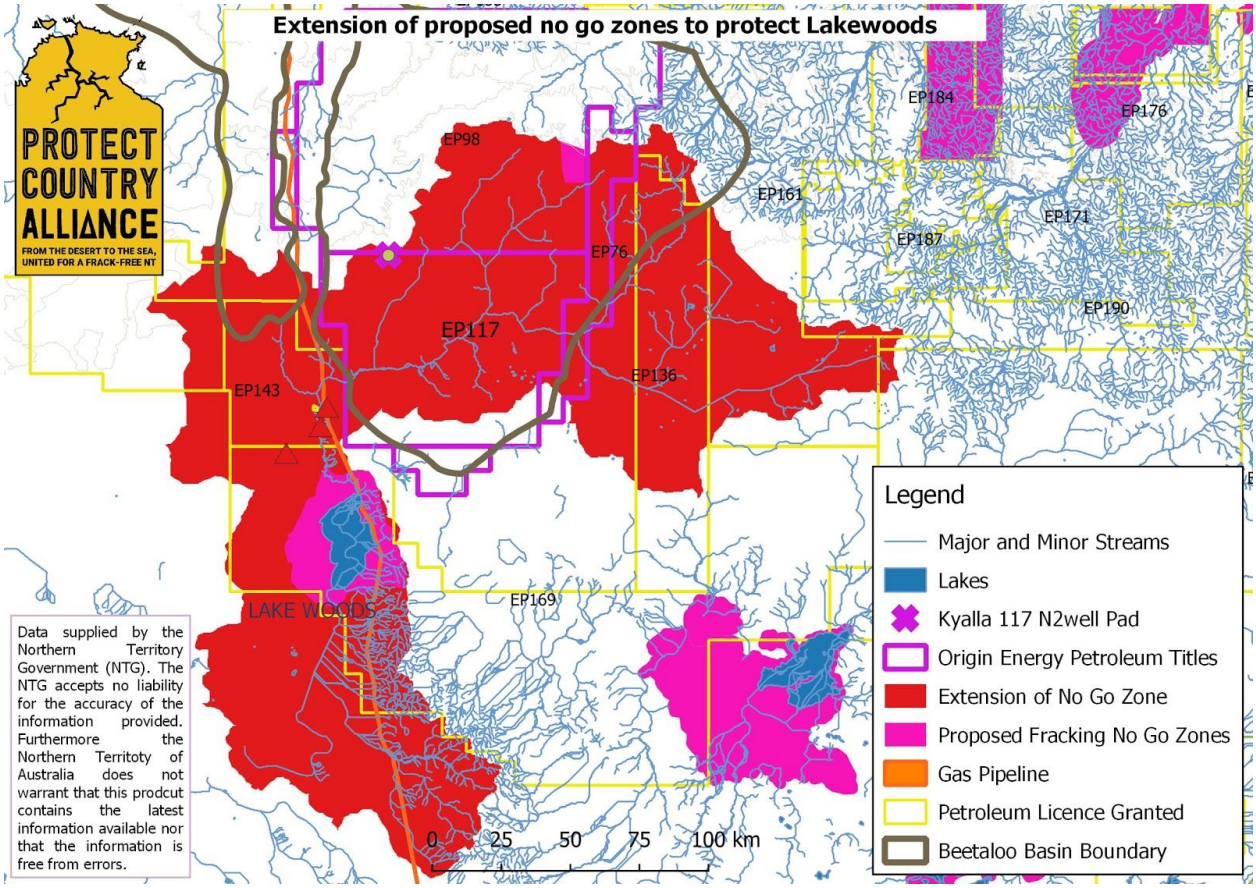
Also the surrounding scientific and archaeological interests must be considered with Traditional Owners and scientists before any decisions on proposed no-go zones can be made.

To ensure Lake Woods is not polluted, the surface water catchment needs to be considered to protect the waters entering Lake Woods. The potential catchment area for Lake Woods is much larger and includes regions across the Beetaloo Basin.

It is uncertain which areas in this catchment contribute to surface water flows entering Lake Woods, and needs to be determined before Origin exploration commences and hydraulic fracturing is undertaken on EP117 with the Kyalla 117 N2 Well Pad site, with potential toxic waste fluid being managed onsite on the surface with and open air system.

Associate Professor Tim Cohen ( School of Earth, Atmospheric and Life Sciences in the Faculty of Science, Medicine, and Health) from the University of Wollongong in NSW is currently undertaking research at Lake Woods. He has suggested a greater understanding of the active surface water catchment for Lake Woods could be done through a spatial analysis of rainfall to Lake Woods, taking into consideration a number of years.

It is essential there is more understanding of this surface water system before any risky unconventional gas exploration commences, especially in areas where surface water undoubtedly is draining into Newcastle Creek. This requires a review of the entire Beetaloo Basin, and all exiting granted exploration licence areas and how associated surface drainage interacts with Lake Woods.




As a matter of urgency the close proximity of the proposed Kyalla Well  Pad on EP117 to Newcastle Creek that flows to fill Lake Woods needs to be investigated, as it lies within the proposed minimum extension of the proposed no go zone designed to protect the Lake Woods

and Newcastle Creek catchment.


Furthermore, an even larger no go zone could be considered through further research and spatial analysis to connect the essential no go zones protecting Lake Woods to the adjacent lakes and wetlands systems to the east.

## Mataranka Springs

*“The springs at Mataranka are very important to us. Their waters are the lifeblood of our region, and the basis of our culture and survival until now. But they also support the farms, the cattle stations, fishing and all the tourism in this area.*

*If anything damaged the springs we would all have to move away, all the towns, the people and our culture would be finished.”* Shelia Conway, senior Mangarrayi/Yungman Traditional Owner, 2019.

The Mataranka springs are of National Significance, situated 110kms south of Katherine, with large volumes of warm water rising from groundwater reserves and held in pools fringed by paperbark and palm forest. This site includes parts of the headwaters of the Roper River (to the junction with Salt Creek), and the numerous thermal spring-fed pools and connecting channels (Roper Creek and the Waterhouse River) (NTG, 2019).

Water researchers in the Northern Territory have long recognised the area to the south of Mataranka as the groundwater recharge zone for the Roper River and the Bitter Springs region.

Simon Fulton and Anthony Knapton (2015) explore the connects across the Beetaloo region to the recharge of the springs and the Roper. They state:

> *The Beetaloo Basin straddles the basement divide that separates regional groundwater flow systems in the Georgina and Wiso Basins. Groundwater flow in the Georgina Basin emanates approximately 300 km south: east of the Beetaloo Basin where a major flow divide occurs in the Cambrian Limestone Aquifer. Groundwater south-east of this divide flows toward discharge points in the Lawn Hill Creek and the Gregory River in Queensland. Groundwater north-west of the divide flows through the Beetaloo Basin and discharges in the Roper River region. Recharge to the CLA forms a local flow component where the aquifer outcrops along the flanks of the Ashburton Ranges. The regional flow direction within the Beetaloo Basin is to the north-west. Gradients in the CLA are flat-lying averaging around 10 m per 100 km (gradient of 0.0001) and flow rates are in the order of metres/year (Tickell, 2003).*
>
> *Groundwater flow emerges from the CLA in the Roper River 100 km north-west of the Beetaloo Basin and provides a major flow component of spring discharge in the Roper River between Matarkanka and Elsey National Park. The majority of groundwater flow in this area of the CLA originates from sinkhole recharge on the Sturt Plateau with throughflow from the Wiso Basin and the Georgina Basin only providing a small flow component (Yin Foo, 2002). Regional groundwater flow in the Wiso Basin is directed toward major discharge points in the Flora and Roper Rivers.*
>
> *Regionally, groundwater in the CLA flows toward Mataranka, located 100 km north:west of the Beetaloo Basin, where the aquifer discharges into the Roper River and supports significant groundwater dependent ecosystems. Dry season flow in the Roper River has been gauged at between 95 000 – 126 000 ML/yr and provides an estimate of the magnitude groundwater discharge from the CLA. Spring discharge in this area is supported by contributing groundwater flow from both the Daly and Georgina basins. Large decadal changes in the discharge to the Roper River suggests that most recharge input occurs close to the discharge zone (i.e. beyond the Beetaloo Basin region). Groundwater recharge mechanisms to the CLA are poorly characterised but are likely to be dominated by indirect recharge through sinkholes and preferential recharge through macro:pores (soil cavities). Recharge to the CLA through outcropping limestone in the Georgina Basin is estimated at between 20 000 – 40 000 ML/year.*

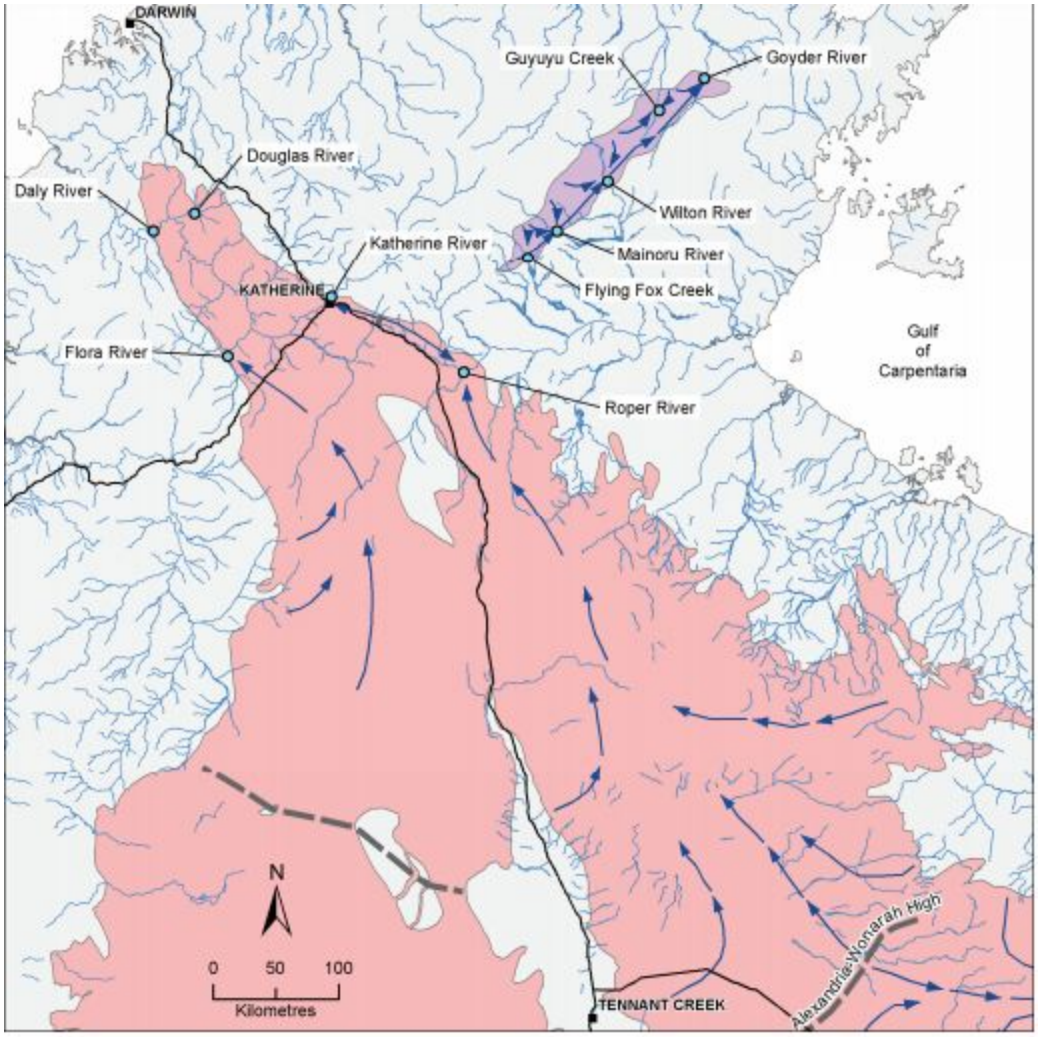



**Figure 8** **Regional groundwater flow in the Cambrian Limestone aquifer and Dook Creek Formation modified from Tickell (2003).**

Map is retrieved from: https://frackinginquiry.nt.gov.au/submission-library?a=433245

CSIRO outlines the data gaps that exist around understanding the groundwater systems of the area. They state: *The Mataranka Thermal Pools are fed by perennial groundwater springs in the upper reaches of the Roper River. However, there is currently not enough confidence in existing groundwater models to report results under different scenarios. In addition, the confidence levels for both high flows and low flows for the asset within the Roper region are ranked unreliable and therefore are insufficient to allow environmental flow metrics to be calculated* (CSIRO, 2009).

### Protecting the Land and Waterways Connected to Mataranka

The current approach by the NTG to just put the geographical extent of the Mataranka Springs water body and little surrounding National Park in a reserve area ignores the reality of the water interconnection across far reaching areas.

Some scientists have discussed the need for a buffer zone of up to 100km from the Mataranka springs in the groundwater recharge zone. This no go zone for fracking would act as an additional safeguard against pollution to prevent chemicals making their way into the springs. This would help to ensure surface spills and groundwater pollution cannot inadvertently travel to the springs at a rate that would cause a short to medium term pollution event at the springs or in the Roper River.

A reserve block that adequately protects the groundwater system that feeds the Mataranka Springs requires far more investigation. More research is required to understand volumes and time scales over which groundwater flows from specific regions across the recharge zone for the Springs.

## The entire NT needs further assessment

SREBAs need to be completed, appropriate buffer zones identified and further spatial analysis undertaken before areas of land to be declared petroleum reserves can be finalised. For now, to be safe, the precautionary principle and Ecologically Sustainable Development (ESD) should be enacted to ensure this critical work can be undertaken prior to any further exploration activities.

This submission only explored through a desktop analysis a little more detail on some matters. There is still a huge amount of uncertainty throughout the NT on how to best make sure areas with high tourism, cultural and ecological value are protected with appropriate buffers zones applied, and catchments identified for surface water and groundwater dependent ecosystems.

The map below shows the proposed no go zones presented in this consultation and the preliminary assessment of other areas that need to be considered as no go zones discussed in this submission. This have been overlaid with the current exploration granted licence areas.

Spatial analysis of the granted petroleum exploration licences, the proposed no go zones provided for this consultation, and the preliminary proposed extension of no go zones discussed in this submission show that out of the current 117 Petroleum Exploration Licences that have been granted in the Northern Territory, 112 of these licence areas come into contact with these preliminary extended no go zone areas. Some licences it is just a small proportion that intersect with these no go zones. In the Beetaloo Sub-basin where there are currently 30 granted

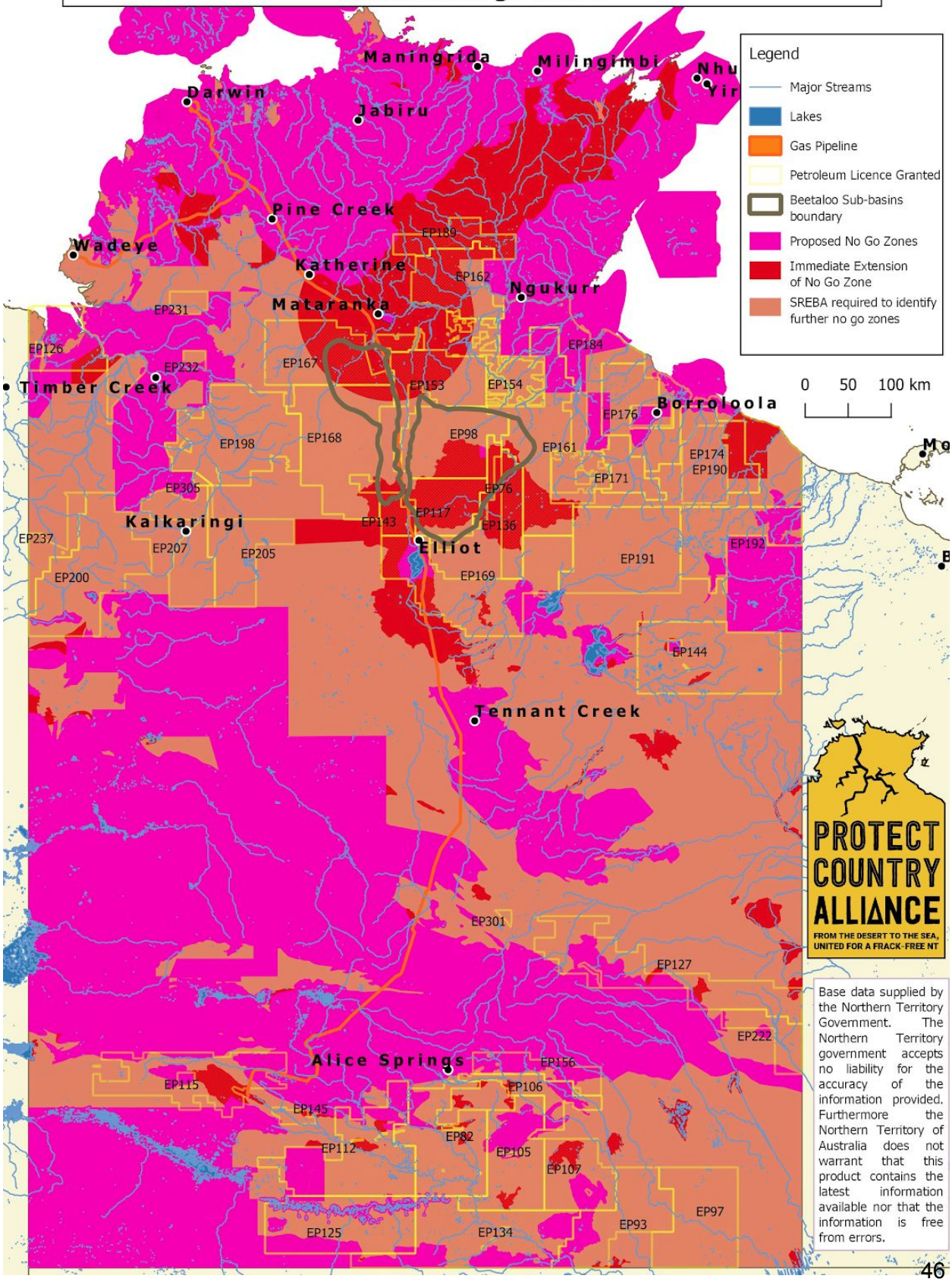
exploration licences, all intersecting with the proposed and extension of no go zones identified in this report. Our preliminary maps are yet to consider a swathe of further information that must be considered by various critical stakeholders.

It is unclear if unconventional gas exploration will commence before full assessment of the no go zones is undertaken post this consultation period, but considering the preliminary assessment and this analysis much of the proposed exploration activities needs to be reassessed.

No development of exploration areas should have been allowed to commence until proper no go zones, based on a deep and thorough assessment, have been established. Considering the significance of this matter, it is concerning that we are hearing reports that the NTG had not done any work on the proposed no go zones since their first exhibition when the moratorium was lifted almost a year ago. Consultation could have started then. It is critical that it happens now and into the future, in a genuine and detailed way, not what has been proposed through the process to date.

Not having deep analysis on which to base petroleum reserve decisions is a major oversight, and risks significant areas in our environment. It may also pose a risk economically if later on if the industry progresses to production, it is found that more and more areas should have been declared no go zones due to the critical natural and cultural significance of the sites. A region's capacity to provide sustainable economic returns and livelihoods for local people may be damaged by fracking, when it could have been protected in a reserve block.

## Map displaying suggested further processing of ares to be declared no go zones



## Further considerations required to identify areas to be declared no go zones

The mapped proposed no go zones for unconventional gas exploration and mining are extremely deficient in capturing this recommendation in its entirety. Therefore it is only reasonable to keep the question of reserve blocks open for consultation until an acceptable consultation and mapping process has been enacted by the NTG.

There is much further spatial analysis and research that can be done to inform this process within reasonable time. Some other areas that need to be explored, and not limited to, area protection of water supplies and residential areas, landscapes of cultural significance, distribution of threatened species and critical habitat, and some guidance and processes to determine appropriate buffer zones, as per Recommendation 14.4.

## Appropriate buffer zones

As mentioned previously Recommendation 14.4 outlines that an appropriate buffer zone be applied to areas to be declared no go zones. There is little discussion in the Scientific Inquiry of what is meant by this, and if it is to be applied in all instances.

However, in the Petroleum Act  section 15(4) it states: “The minister administering the Territory Parks and Wildlife Conservation Act 1996 may require the Minister to give directions under subsection (3) such directions in relation to the protection of the environment in the park or reserve as the minister thinks fit, and the Minister shall give those directions accordingly.” Subsection 3 includes that this Minister can also exclude exploration and production activities to protect a national park or reserve “in or in the vicinity of the park or reserve”.

It is highly recommended that the Minister administering the Territory Parks and Wildlife Conservation Act 1996 review parks and reserves such as Lake Woods and Mataranka Thermal Pools and considers appropriate buffer zones, or extension of proposed no go zones to protect these areas from water pollution and or depletion of groundwater potentially associated with hydraulic fracturing.

# Understanding of implementation of SREBA and development of no go zones

In the findings of the Scientific Inquiry into Hydraulic Fracturing, the panel very adamantly decided that the timing of the SREBA would not have to occur before any commencement of exploration, as well as not being required to inform the identification of no go zones.

This decision ignored widespread concern from submission that a SREBA would be most effective and essential prior to any commencement of exploration due to the similar risks existing for hydraulic fracturing during exploration, as there would be in production. And exploration activity may occur in areas that a SREBA may subsequently identify as inappropriate for any shale gas activity, for example, a no go zone.

The panel did not reconsider their original position with a number of justifications. This panel calculated the footprint associated with exploration in the Beetaloo Sub-basin is unlikely to have significant regional impact for three to five years, which is the same time it would take to complete a SREBA for the Beetaloo Sub-basin. And the approval process, including the submission of an EMP before any drilling can commence would take care of any environmental concerns. The panel also correlated exploration activities as symbiotic with the SREBA processes, providing essential hydrogeological and groundwater data along the way.

However, there were some elements of the SREBA that were identified as needing to commence immediately and/or be completed before exploration. A development timeline was developed for implementation of the SREBA seen in the table below.

**Table 15.1:** Development timeline and SREBA Implementation.

| Stage[1] | Description[2] | Number of wells/size of development | Timeframe for SREBA component to be completed |
|---|---|---|---|
| Exploration | 2-5 years | Small number of widely spaced wells to investigate and confirm lateral extent of any onshore shale gas resource. | Prior to the grant of any further exploration approvals<br>• baseline acquisition of methane concentrations to be undertaken for a six month period (***Recommendation 9.3***);<br>• local groundwater quality data to be acquired using multi-level wells installed adjacent to, and six months prior to the drilling of, any new shale gas exploration wells, (***Recommendation 7.11***); and<br>• other elements of SREBA commence, including: regional surface and groundwater studies (***Recommendation 7.5***); terrestrial bioassessments (***Recommendations 8.2***, ***8.4***, ***8.5***, and ***8.6***); aquatic biodiversity assessments (Section 15.3.2); and social (***Recommendation 12.13***), cultural (***Recommendation 11.8***) and human health (Section 15.3.5) baseline studies. |
| Appraisal | 1 year | Increased number (small) of wells to prove the technical viability of the extraction technology in the target shale formation. | Prior to the grant of any production approvals:<br>• the bulk of the data acquisition required by a SREBA must be completed by the end of appraisal;<br>• key SREBA elements (for example, sustainable yield of groundwater; ***Recommendation 7.16***) must be completed by the end of the delineation phase because the results could have major implications for the location and scale of any onshore shale gas industry and could impact upon the commercial decision to proceed to production; and<br>• full social, cultural, environmental and human health risk assessments must be completed prior to commercial production commencing. These assessments can only be finalised at this late stage because the scale and location(s) of any development will not have been known earlier. |
| Delineation | 2 years | Several multi-well pads constructed to assess economic viability of any commercial scale production. Could potentially produce a marketable quantity of gas. | |
| Commercial production | 6-10 years | Staged construction of successive multi-well pads, increasing to required scale for commercial production. | |

1 These descriptions are consistent with accepted gas industry terminology.
2 Theses are indicative only but are based on information provided to the Panel by the gas industry.

It has been exhibited many times through this submission the need for more detailed regional analysis before exploration can be planned, and appropriate land can be identified to become petroleum reserves. We are concerned that the Recommendations and the consultation paper for declaring areas of land to be made petroleum reserves has very carefully restricted these considerations. They became simply about whether an exploration or production tenement can be granted right at that spot, not about possible upstream/downstream/off site contamination issues and interconnectivity.

Nothing takes place in a vacuum. The push forward into exploration without a SREBA could jeopardise our natural resource assets and the water we depend on. The more detailed assessment in this submission given to identify areas that need to be excluded from the impacts of unconventional gas exploration already indicates the criteria of these proposed areas cannot be achieved without a SREBA.

## Declaring the entire NT a no go zone through ESD and the Precautionary Principle

Ecologically Sustainable Development requires integrated thinking. This means areas to be declared a no go zone cannot focus on a location without considering this interconnectedness.

This is especially important in relation to Arid areas, ecological refuges, aquifers and culturally important of water. This cannot be achieved without a SREBA. No go zones should be extended to cover all areas that are a recharge area or catchment for water dependent systems.

No Go Zones are there to protect places of conservation significance because hydraulic fracturing can't guarantee there will be no risk of contaminating water, regardless of the severity or likelihood of that risk. If the NTG is serious about protecting these highly significant areas, and pollution and depletion of water is a risk, then the whole catchment needs to be considered to truly fulfill this responsibility.

ESD principles include inter and intramural generational equity and this includes notions of social licence as well as economic and wellbeing. The core principle of intergenerational equity to ensure that development meets the needs of the present without compromising the ability of future generations to meet their own needs. This has to underpin the policy.

In relation to social licence, it is important for a community to be a part of these processes and for broad agreement about projects can be achieved. Equity is a core principle of sustainability and comes partly from this engagement process. The consultation time allowed for community consultation about No Go Zones does not provide for enough time for this social licence to be achieved.

The appalling consultation process, where inadequate time is allowed for informed comment to be developed is not acceptable, especially with Indigenous groups and Aboriginal communities and also others. 4-5 weeks is inadequate. There is a disproportionate level of impost on Traditional Owners and Aboriginal people living remotely and their culture. A far deeper listening program is required to properly establish no go zones with respect to the concerns, aspirations and feedback from Aboriginal people across the Northern Territory.

So far, the extension of no proposed go zones outlined in this report would limit the potential economic gain from fracking so much so it questions its financial viability, being restricted to a small scale. If the extension of the proposed no go zones was ignored and these activities were allowed within these extended areas there is no doubt the principles of ESD are in jeopardy. This push to leave the SREBA and fast track exploration and the sequential process to

production gas resources in the region to a commercially viable stage goes against all the principles of ESD.

There is no doubt that without a SREBA, the places cannot be defined that Recommendation 14.4 sets out to protect. Furthermore, without a SREBA and the ability to effectively identify these areas to be protected, there is too much uncertainty in managing the impacts associated with unconventional gas exploration and production. There are activities and elements that simply cannot co-exist, and there is significant uncertainty around what areas could be suitable for economic development.

It needs to be acknowledged as in the Pepper inquiry that the regions around the Beetaloo basin and many areas of the NT are data deficient in relation to cultural understanding, economic opportunities, biodiversity, aquatic systems, and the botanical systems. This requires that the Precautionary Principle underpinning the EPBC act needs to underpin decision making including those relating to No Go Zones.

The areas of the NT are data deficient in relation to most aspects of the science that would help to inform decision making in relation to the potential impact of fracking on these elements. This has significant implications for No Go zones in relation to Hydraulic fracturing which has the potential to dramatically alter water flows and to also alter water chemistry.

In light of the findings presented and discussed in this submission report, there is no other action than to accept the precautionary principle of ESD and declare the entire NT a no go zone for unconventional gas exploration and production.

### Recommendations arising from this Submission to the NT Government:

- The no go zones are rejected in entirety and a better standard of no go zones are released again for public consultation with consideration outlined in this submission.
- Inter-departmental discussions to determine and publicly release more careful areas that meet the criteria under the Recommendations for declaring no go zones.
- Traditional Owners and landholders are provided a far more detailed process with genuine opportunities to successfully advocate to be protected in a no go zone for unconventional petroleum activities.
- The criteria be reviewed to encompass off site/downstream effects of unconventional gas exploration and production.
- Regional and remote community aspirations to be frack-free by as the result of local community surveys are respected by Government and acted upon.
- Far greater consultation and consideration of sacred sites and sacred underground waterways be considered prior to finalisation of proposed no go zones.

- Undertake a broader approach to cultural risk assessment and a regional cultural mapping initiative with Traditional Owners to recognise and understand the connections between water, sacred sites and songlines in the Beetaloo Sub-basin.
- All progress with exploration is halted until the no go zones are finalised and the process for considering granted exploration retrospectively in no go zones is clarified.
- Recognise that the principles of Ecologically Sustainable Development (ESD) have been completely ignored and are in breach by progressing to exploration without no go zones implemented and without a detailed SREBA.
- A SREBA is undoubtedly required to be able to implement this recommendation properly. Connectivity between groundwater and surface water resources is vital to protect ecologically and culturally significant areas, and current and future water supplies.
- Undertake scrutiny of why the implementation of no go zones was not done earlier and has been fatefully put aside whilst approvals move forward for exploration.
- Cease immediately the proposed exploration works in the area that is likely to be in the active surface water catchment for Lake Woods. This area on Hayfield cattle station is likely to fall within a revised no go zone boundary to protect Lake Woods.

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