ENVIRONMENTAL IMPACT REPORT

Drilling, Completion and Initial Production Testing

PEL 255 REGION
OTWAY BASIN
SOUTH EAST, SOUTH AUSTRALIA

ADELAIDE ENERGY LTD

MARCH 2007

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1 PROPOSED ACTIVITIES

1.1 INTRODUCTION

Adelaide Energy is the Operator of PEL255, Otway Basin, South East South Australia. As part of the Year 1 licence requirements, Adelaide Energy Ltd proposes to drill petroleum exploration well Jacaranda Ridge 2 at a location approximately 8klm West of Penola. The well will test the oil and gas potential discovered in Jacaranda Ridge 1. The primary target is the Top Sawpit Sandstone at an expected depth of approximately 2630 metres. The possible maximum total depth for the well is 2800-2900 metres.

In the event of any well failing to discover economic hydrocarbons, it will be appropriately plugged with cement plugs to isolate any permeable zones and abandoned. The wellsite will then be rehabilitated.

It is intended to spud a well in 2nd Qtr, 2007. The actual timing of operations will depend on the final schedule for CDL Rig 11 within the Otway and Gippsland Basins. Drilling related activities will be continuous over a 3 to 4 week period.

During the drilling related activities Adelaide Energy will control environmental impact at the site to acceptable levels and will minimise risk and inconvenience to the landholder, the local community, all personnel and third parties.

All activities will be carried out according to best industry practice and will conform to the relevant State and Federal Government regulations.

1.2 SCOPE

The scope of this Environmental Impact Report is to address the various risks associated with the drilling of a well within the PEL 255 region and in the case of a successful well, the completion and production testing of a well.

1.3 LOCATION AND ACCESS

Adelaide Energy proposes to drill and test petroleum wells within the PEL 255 permit area. The lands are primarily Freehold, cleared of native vegetation, under crop and fenced. As required under the Petroleum Act 2000 and its Regulations and following PIRSA guidelines, a Notice of Entry will be presented to the relevant land titleholders and a compensation agreement signed. The landholders will be given notice in accordance with Part 10 of the *Petroleum Act 2000* of the timing of wellsite operations. Access is generally via sealed roads and formed wide gravel roads to within close proximity of any well site.

- There are no current land rights claims over this area. The Kungari Aboriginal Organisation will be notified and invited for a site visit as part of the consultative process. Any issues raised will be dealt with accordingly.
- There are no sites of European heritage in the permit area. The EPBC search also found no listing of nearby sites. The original homestead of Yallum Park is to the south and outside the permit area.

1.4 WELLSITE REQUIREMENTS

1.4.1 Drill Pad

A drill pad area approx 100m X 90m will be levelled and paved for the drill rig and associated equipment. It will be necessary to remove some topsoil from the pad area. Any topsoil removed will be stockpiled adjacent to the pad for replacement when the site is rehabilitated. If the grass is dry or operations are within the fire season, the pad will be surrounded by a 10 metre wide ploughed firebreak. The pad will be paved with gravel to a depth of approximately 30cm. Thicker paving (50cm) may be required for the 40m X 20m rig base. Small drains sufficient to control surface runoff from the drill pad will be constructed around the pad margins. The pad will be constructed so that any runoff upslope from the pad will be directed away from the pad.

1.4.2 Sump and Flare Pit

A shallow sump (approximately 25m X 30m x 2m) will be constructed to hold drill cuttings and waste drilling fluids. This sump will be lined with a dam liner. Drilling fluids used will be non-toxic polymers. A small shallow flare pit will be constructed adjacent to the drill pad. A firebreak will be ploughed/graded around the flare pit.

1.4.3 Access Track

A short access track will be constructed from the public roadway to the drill pad. The track will be approximately 4m wide except on bends and at entry and exit points to camp and pad where it will be 8 metres wide. There will likely be a ring road built for safety and for keeping trucks to the graveled areas rather than causing wheel ruts in the undisturbed lease areas. If grass is dry a graded/ploughed firebreak along each side of the access track will be constructed.

1.4.4 Water

An estimated volume of less than 1 ML of water will be used to drill the well. If a nearby water bore is acceptable, water will be pumped from it in agreeance with the landholder. A new stock/domestic bore may be required if this is not an option. This will be drilled by a local licensed water well driller familiar with regional issues like the Dilwyn formation.

1.4.5 Camp Site

A crew camp will be required. An approximate 60m X 50m area adjacent to the drill pad will be used for a self-contained 30 person re-locatable camp equipped with septic tanks. Disturbance to the soil surface will be kept to a minimum. It will be necessary to lightly pave the camp area with gravel.

1.4.6 Toilet Facilities

Toilet facilities with septic tanks will be provided at the site and at the camp. These will be emptied by a licensed waste removal contractor on an as required basis. Small pits will be constructed to house the tanks which will be removed after drilling operations are completed.

1.4.7 Fencing and Fire Break

A fence will be constructed to enclose the wellsite area of approximately 2 hectares and the access track, if required. Lockable gates will be placed across the start, or an appropriate section, of the access track. All activities will be confined to within the fenced area. A firebreak may be ploughed/graded along the outside of the fence.

1.4.8 Drilling Period

It is proposed to drill the first well of the permit license during May 2007. The drill pad will need to be constructed well in advance of the commencement of drilling operations. Actual drilling operations will take between 21 and 28 days and will be on a 24 hour 7 day week basis. If the well is successful, initial testing may be carried out for a period of up to 2 weeks. It is envisaged that the drill rig will be demobilised within one week of the completion of drilling/completion. The site will be rehabilitated on a timetable suitable to the landholder and the paving material removed. The drilling fluids and drill cuttings will be tested as to the suitability for disposal as clean or contaminated waste. Once this occurs the sump contents will be cleaned out and disposed of at an appropriate location.

1.5 ACCESS AND VEHICLE MOVEMENTS

Access is likely to be via existing wide, well formed, sealed and gravel roads to within reasonably close proximity of the site and then by a constructed paved access track. A lockable gate will be installed in the fenceline at the start, or an appropriate section, of the access track. Vehicle movements will be mobilisation and demobilisation of the drill rig, crew change vehicle, water truck. Vehicle noise will be monitored and movements restricted to daylight hours as far as practicable.

1.6 INITIAL PRODUCTION TESTING

In the event of a significant gas or oil discovery, the well will be completed and an initial production test undertaken.

1.6.1 Initial Production Testing - Gas

In the case of a potentially producing gas discovery, a single / multirate flow and buildup operation would be undertaken, with produced gas flared off. Details will necessarily depend on the outcome of drilling, but an initial production test for gas, while "producing" under the meaning of the Petroleum Act, will not require additional surface infrastructure. A separator may be required to remove liquids to a tank for measurement and subsequent transportation to a processing facility. If initial production testing were successful, approvals would be sought for upgrading to production rather than exploration facilities.

1.6.2 Initial Production Testing - Oil

If warranted by oil shows, a drill stem test(s) would run with open/shut-in times based on hole and drilling conditions. Any zones would be progressively tested, based upon quality of oil shows. Total oil volume produced from such drill stem tests is low, likely from nil to 50 barrels maximum. Further initial oil production testing may be performed to provide increased confidence in the commercial possibilities of the discovery. This testing would be conducted over a 24 hour to 7 day period following completion of the well. Produced oil will be stored in a special purpose tank for subsequent transport to a processing facility.

2 SUMMARY OF LOCAL ENVIRONMENT

2.1 CLIMATE

The average rainfall of the Penola area is 715 mm. Most rain comes in the months of May, June, July and August. The opening rains begin in late April so earthworks need to be completed before then, if possible. Strong winds can be experienced across the Penola plains. There is no shelter from these winds as there has been almost total clearing of the native vegetation for the practices of cropping and farming.

2.2 REGIONAL LAND USE

The Penola region in the SE East of South Australia was historically a sheep and cattle grazing area. Cash cropping and dairy farming have now been added to the landuse along with the development of the Coonawarra wine region with pockets of vines being grown outside the famous terra rossa soils.
There has also been an expansion of Radiata Pine plantations for the supply of timber to the nearby timber mills, while recently Tasmanian Bluegum plantations have made a visible impact in the area as well.
Tourism has also made for greater diversity of land use in the Penola area. Apart from the attraction of the wine industry, Tourism has expanded within the region due to the development of the Bool Lagoon wetland to the north of the permit boundary; the Mary McKillop Trail based at Penola; Yallum Park House just outside the southern perimeter of the permit boundary; as well as other minor attractions like the Penola Conservation Park, just to the west of the permit boundary.

The original native vegetation in the permit region has been primarily removed and replaced by continual cash cropping and sheep and cattle grazing. Destruction of this vegetation has been complete, even along the roadsides where over-spraying, over-fertilizing and introduced aggressive plants like phalaris have even destroyed the native grasses. The black plains country is quite fertile but becomes rather boggy when wet.

2.3 LANDFORM AND SOILS

The landform is gently undulating and low to flat plain relief. The area is characterized by flat sodsolic plains interrupted by limestone rises. There are also some low lying depressions consistent with Karst topography. Some pebble sized limestone is usually brought to the surface during the cropping processes.
The underlying limestone has caused numerous ephemeral swamps. These only fill in heavy rainfall periods, and with the current dry seasons, none are holding water.
Soils are grey/black cracking clays which are desirable cropping soils. The A horizon can be prone to water logging in wet years. Underlining the topsoil is a limestone Marl. The soils are stable with minimal erosion evident.
There are also remnant sand dunes every 20 –30 kms running in a north /south direction reflecting the ancient retreating sealevels. These remnant dunes are only 10-20 metres high. These sandy strips have the most native vegetation remaining, mainly because the sandy loam soils were considered not that productive for cropping and grazing.

2.4 HYDROLOGY AND HYDROGEOLOGY

An unusual feature of the Southeast is the lack of surface streams and rivers. The largely flat terrain with its system of parallel dune ridges has resulted in the formation of many interconnected swamps that generally have a slow north-westerly flow. Until the artificial drainage system was constructed there were few outlets to the sea and large areas of the South East were seasonally inundated
The groundwater hydrology of the region is dominated by two aquifer systems. These are associated with the highly porous Gambier Limestone near the surface and the deeper Dilwyn Formation consisting of sands and gravels.

The Gambier Limestone generally forms a 20 metre thick unconfined aquifer containing good quality water (<500 mg/L total dissolved solids). Flow rates from surface bores (6-18 metre deep) of 30,000 to 50,000 litres per hour are not uncommon. Since it is recharged directly by rainfall during winter the water table often rises to near the ground surface and is vulnerable to contamination. Any activity that may result in surface run-off poses a threat to water quality in the Gambier Limestone and all activities at the well site will be conducted in a manner that minimises risk of contamination.

The Dilwyn Formation forms a 20 – 100 metres thick confined aquifer and contains water of good quality (600 – 1000 mg/L total dissolved solids). This aquifer is not only used to supply most of the town and city water supplies in the Southeast but is also used for irrigation, watering stock and for industrial purposes. Risk of down-hole contamination of this and all other aquifers will be minimised by running a combination of low fluid-loss drilling mud, steel casing and a cementing programme that will effectively isolate all permeable sands.

Chemical analyses of water recovered from aquifers below the Dilwyn Formation shows that salinity increases to higher levels with depth and the water is unsuitable for agriculture; this observation lowers the magnitude and associated risk of contamination by saline mud filtrate.

2.5 NATIVE VEGETATION AND WILDLIFE

The Penola Conservation Park is to the west and just outside of the PEL 255 boundary. This does harbour some of the original native flora and fauna. The remaining native vegetation is generally sparse as it was deemed by the early pioneers that to preserve it had no monetary merit.

Intensive grazing and cropping has left only very small patches of remnant native vegetation scattered throughout the area. Even the roadsides and unmade but surveyed roads have very little if any native vegetation left. This destruction of habitat has obviously had a major impact on the native wildlife in the area. An examination of Dept. of Environment and Water Resources website EPBC Act has revealed several Fauna/Flora species as having potential cause for concern. These endangered/vulnerable species are listed below. Comments on the impact of the activities associated with this wellsite on these species are also described below.

Red-tailed Black-cockatoo (`*Calyptorhynchus banksi graptogyne*) The habitat of these birds is in woodlands or along wooded watercourses. Neither of these apply to this well location. Noise from drilling activities and the floodlit derrick should deter any bird from the rigsite

Swift parrot *(Lathamas discolor)* These birds nest in hollows in eucalyptus trees. They also nest and shelter in sclerophyll forests and woodlands, again, not present at the wellsite. Noise and the floodlit derrick should also deter these birds.

Australian Painted Snipe (*Rostratula auatralis*) This species lives mainly on the margins of swamps and streams, mainly covered by low and stunted vegetation. Again the proposed wellsite does not have these features. The noise associated with drilling activities should keep them away from the site.

Several frog species under the Genus of *Litoria raniformis* including The Southern Bell Frog, Growling Grass Frog, Warty Bell Frog and Green and Golden Frog could be in the vicinity.

However, as these mainly live in permanent swamps/waterholes, the activities associated with earthworks, drilling and rehabilitation should not impact upon these frogs. If any are found during earthworks, drilling or rehabilitation they will be collected and placed outside the lease area.

The mammals listed as potentially in the area are Quolls and Bats. More specifically, the Spot - tailed Quoll , the Spotted Tail Quoll and Tiger Quoll. *Dasyurus maculates maculates (SE mainland population)* The Quolls listed live in sclerophyll forests, coastal heaths and scrubs. Once again this doesn't apply to the wellsite. The noise and human activity should keep any away, as well as their prey.

The Southern Bent -Wing Bat also lives in hollowed trees, none of which are on or near the wellsite. When hunting at night these bats may even be assisted by being able to catch the insects attracted to the lit derrick.

The one reptile listed is the Striped Legless Lizard. (*Delma impar*)
This does not require tree cover and does find grassland plains favourable to its habitat. Careful observation will be needed in the initial stages of stripping off the topsoil to avoid these reptiles. The grader and scraper drivers will be instructed about the possibility of these lizards being in the work area. Vehicle movement after this should be enough to make any lizards move away from the work area.

Migratory birds which may be within the area include:
South Eastern Red-tailed Black cockatoo (*Calyptorhynchus banksii graptogyne*); White-bellied sea-eagle (*Haliaeetus leucogaster*); White-throated Needletail (*Hirundapus caudacutus*); Rainbow Bee-eater (*Merops ornatus*); Satin Flycatcher (*Myiagra cyanoleuca*). The risk of drilling activity affecting these birds will be minimal because the derrick is painted red and white, to optimize visibility during daytime, while at night, the derrick is illuminated to optimize night-time visibility. This is meant to prevent accidental collision into the derrick by bird and plane alike.

Migratory species of Wetland birds which may be present within the area include:
Latham's Snipe aka. Japanese Snipe (*Gallinago hardwickii*); Painted Snipe (*Rostratula benghalensis s. lat.*). As mentioned previously, there should be no danger to these birds from drilling. The derrick is painted red and white to optimize daytime visibility and is illuminated by night to optimize night-time visibility. This greatly reduces the chance of the birds flying into the rig.
The plants that are listed which may occur in the general area are Small Western Spider Orchid, Coloured Spider Orchid *(Caladenia colorata*) ; Trailing Hopbush (*Dodonaea procumbens*); Purple clover, Clover Glycine *(Glycine latrobeana*); Metallic Sun-orchid (*Thelymitra epipactoides)* Due to the incessant ploughing, burning, spraying, grazing and cropping, the chance of any of these being present in this paddock would be extremely unlikely.

2.6 LOCAL COMMUNITY

The permit is located between 4 and 6 klms west of the town of Penola.

Penola is not a stagnating rural town. The nearby Coonawarra red wine district has a large impact on the town. It has large influxes of population for the different stages of vineyard work as well as the tourism industry associated with the vineyards and the Mary McKillop trail.

The people of Penola are very familiar with the gas exploration industry, having accommodated many seismic crews over the years. There have been numerous wildcat wells drilled in the area, with many local contractors and businesses gaining work through these activities.

Access to Jacaranda Ridge #1 was via EYS Lane. This is a white metal road under the jurisdiction of the Wattle Range Council. It is not a school bus route.

There will be increased vehicle movement during the construction phase, rig mobilization, rig demobilization and rehabilitation. The truck widths, weights and numbers are similar to the activities of cropping harvesters, baling contractors, vineyard operations also operating in the area, but not necessarily at the same time in the season.

The rig will be highly visible at night because there are no trees or hills to shield the night lights. The community already experiences 24 hour operations and noise and light from the annual grape harvesting at Coonawarra and surrounds. This visual impact will be transient.

Dwellings are present throughout the permit and due consideration will be given to site selection to minimize the associated impact.

3 ENVIRONMENTAL RISKS ARISING FROM PROPOSED ACTIVITIES

Possible risks, their avoidance or amelioration, and environmental objectives to be pursued during operations are summarised for risk level in Table 1 and for management in Table 2. The objectives and risk management procedures listed in Table 2 form the basis of the SEO.

The permit area is predominately on regularly ploughed and cropped/grazed flat farmland, the risk to the natural environment is very low. Also, the ploughed site makes it most unlikely that cultural materials are still present intact. Principal risks are vehicle accidents and minor oil spills. The degrees of risks from the proposed operations are summarised in Table 1 below. Where there is an absence of any native vegetation at the annually ploughed wellsite location minimises the likelihood of any endangered or threatened species of flora or fauna.

TABLE 1.
ENVIRONMENTAL RISK LEVEL

Potential Risks relating to:	Specific Aspect	High Risk	Low Risk
Cultural heritage	Cultural Heritage		*
Flora and fauna	Native vegetation		*
Flora and fauna	Native fauna		*
Weeds	Weed/disease introduction		*
Soil impacts	Topsoil	*	
Erosion	Wind erosion		*
Aquifer pressures	Aquifer isolation	*	
Water and groundwater impacts	Confined aquifer contamination	*	
	Groundwater or unconfined surface aquifer pollution and contamination	*	
	Surface water pollution	*	
	Natural drainage	*	
	Flooding		*
Land access, landholders	Land use impairment	*	
Public risks	Spills, safety, dust, traffic dealt with under other objectives, below	*	
	Visual impact		*
Waste control / Oil spills	Waste / minor oil spills	*	
Livestock	Farm stock		*
Dust	Road safety/dust	*	
Noise	Noise		*
Vehicle movement	Vehicle movement	*	
Fire	Fire		*

3.1 RISKS FROM WELLSITE CONSTRUCTION

3.1.1 Vehicle Movement

General risks associated with extra heavy vehicle movement apply.

Trucks carrying paving material from the source stockpile to the wellsite have the potential to cause a dust hazard and to damage road pavement. The trucks also have the potential to cause a hazard to other road users. Trucks, excavators, scrapers, rollers etc constructing the wellsite also have the potential to cause local excessive noise and dust, and to compact soils immediately adjacent to the drill pad area. Vehicles which have moved through areas of seeding weeds have the potential to introduce these to the wellsite area. The heavy vehicles may also damage pasture in the vicinity of the wellsite. Although at the time of this documents compilation there were no stock in the vicinity of the wellsite, there is the possibility of sheep or cattle disturbance. These animals are used to trucks, harvesters, graders already operating near them. Refuelling of equipment has the potential for minor fuel spills to contaminate the soil. Malfunctioning exhaust systems and discarded cigarette butts have the potential to cause grass and crop fires which are a hazard to human life, stock and crops.

3.1.2 Introduced Materials

The sandstone needed for the construction of the access road and pad is sourced locally minimizing potential contamination problems. Significant volumes of crushed limestone will be laid on the site and compacted as paving. This has the potential to prevent rainfall from penetrating the underlying soil and of causing erosion on runoff. On abandonment of the site, limestone paving material left behind may impede future crop growth. There is the potential for the introduction of weeds if the paving material source is contaminated.

3.1.3 Interference to Topsoil and Natural Drainage

Any impact to the topsoil will be localized to any actual wellsite lease area. Similarly, there will be no regional impact on wetlands or drainage systems

Topsoil will be stripped off to enable ease of rehabilitation. The black/grey cracking clays do not freely release all the imported fill during rehabilitation. Depending on the exact location Geo-fabric may be used to alleviate this problem. Site construction vehicle wheel tracks in soft recently ploughed soils could form poorly directed drainage channels.

Risk to natural drainage is expected to be minimal because the area is flat. Culverts will be placed at appropriate points to prevent artificial damming of any surface water.

3.1.4 Risk to Natural Vegetation and Native Fauna

As per section 2.5 above, the endangered or at risk flora and fauna should not be seriously impacted upon by the associated drilling activities. Increased vehicle movement is always an increased risk to birds and animals along any road corridor. Any other impact will be wellsite specific. The intention is to locate wellsites in a crop rotation/grazing paddock which is regularly ploughed. All natural vegetation have thus been removed.

3.2 RISKS ARISING FROM DRILLING OPERATIONS

3.2.1 Risk to Aquifers and Groundwater

Aquifer and cross-aquifer contamination can occur in a bore hole. The drilling fluids used will be nontoxic. Incompletely cemented casing risks cross-aquifer contamination and possible flow to surface of artesian aquifers. There is a risk that spillages of chemicals, fuel, lubricants, etc. may contaminate any surface and near surface groundwater and aquifers. It is highly unlikely that any event will be of anything but a wellsite localized impact. No regional impacts should occur

3.2.2 Risk to Community

The wellsite is likely to be located in close proximity to a public road and could be clearly visible to the public. Tourists may be distracted by the wellsite illumination at night. Unauthorised non-inducted people may attempt to access the wellsite. There will be 2 short periods of high road use as large trucks mobilise and demobilise the drill rig and other equipment through the region. The construction stage can see up to 400 truck movements in and out of the site. The drilling contractor will be required to comply with all District Council, traffic authority and police permitting requirements. Continued local vehicle movement on roads can create a safety hazard and a dust nuisance. Drill rig operations may be discernable to any nearby residents and their animals. Lighting at the site has the potential to disturb nearby residents. Flaring may cause a grass fire and thus be a threat. Grinding and welding equipment can cause fire. Then there is the potential that sparks from faulty equipment and cigarette butts may start a fire in dry grass.

3.2.3 Waste Risks

Improper management of human waste and rubbish can result in a health risk and soil contamination. The cartage tanks used by the licensed waste removalist will be checked that they do not leak waste onto the roads. Skips containing the potential windblown rubbish will be covered during transit to avoid regional littering. Spillage can occur during transfer of septic waste from septic tanks. Improperly contained food waste will pose a health risk. Improperly secured empty containers and drilling fluid bags can be blown around and off the wellsite area.

3.2.4 Risks From Fuel, Oils, Drilling Fluids, Chemicals, Radioactive Sources, Sump

Any movement of fuels and lubricants along regional roads increases the risk of a more regional impact. Any poorly maintained leaking fuel and lubricant hoses and containers will contaminate the site. Damaged drilling fluid containers/bags are also a risk. The delivery and associated unloading/transfer of fuels, lubricants, chemicals and drilling fluids presents a risk of spillage.

Heavy rain or flooding can flood the sump and result in the contents flowing out of the sump. Radioactive sources pose a contamination threat if not properly stored and handled. Radioactive sources lost in hole can contaminate the hole.

3.2.5 Drilling Operations Risks

Unplanned emissions of hydrocarbons, hydrogen sulphide, overpressured fluids, from the well, including blow out, can cause significant environmental damage by fire and by contamination. Oils recovered by drill stem testing and flaring have the potential to contaminate the local environment if not correctly handled and disposed of. In the event of any well testing and flaring during the fire season the presence of a CFS unit will be requested. If the well is plugged and abandoned, a failure to isolate any aquifers or permeable zones in the well can lead to contamination or flow from the well.

3.2.6 Risks Arising From Initial Production Testing

The primary risks to the natural environment from production testing relate to oil production, not gas. Gas production, with gas flared off, poses little risk provided flare and flare pit are constructed appropriately and surrounded by a suitable fire break. Initial production tests will use the same pads and access as for drilling, with the same construction risks. Oil produced on initial production testing will be conducted to a special tank or road tanker via production line. The primary risks are:

- Spills resulting from leaks in production line and valves
- Catastrophic failure of storage tank, including fire
- Spills due to overfill of storage tank
- Spills during loading and road transportation of storage tanker
- Impacts of spills extending downslope beyond the initially affected area
- Hydrocarbon pollution of soil or natural waters.

3.3 RISKS ARISING FROM SITE REHABILITATION

3.3.1 Risk to Soil Quality and Original Drainage

Paving material left at the site has the potential to reduce the soil quality for crop production and to reduce the penetration of rain. Imported sandstone left at the surface may damage farming implements. A failure to restore the original topography and drainage can result in erosion of the site and surrounding area. Untreated oil and fuel spillages, if left in contact with the soil can contaminate the soil and reduce crop production. Distribution of subsoil over topsoil will result in a deteriorated soil quality.

3.3.2 Risk of Rubbish Contamination

Any rubbish, including plastic bags and cigarette butts left at the site create visual pollution and are a threat to stock.

3.3.3 Other Risks

Site rehabilitation vehicular movements pose the same risks as those described in 3.1.1. above. Fire risks are similar. Casing, wellhead equipment, etc., left on the well can pose a risk to stock or to unauthorised persons interfering with the well.

3.4 RISKS TO ABORIGINAL AND EUROPEAN CULTURAL HERITAGE

There is a risk of damage or interference to any nearby sites of significance to Aboriginal Peoples. Damage can occur to items of European cultural significance such as buildings, monuments or significant trees.

4 MANAGEMENT OF ENVIRONMENTAL RISKS

Possible risks to the environment are described in section 3 above. Section 4 outlines how these possible risks will be managed to prevent their occurrence or minimise their impact. Table 2 Risk Management and Procedures, details potential impact, risk source, risk management procedures and environmental objectives.

4.1 WELLSITE CONSTRUCTION

4.1.1 Vehicle Movement

Warning signs will be positioned on the public road 200m on either side of the entry to the wellsite. Wattle Range District Council requests regarding signage will be followed. Any local resident farmers will be individually notified in advance when truck movements are to commence

The Penola Robe sealed road is well maintained and has good visibility for vehicles accessing or egressing. Generally, unsealed roads within the permit area are of high standard. Paving material will be sourced from a nearby sandstone pit with a current Extractive Mineral Licence. Visibility is good for all vehicles operating on these roads. If road dust becomes a concern then a water truck will be used to settle the dust. All necessary permits will be obtained for trucks transporting construction equipment and paving materials.

If the paving being laid on the drill pad is very dry and dusty a water truck will be used to reduce dust and assist compaction.

Excessively noisy construction equipment will not be used. Trucking and wellsite construction will only be carried out during daylight hours.

A specially constructed perimeter fence will prevent vehicles driving outside the lease thereby compacting soils or damaging crops adjacent to the area.

Construction vehicles will be inspected for signs of weeds and seeds and cleaned if found. Using local contractors and local pits drastically reduces the spread of any noxious weeds or diseases like Phyloxera.

The wellsite perimeter fence will protect sheep and cattle from serious disturbance.

Refuelling equipment will be regularly checked to ensure that there are no leaks. Spill cleanup materials will be onsite so that any minor spills can be immediately treated.

Grass fire risk will be low due to the dry season. If necessary of a fire break may be graded around the wellsite and access track perimeters. Vehicles and equipment with malfunctioning exhaust systems will not be allowed onsite. Smoking will not be allowed removing the possibility that discarded cigarette butts could cause fire.

Secure gates will be positioned on the roadside fence across the wellsite access and will be kept closed when there is no construction activity.

4.1.2 Introduced Materials

On abandonment of the site, the limestone paving material will be removed and returned to the source stockpile, except where it is required for further development/production or needed by the landholder. The paving material source stockpile consists of clean weed free sandstone material and clean equipment will be used to load, transport and lay the material.

4.1.3 Interference to Natural Drainage and Soil Profile

The wellsite will be constructed to minimise interference with natural surface runoff. Culverts and other drains will be constructed to divert any surface runoff after heavy rains around the site area. Site construction vehicle wheel tracks in soft recently ploughed soils will be removed to avoid the development of poorly directed drainage channels.

Soil moved for sump and other construction will be carefully stockpiled for redistribution during rehabilitation.

4.2 DRILLING OPERATIONS

4.2.1 Aquifers and Groundwater

The 9-5/8" surface casing string will be cemented back to surface and consequently will isolate the known Dilwyn acquifer. Any aquifers/permeable zones identified during drilling of the 8 ½" hole will be isolated by cement plugs on abandonment of the well or by casing cemented for production.

Chemicals, fuel and lubricants, etc., which may contaminate any surface and near surface groundwater and aquifers, will be stored in their product drums within a suitably contained bunded area. A spill clean-up kit will be located in this area. Transfer/unloading of potential contaminants will be carried out according to industry accepted procedures to minimise risk of spillage. Any run off from high risk contamination areas within the drill pad will be directed into the sump.

4.2.2 Community Risk Management

Because the wellsite is likely to be located in the vicinity of a public road and will be clearly visible to the public, access to the wellsite will need to be strictly controlled. Signs prohibiting unauthorised entry will be erected at the public road fenceline at the start of the wellsite access track. All wellsite vehicles will be parked on the lease area so no road congestion on public roads will occur. Gates at the start of the access track will be kept closed during any periods of low activity. Unauthorised non-inducted persons will be refused entry.

Local farmers/residents, the Council and police will be warned immediately prior to the movement of large trucks during rig mobilisation and demobilization. Heavy vehicles will be diverted around town centres wherever feasible. Road signage as in 4.1.1 above will be maintained. All necessary permits will be obtained for trucks transporting drilling and other equipment. Nearby residents will be notified of regular truck movement on roads.

Where practical transportables needed at the wellsite will be placed between the drill rig and any nearby farmhouses as a noise barrier.

If a grass fire hazard exists it will be controlled by grading a firebreak around the flare pit, the entire wellsite and the access road. Mechanical equipment and all vehicles will be carefully checked for fire hazard resulting from faults including faulty exhaust systems. Vehicles will not be permitted to drive over dry grass. If drilling operations are conducted during a high fire danger period, a fire unit consisting of a trailer with water tank, pump and hoses, will be on standby at the wellsite. Use of grinding and welding equipment will not be permitted off the paved lease pad area. The local CFS will be fully briefed on the operations. The CFS may wish to conduct a controlled burnoff behind the flarepit as an extra precaution. Contractors housed off site will be briefed on pro-community behaviour.

4.2.3 Waste Management

Septic tanks will be pumped by an accredited waste management contractor to avoid any spillage. General non-toxic waste will be placed in proper waste skips for collection by a waste contractor. Any toxic wastes will be stored in the correct clearly marked sealed containers and disposed of according to State government and District Council regulations. A clean completely rubbish free policy will be implemented. Wellsite cleanliness and waste disposal will be included in Induction procedures.

4.2.4 Fuel, Oils, Drilling Fluids, Chemicals, Radioactive Sources, Sump

Fuel and lubricant hoses and containers will be regularly checked for signs of wear. A designated Hazchem chemicals bunded storage area will be clearly identified. Where feasible, containers will be kept on polythene liners to prevent any minor spills from contaminating the soil and to allow for proper cleanup. A quantity of suitable absorbent materials will be kept on site for cleanup of any spills. Contaminated soil and cleanup materials will be placed in approved clearly marked containers for proper disposal. Drainage from storage areas will be directed to the lined sump. Drilling fluid containers/bags will be stored away from risk of damage. Radioactive sources will be stored and handled strictly in accordance with the Regulations. Any tools containing radioactive sources lost in the hole will be secured by a cement plug. Rig and campsite generators will have collection trays or liners for collection of any leaks. Care will be taken to avoid damage to the sump liner that may allow the contents to contaminate the area. Some of the earth removed during construction of the sump will be used to form a raised berm around the sump to prevent runoff following heavy rain from flooding the sump.

4.2.5 Drilling Operations

All drilling related operations will be carried out according to Regulations and to approved procedures designed to protect personnel at the site and the general public. Drilling operations will be conducted according to an approved Drilling Operations Manual. The rig will be equipped with fully functional and regularly tested blow out preventers. Unplanned emissions of hydrocarbons, hydrogen sulphide, overpressured fluids, from the well, including blow out, which can cause significant environmental damage by fire and by contamination, are covered by Emergency Response Plan and other procedures.

The local CFS and Emergency Services will be involved to an extent which will be detailed in the Emergency Response Plan. If the well is plugged and abandoned, any aquifers or permeable zones in the well will be isolated by cement plugs to prevent contamination or flow from the well.

4.2.6 Well Testing

Testing of hydrocarbons may be carried out during drilling operations. Drill stem tests, on penetration, or cased hole tests may be conducted. A drill stem test may produce up to 50 barrels of oil which will be transferred to a special storage tank. Depending on the volumes involved, any oil recovered will or be trucked to a oil refining facility or disposed of appropriately. Drill stem tests may recover formation waters and these would be disposed of into the sump.

4.2.7 Initial Production Testing

Initial production testing may produce up to 1000 barrels of oil. This oil will be transferred from the well to a special storage tank or road tanker via a production line which will be tested for leaks prior to use. The storage tank will be inspected for structural integrity and potential leaks before transport to the site and at the site prior to use. Fire extinguishers will be located close to the tank during testing. Oil levels in the storage tank will be continually monitored during the production testing to avoid overfilling and spillage. The storage tank will be positioned to contain any minor spillage from moving away from the area and polluting soil and natural drainage.

4.2.8 Serious and Reportable Incidents

Section 85(1) of the Petroleum Act defines a "serious incident" to mean:

"an incident arising from activities conducted under a licence in which :-

(a) a person is seriously injured or killed; or

(b) an imminent risk to public health or safety arises; or

(c) serious environmental damage occurs or an imminent risk of serious environmental damage arises; or

(d) security of natural gas supply is prejudiced or an imminent risk of prejudice to security of natural gas supply arises."

Under Regulation 12(2) of the Petroleum Act, the events listed below are considered to be those which could arise and, if not properly managed or avoided, cause a serious incident:

- Explosion or fire at the well facility;
- Failure of containment systems resulting oil spillage beyond confines of well site or into ground water or surface water bodies;
- Transportation accident involving oil spillage;
- Transportation accident resulting in fire;
- Disturbance to sites of Aboriginal heritage significance;
- Removal of rare or endangered native vegetation.

Pursuant to Regulation 12(2) of the Act, the events listed below are considered to be reportable incidents under Section 85(1) of the Act:

- Non-compliance with procedures defined or developed to implement environmental objectives
- Spills of oil outside bunded and other defined areas intended to contain spillages
- Evidence of oil in disposed formation water
- Landowner complaints in regard to operations
- Other non-compliances with SEO objectives as indicated by assessment criteria.

4.3 SITE REHABILITATION

4.3.1 Soil Quality and Original Drainage

Rehabilitation and restoration of the access road, camp and drill pad will be completed to meet the landholders approved requirements, without interference to the natural drainage. Should the well be completed for production then the site will be restored so as to leave sufficient pad and access required for a production licence. If the well is plugged and abandoned as a dry well and the landholder does not seek to use the paved area, all paving material brought to the site will be removed. The sump will be rehabilitated by having the contents tested to ascertain what type of prescribed waste category it falls under. After this the contents will be removed and disposed of at the designated location(s). The previously excavated sump materials will be returned in correct order so that future pasture/crop growth will occur.

All pits including the septics and flare pit will be backfilled in a similar fashion so that normal cropping/grazing practices can resume after abandonment of the site.

The original topography/slope of the wellsite will be restored and any topsoil evenly redistributed across the disturbed area to ensure that the original drainage and cropping potential are restored. The whole area previously graveled will be tyne ripped before replacing of any stockpiled topsoil. This solves the problem of soil compaction and enables good rehabilitation back to pasture/crops. Small stones not picked up by front end loaders or excavators will be rolled into the soil as is common farming practice. A final shallow ploughing/harrowing will be carried out to ensure soil aeration and permeability. A crop/pasture will then be sowed for additional soil stabilisation.

4.3.2 Rubbish Contamination

A rubbish free wellsite policy should result in no rubbish to cleanup. A very thorough inspection will be carried out at the completion of each stage of rehabilitation to ensure that that no rubbish of any kind remains.

4.3.3 Other Risks

Rehabilitation vehicular tracks will be removed by ploughing the wellsite area. Grass fire precautions will be the same as for wellsite construction. Any casing cap or wellhead left on the well above ground level will be in accordance with the Regulations and be so constructed as to present no safety hazard to farming machinery, livestock, or to unauthorised persons interfering with the well.

4.4 ABORIGINAL AND EUROPEAN CULTURAL HERITAGE

Representatives of the Kungari people will be invited to carry out a site inspection prior to any site preparation. No features of traditional significance will be interfered with. The relevant government department and Aboriginal Group will be immediately notified should any indications of possible items of traditional significance be discovered during operations. The Department of State Aboriginal Affairs and Department for Environment and Heritage will be consulted if cultural aspects at the site are in doubt.

There are no features of European cultural significance in the permit area.

	RISK MANAGEMENT AND PROCEDURES		
POTENTIAL IMPACT	**RISK SOURCE**	**RISK MANAGEMENT PROCEDURES**	**ENVIRONMENTAL OBJECTIVES**
Disturbance to sites of Aboriginal significance	Wellsite construction	Liaise with relevant Aboriginal organisations. Site inspection by people with traditional responsibility. Avoid any identified areas of significance.	1. Avoid disturbances to sites of Aboriginal and European heritage significance.
Loss of natural habitat	Wellsite construction Vehicle movements Fire	Where possible, locate wellsite where natural habitat is already cleared. Ensure that vehicles travelling to and from site do not damage any roadside vegetation. Adequate grass fire prevention.	2. Avoid disturbance to rare, vulnerable and endangered flora and fauna species.
Importation of weeds or soil pathogens on equipment	Wellsite construction, vehicle movement, earthmoving	Source paving materials from sites free of weeds. Vehicles to be free of weeds/soil from other areas.	3. Prevent the introduction and establishment of exotic weed species.
Physical damage to topsoil,	Wellsite construction	Minimise movement of soil during drill pad construction. If appropriate lay paving on top of topsoil. Stockpile any topsoil moved, for later redistribution. Avoid disturbance of subsoil. Limit area of soil compaction by restricting vehicle movements off the drill pad area and access track. Plough wheel tracks and other off-pad topsoil disturbance at completion of construction phase. Proper coverage of contamination in induction procedures.	4. Minimise impacts to soil.

	RISK MANAGEMENT AND PROCEDURES		
POTENTIAL IMPACT	**RISK SOURCE**	**RISK MANAGEMENT PROCEDURES**	**ENVIRONMENTAL OBJECTIVES**
	Drilling and testing operations	Store all fuel, lubricants, chemicals, radioactive sources appropriately in safe areas. Clearly identified Hazchem chemical storage area. Store potentially contaminating materials in bunded areas. Rig and camp generators to have spill trays or liners to contain leaks. Have spill cleanup material in clearly identified locations close to potential contaminants, with clearly marked approved containers for contaminated soils and cleanup materials. Production testing tubing and storage tank to be inspected prior to use. All drill pad runoff from high risk areas directed into sump. Sump protected from flooding by earth berm. Follow approved drilling operations and safety procedures to avoid/control unplanned emissions from the well. Use pressure control during drilling, including blow out preventers.	
Loss of productivity of land	Area of land affected Period of occupation Loss of fertility Inadequate rehabilitation	Use only that area of land needed for safe and effective conduct of operations. Pave only that area needed for safe effective operations. Rehabilitate site as soon as feasible after completion of operations. Careful preservation of soil structure. Careful stockpiling of any topsoil removed for excavations. Avoid soil compaction where possible. Avoid soil erosion. Avoid soil contamination. Rehabilitate site to original condition as required by landowner Removal of paving materials. Careful redistribution of any stockpiled topsoil. Aeration of soil by tyne ripping, ploughing.	4. Minimise impacts to soil .....cont…..

	RISK MANAGEMENT AND PROCEDURES		
POTENTIAL IMPACT	**RISK SOURCE**	**RISK MANAGEMENT PROCEDURES**	**ENVIRONMENTAL OBJECTIVES**
	Site rehabilitation	Fuel storage and refuelling checks as above. Thoroughly check pad for any contamination areas and remove before removal of paving. Avoid spillage during pumping and removal of septic tanks Redistribution of any stockpiled topsoil. Restoration of original topographic profile. Restoration of original drainage pattern. Restore original soil profile over sump, septics and flarepit Final light ploughing of site to aerate soil. Sow crop/pasture to stabilise soil.	4. Minimise impacts to soil .....cont…..
Pressure loss Contamination of aquifers	Drilling operations Drilling, testing	Isolate and seal off potential aquifers behind casing cemented to surface or back into previous casing string. In open hole, isolate aquifers / permeable zones with cement plugs. The Drilling Fluids program will adopt best industry practices and give due consideration to ground water acquifers. Case off any aquifers with cemented casing. Isolate multiple aquifers with cemented casing or cement plugs. Cement in hole any radioactive tools irretrievably lost in hole.	5. Minimise loss of reservoir and aquifer pressures and avoid acquifer contamination.
Disruption to natural drainage, erosion	Wellsite construction Drilling operations	Locate wellsite on most level site possible. Locate wellsite away from swampy ground. Construct culverts to divert surface runoff from adjacent areas from entering the wellsite, but in such a manner so as not to induce the development of downslope erosion channels. Site rehabilitated to original condition as required by landowner Restrict vehicle movement off pad area and access track by construction of a perimeter fence.	6. Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources.

	RISK MANAGEMENT AND PROCEDURES		
POTENTIAL IMPACT	**RISK SOURCE**	**RISK MANAGEMENT PROCEDURES**	**ENVIRONMENTAL OBJECTIVES**
Contamination of topsoil, surface water, groundwater due to spills of oil or hazardous material outside areas designed to contain them	Wellsite construction Drilling operations	Check all earth moving mechanical equipment for oil leaks. Check fuel and lubricant storage and delivery systems for potential leaks. Locate fuels and lubricants such that any leaks are most easily treated. Restrict vehicle movement off pad area and access track by construction of a perimeter fence. Restrict movement of equipment to wellsite area. Have spill cleanup material onsite. Significant volumes of oil recovered by testing to be placed in suitable stock tanks.	6. Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources…..continued…..
Personal Injury	Wellsite construction Drilling operations	Use nearby source of paving material. Cart paving material only during daylight hours. Lockable gates and signs prohibiting unauthorised entry at entrance to wellsite. Compulsory induction of all persons prior to entry to operations.	7. Minimise risks to the safety of the public, employees and other third parties.
General interference to Landholder Stock disturbance Vehicle generated dust on roads and drilling lease areas Heavy vehicles, rig noise	All operations.	Considerate attitude and consultation by Field Liaison Person. Ready availability to access Field Liaison Person. Open but non-intrusive communication. Follow PIRSA guidelines and Regulations under the Petroleum Act. Rapid settlement of compensation for losses. Advance notice of vehicle movements and wellsite operations. Landholder to inspect all operations. Perimeter fence to isolate sheep and cattle from wellsite. Unpaved roads are limestone/sandstone, will raise dust if dry. Water truck to be used when necessary. Wellsite construction only during daylight hours. Transport trucks to be restricted to daylight hours where possible	8. Minimise disturbance to the local community and other land users.

	RISK MANAGEMENT AND PROCEDURES		
POTENTIAL IMPACT	**RISK SOURCE**	**RISK MANAGEMENT PROCEDURES**	**ENVIRONMENTAL OBJECTIVES**
Interference to nearby residents General interference to local community	Vehicle movements Drill rig moving through the local community. Wellsite operations. Water Truck. Carting of paving material	Consultation by Field Liaison Person. Advance notice of vehicle movements and wellsite operations. Appropriate speed limits to be enforced. Dust minimisation with road watering when necessary. Warning signs on roads. Avoid engine braking and excessively noisy vehicles. Wellsite located away from community centres. Consultation with wattle Range District Council. Heavy vehicles to detour around town centre. Notification of residents in the vicinity of the wellsite. Obtain all statutory approvals. Advise local police, CFS, ambulance, hospital of activities and their timing. Ready availability of Field Liaison Person. Heavy vehicles avoid school bus route/times. Warning signs on roads in immediate vicinity of wellsite. Careful briefing of drilling and transport contractors. Assist local community by use of local services, employment, etc. where feasible.	8. Minimise disturbance to the local community and other land users…….continued…..
	Personnel housed off site.	Promote pro-community behaviour.	
Visual impacts of paved wellsite and access track	Wellsite construction	• In the case of an abandoned restored site, the entire area will be restored to original land surface topography with no irregularities	9. Minimise visual impact

Waste mismanagement	General rubbish Waste drilling fluids and cuttings Waste lubricants Human waste	Site cleanliness as part of compulsory induction process. Adequate distribution of lidded properly labelled general waste containers. Rubbish skips with lids. Adequate sized properly constructed sump to hold waste from well. Allow sump to dry prior to rehabilitation. Waste lubricants to be stored in the correct properly labelled containers. Waste lubricant containers to be disposed of according to State and Local Government regulations. Septic tanks to be correctly emptied and cleaned and removed contents taken to disposal facility. Careful inspection of area for missed waste post rehabilitation.	10. Minimise impact of domestic and industrial waste

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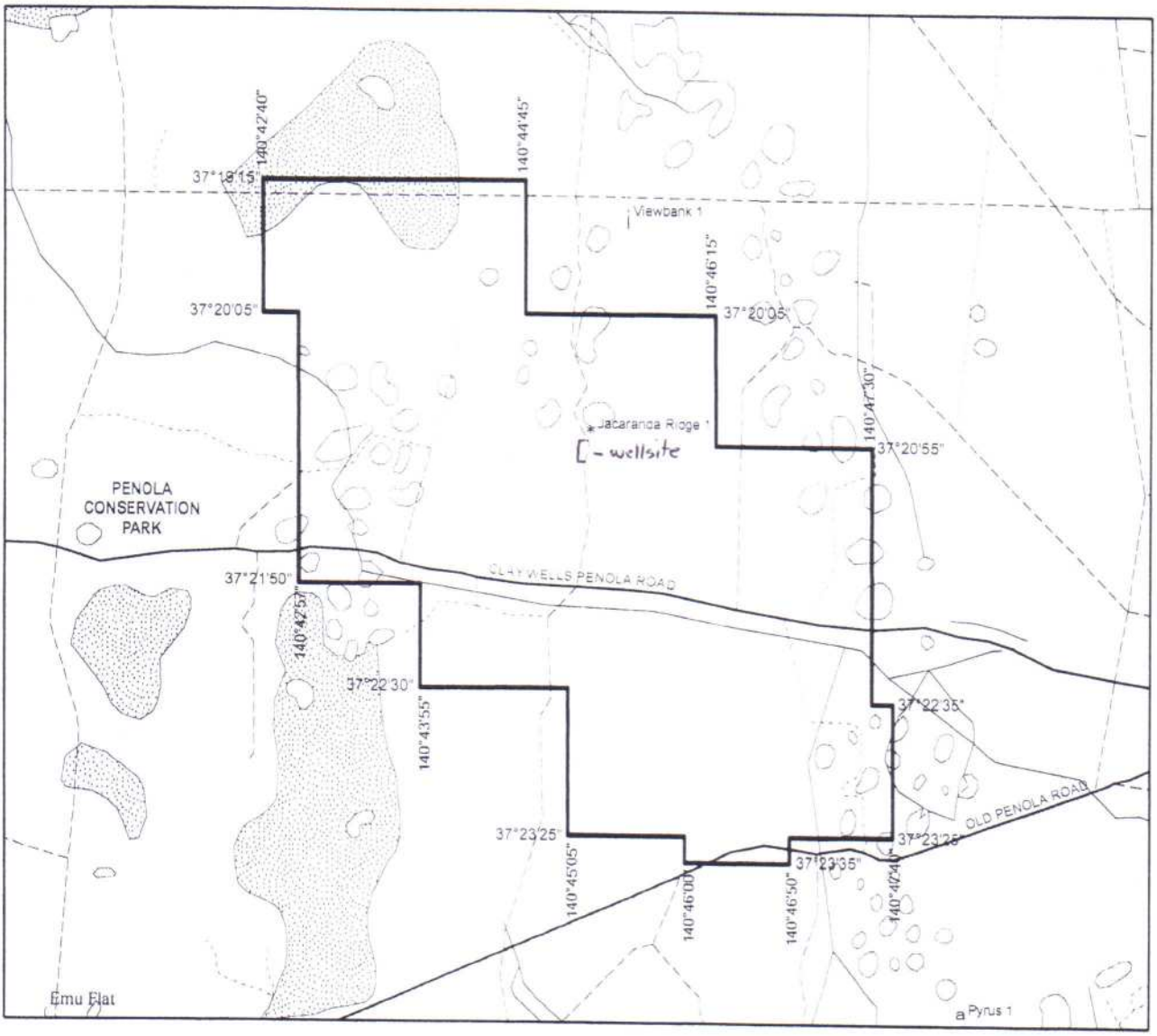
FIGURE 1



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Kilometres

Note: There is no warranty that the boundary of this licence is correct in relation to other features of the map. The boundary is to be ascertained by reference to the Geocentric Datum of Australia (GDA94) and the schedule.

THE PLAN HEREINBEFORE REFERRED TO

PETROLEUM EXPLORATION LICENCE NO: 255

Government of South Australia
Primary Industries and Resources SA

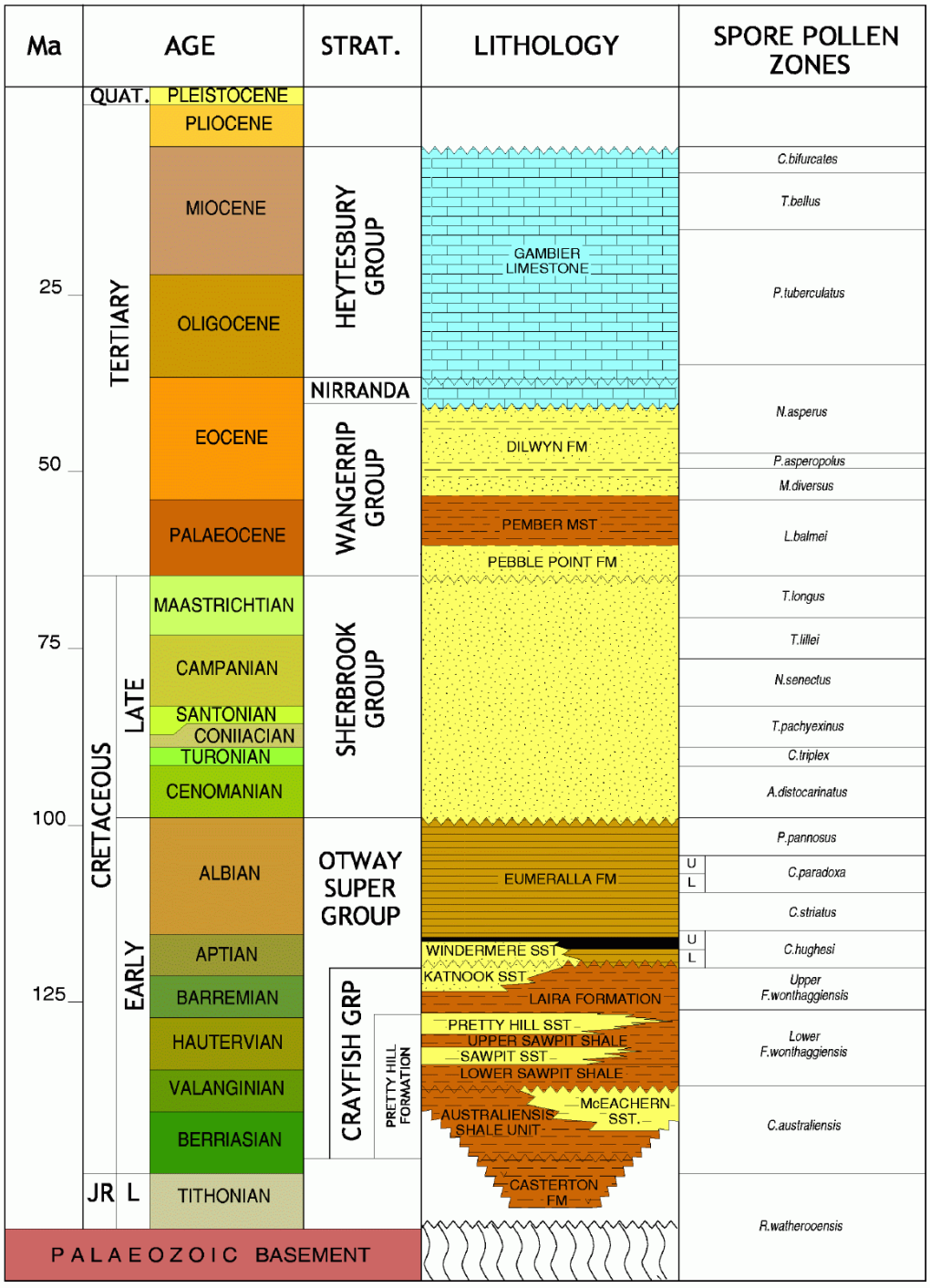
SR 27/2/418

AREA: **36.9** sq km (approx)

Figure 2 – Satellite Image shows JR-1 location on Ey Lane

OTWAY BASIN - PEL 32

STRATIGRAPHY OF THE PENOLA TROUGH, WESTERN OTWAY BASIN



(Permit Summary)

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