2009 Narrabri Coal Seam Gas Project
Bibblewindi Lateral Pilot

Supplementary Review of Environmental Factors

Bibblewindi Shield Laterals

Petroleum Assessment Lease 2
Gunnedah Basin, New South Wales

July 2009
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Location of lands referred to by REF
The proposed activity will occur 4000 metres south/southeast of the Bibblewindi CSG Pilot and approximately 40 kilometres south of Narrabri within the Bibblewindi State Forest (Figure 2.2).

Declaration
Eastern Star Gas Ltd declares the information contained within this document an accurate representation of the existing operational environment and the extent of impacts likely to occur as a result of the proposed development. Eastern Star Gas has endeavoured to characterise the environment within which the project is located and with the assistance of Government agencies and external contractors mitigate environmental impacts and ongoing operational risks.

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1 EXECUTIVE SUMMARY
This supplementary Review of Environmental Factors (REF) has been prepared by Eastern Star Gas Ltd for further the development of the Bibblewindi lateral CSG pilot within Petroleum Assessment Lease 2. It is proposed that additional two lateral arms comprising a total of four wells be drilled and completed on the flanks of the existing Bibblewindi Lateral Pilot to assist in the effective operation of the production pilot.

The Bibblewindi lateral pilot is located approximately 4000 metres to the south/southeast of the Bibblewindi CSG pilot and 40 kilometres south of the Narrabri Township.

The total area of land impacted by this activity will approximate 5.2 hectares based upon four separate drill pads of a maximum 100 metres by 80 metres (3.2ha) and up to 2km of access tracks into each site (2ha). The proposed activity will not create any permanent detrimental impacts on native vegetation resources in this locality nor on any threatened species of flora or fauna or known endangered ecological communities. The shrub and understorey vegetation has an inherent resilience to short term impacts and recovers well within a reasonable timeframe where adequate strategies to protect regeneration potential are observed.

Prior to the activity commencing, cultural heritage surveying with the assistance of representatives of the Pilliga Forest Aboriginal Land Management Committee will be conducted to ensure that no sites of significance are impacted by the proposed activity. Consultation with existing heritage databases indicate that the proposed locations do not present any risk to known sites of neither aboriginal heritage significance nor areas more likely to contain such sites.

In terms of greenhouse gas impacts, it is to be noted that all CSG generated by the proposed pilot will be consumed in situ or otherwise collected and transported via gathering system to Bibblewindi and/or Wilga Park for consumption.

The provision of this document fulfils the company’s responsibility under Part 5, Section 111 of the Environmental Planning and Assessment Act 1979 in which the determining authority (NSW Department of Primary Industries – Mineral Resources) is required to consider the likely and actual environmental impacts of the activity. It is the opinion of Eastern Star Gas that the impacts created by the proposed activity when considered alongside the mitigation strategies in place will create no long term effect on the localised and regional environment.
2 INTRODUCTION

This supplementary Review of Environmental Factors (REF) has been prepared by Eastern Star Gas Ltd (ESG) for the continuing development of the Narrabri Coal Seam Gas (CSG) project in Petroleum Assessment Lease 2 (PAL 2) northern NSW (Figure 2.1).

Figure 2.1: Eastern Star Gas Exploration Licences, NSW & Victoria

2.1 Location

The lateral pilot is located approximately 4000 metres south/southeast of the existing Bibblewindi CSG pilot on Little Tighes Road. The proposed laterals are approximately 400 metres from existing production wells and are 1600 metres in length.
Figure 2.2 Location of the proposed lateral pilot within PAL 2

Table 2.1: Location of the proposed dewatering wells in the lateral pilot

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Well Type</th>
<th>Easting (m)</th>
<th>Northing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bibblewindi-21H</td>
<td>lateral</td>
<td>754169</td>
<td>6605606</td>
</tr>
<tr>
<td>Bibblewindi-27</td>
<td>vertical</td>
<td>755476</td>
<td>6604684</td>
</tr>
<tr>
<td>Bibblewindi-28H</td>
<td>lateral</td>
<td>752899</td>
<td>6604208</td>
</tr>
<tr>
<td>Bibblewindi-29</td>
<td>vertical</td>
<td>754151</td>
<td>6603222</td>
</tr>
</tbody>
</table>

Coordinate System: GDA 94/Zone 55

2.2 Description of the Activity and Justification

The proposed lateral pilot installation illustrated in Figure 2.2 to which the following REF refers includes the following activities (in general order of occurrence):

- The preparation of four (4) drill pads to a maximum of 100 metres by 80 metres at the locations indicated;
- The drilling of two (2) Vertical Production Wells (VPW) at Bibblewindi-27 and 29;
• The drilling of two (2) Horizontal Build Wells (HBW) at Bibblewindi-21H and 28H;
• The installation of gas and water gathering system linking Bibblewindi 29 and 27 to 13 and 17 respectively;
• The operation of the CSG production pilot; and
• The incorporation of the additional production wells into the approved water and operations management plan.

Figure 2.3 illustrates where the additional lateral arms are to be drilled in relation to the current lateral pilot wells.

**Figure 2.3: Conceptual representation of the proposed CSG Lateral Pilot**
Production has only recently commenced from the Bibblewindi Lateral Pilot, and early results have been very positive. High rates of water recovery and the early onset of gas suggests that the fracture network and high permeability of the Bohena Coals lends itself to the lateral completion technique and further communication between the production wells through the fracture system has also been confirmed. However, the increased volumes of water flowing into the pilot wells from adjacent coals are limiting the ability to effectively reduce the pressure between the lateral wells. It has therefore been proposed to install an additional lateral arm on the northeast and southwest flanks of the lateral pilot to shield the wells from an excessive inflow of water. This will assist each of the inner lateral wells to effectively reduce the hydrostatic pressure and facilitate the production of gas.

2.3 Alternatives

The only method of testing for subsurface accumulations of petroleum (including gas) is to drill a petroleum exploration well. Surface mapping, gravity, magnetics, seismic reflection and other forms of geophysical exploration are only able to provide an interpretative view of geological parameters and the discovery of petroleum relies on drilling. The discovery of a petroleum accumulation by the drilling of an exploration well generally requires that the hydrocarbon bearing Area/s be evaluated by flow testing prior to a decision being made as to the commercial significance of that discovery.

The main objective of the Narrabri CSG project to date has been exploration for and appraisal of the two coal seam reservoirs underlying PAL 2. The drilling and fracture stimulation program completed at Bibblewindi in 2006 was successful in achieving greater deliverability of gas utilising a more aggressive dewatering program from the closely spaced wells in the pilot.

The 2007/2008 corehole program carried out across PAL 2 has been successful in gaining a significant quantity of technical data on the quality of the CSG reservoir including a number of areas with high potential to support further production development activities. Bibblewindi-11C completed as part of this program, not only contributed to the recent reserves upgrade but also identified a thick and well developed coal sequence trending off towards the south east hence the arrangement of the lateral pilot as shown in Figure 2.2.

2.4 Current Activities:

The ongoing development of CSG resources in PEL 238 and PAL 2 represents the main focus of company activity at this time. The operation of a total of 18 production wells across PAL 2 Project area continues to provide important technical data on the coal reservoir and its production capabilities.
Core hole drilling across PAL 2 and PEL 238 has continued throughout 2008/09 and is currently focusing on new prospect surrounding Narrabri. Edgeroi 1 is located approximately 12 kilometres north of Narrabri and was completed in late 2008 with positive results in locating additional gas bearing coals in a previously unexplored area of PEL 238. Subsequent CSG exploration core drilling has been undertaken at Blue Hills 1 (5 kilometres west of Edgeroi-1) and Moree 4 (PEL 427) and Kurrabooma 1 (PEL 428) and the rig has now moved back into the Narrabri Region at Coonarah 9.

The drilling of the Bibblewindi lateral pilot 4 kilometres southeast of the Bibblewindi CSG pilot has been completed as has the construction of the water/gas gathering system linking the new production wells to existing water and gas management facilities. Construction of the gas pipeline linking the Bibblewindi and Bohena CSG pilots to the Wilga Park power station has recently been completed.
3 THE EXISTING ENVIRONMENT

The information contained in this section has been collated from a range of sources and characterises the existing environment around the proposed lateral pilot.

3.1 Topography

The lateral pilot is located in the Bibblewindi State Forest, to the east of Bohena Creek and is surrounded on its east, west and south by the Pilliga East State Forest. Indicative elevations of this area approximate 280 metres Average Height Datum (AHD) and generally fall away to the west and northwest.

3.2 Drainage

The lateral pilot lies within the Namoi River Basin Catchment, one of the main tributaries of the Barwon Darling River System. The Namoi River Basin covers an area of 43 000 square kilometres and incorporates the regions major centres of Tamworth, Gunnedah, Narrabri and Walgett (Corkery and Assoc., 2004).

The Bohena Creek sub-catchment covers an area of 1500 square kilometres, and is the major drainage feature in the area. It is ephemeral in nature and flows only with significant rainfall in the catchment further south of PAL 2 towards the north western margins of the Warrumbungle Ranges.

3.3 Land Use

The lateral pilot will be wholly located upon lands designated Crown Lands State Forest under the Forestry Act 1916.

The Brigalow and Nandewar Community Conservation Area Act 2005 redefined the land classification for the Pilliga State Forests system. The objects of this Act are to reserve forested land in the Brigalow and Nandewar sub regions for the maintenance of Community Conservation Areas (CCA) which provide a mechanism for the permanent conservation of land, protection of areas of natural and cultural heritage significance to Aboriginal people and sustainable forestry, mining and other appropriate uses. The lateral pilot is located within a zone four CCA which wholly permits the continued exploration for and assessment of petroleum resources.
3.4 Cultural Heritage

Throughout the development of the Narrabri CSG Project, the existing knowledge base on the extent of Aboriginal inhabitation across the region has steadily grown. Cultural heritage surveying has occurred frequently since ESG commenced the active development of PEL 238’s CSG reserves in 2004.

Survey efforts carried out to date have included numerous site specific cultural heritage investigations for the installation of production and core hole well pads across PAL 2, the surveying of the area impacted by the installation of the Bibblewindi CSG Pilot and water management facility and the pipeline linking the Bibblewindi and Bohena CSG pilots with the Wilga Park Power Station. The surveys have been directed by Mr Eddie Trindall, cultural heritage advisor and representative of the Pilliga Forest Aboriginal Management Committee.
The existing archaeological record for the region consists of various sources of cultural heritage information including the National Park and Wildlife Service (NPWS) Aboriginal Heritage Information Management System (AHIMS) database, the Forestry NSW/ Pilliga Forest Aboriginal Management Committee (PFAMC) site register and a number of published reports on the Aboriginal inhabitation of the Pilliga Forests. These sources corroborate on the understanding that Pilliga Forests were frequently utilised by Aboriginal communities for a range of important uses and that a number of significant sites have been identified during subsequent survey efforts.

The information contained within the various published reports provides the basis for the cultural heritage investigations for the lateral pilot.

**Figure 3.2: Site of significance within the Pilliga State Forests (WRAC in Trindall, 2007)**
3.5 Flora

The Pilliga East and Bibblewindi State Forest has received little detailed attention in terms of botanical surveying to assess the type and quality of floral composition or the presence of threatened floral species, populations or ecological communities and potential habitat for faunal species. The basis for this lack of structured floristic study of native flora across this region can be attributed to the commercial foundations of vegetation management; a majority of the mapping of native vegetation has been developed for commercial management rather than ecological purposes.

Lindsay (1974) mapped a majority of the northern Pilliga East State Forests as Cypress Pine, Narrowleaf Ironbark and Forest Oak, corroborating with Binns and Beckers (2001) description of “Grassy White Pine-Ironbark” communities containing the same dominant canopy species. Survey efforts carried out by Mr Greg Elks of Idyll Spaces have been successful in adding to the existing knowledge base on the floristic composition of the operational areas in PAL 2.

Preliminary desktop data analysis has been based upon Global Information System (GIS) data provide by Forests NSW (Baradine) on dominant canopy species in the area surrounding the proposed lateral pilot location. Figure 4.3 indicates that the lateral pilot will be located in and amongst vegetation communities dominated by Narrow leaf Ironbark/Bull Oak/White Cypress (COP) and White Cypress/Narrow leaf Ironbark/Bull Oak (PCO), although field verification of these communities cannot identify a consistent difference between the stated dominance of any one species.

The database searches completed prior to the survey indicated that various threatened and endangered ecological communities and threatened flora species have been observed within the Pilliga East State Forest.
Figure 3.3: Dominant canopy species mapping of the area surrounding the proposed lateral pilot

3.6 Fauna

The Pilliga East State Forest has received little detailed attention in terms of systematic fauna surveying to assess the presence of threatened faunal species, populations or ecological communities and potential/actual habitat. Faunal studies completed for the ESG Pilliga Seismic Survey by Smith (2002) suggest that the Pilliga State Forests and Nature Reserve, including Bibblewindi State Forest, form one of the largest forest remnants on the northwest slopes and plains of NSW. The remnant has national, state and regional conservation significance for the protection of biodiversity and threatened species due to its large size (>500 000 hectares), high threatened species diversity and high quality habitat.

Since the initial fauna assessment in 2002, a number of survey efforts have been carried out across PAL 2 during the development of the Narrabri CSG project. The methodology for this impact assessment has focused on the compilation of existing data sources including the Department of Energy and Climate Change (DECC) threatened species records, significant fauna and fauna species habitat records held by Natural Resources and
additional consultation with State and Federal schedules for the protection of threatened species and threat abatement plans.

**Figure 3.4: DECC database records for threatened species of fauna nearby the project site**

Field surveys have generally been carried out on the basis of determining the relationships between habitat types and fauna distribution across the Pilliga and so have utilised the findings of Greg Elks in the various flora survey reports completed to date. Eastern Star Gas has employed Mr Keith Kendall of Kendall & Kendall Ecological Consultants to complete detailed fauna assessments on a number of project related developments.

The impact assessments carried out to date and recent database searches indicate that various threatened and endangered species have been observed within the Pilliga East State Forest. Many of the observations shown in Figure 4.4 were registered by Kendall at the completion of the survey efforts carried out for ESG in the past 4 years (Kendall, 2005 and Kendall 2006).
3.7 **Land Use**

The land in the general area surrounding the lateral pilot is predominantly native woodland vegetation within the Bibblewindi State Forest. This area is made up of forest types 190 (White Cypress Pine-Brown Bloodwood) and type 189 (White Cypress Pine-Narrow leaved Ironbark) and terms of commercial forestry operations is considered of low quality/low productive capacity.

The occupation of Forestry Lands for the purposes of petroleum exploration and production is subject to an occupation permit (pending as at 01/06/08) under the *Forestry Act* 1916. Eastern Star Gas will engage the assistance of Forests NSW in assessing the commercial value of forestry resources located on or adjacent to operational areas including the proposed lateral well pads.

All works conducted in this regard are done so with the endorsement of Forests NSW Baradine.
4 ASSESSMENT AND PREDICTION OF ENVIRONMENTAL IMPACTS

The assessment and prediction of the likely environmental impacts associated with the proposed activity is provided by ESG in response to Section 111 of the Environmental Planning and Assessment Act 1997. The level of detail contained in this REF document was determined by factoring together the intensity of the activity and the relative sensitivity of the environment in which the activity will occur.

The following table summarises how the proposed amendments to the original lateral pilot proposal will impact on key environmental factors.

<table>
<thead>
<tr>
<th>Factor</th>
<th>REF Section</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Land</strong></td>
<td>4.3.1</td>
<td>Access: Access to the four additional well sites will most likely require new roads to be installed from the nearest existing well pads (see Figure 2.2). Minimising the clearance of vegetation for this purpose where possible, the new access to the well sites will result in a maximum of 2km of new access being created. This activity will occur in consultation with Forestry NSW.</td>
</tr>
<tr>
<td></td>
<td>4.3.2</td>
<td>Well Pad Construction: The proposed activity will require the installation of four additional well sites of 0.8 ha (cumulative area 3.2 ha) at the locations described in section 2.1.</td>
</tr>
<tr>
<td></td>
<td>4.3.3</td>
<td>Drainage: The proposed activity will not result in any impacts not previously characterised. Drainage installed onsite to direct meteoric water away from the main work areas and mud sumps will have silt/sediment containment devices installed to minimise incidental loss of soil materials into the surrounding forest zone.</td>
</tr>
<tr>
<td></td>
<td>4.3.4</td>
<td>Initial Rehabilitation and Site Restoration: Rehabilitation and restoration of the Bibblewindi lateral location will follow the strategy defined in the REF. When drilling operations cease, the 100 metre by 80 metre site will be fenced with an appropriate 5 strand (or equivalent) stock proof fence and lockable gate.</td>
</tr>
<tr>
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<td>4.3.5</td>
<td>Subsurface Impacts: The proposed drilling activity will utilise the same subsurface protection processes as all previous activities. There will be no variation to the drilling program.</td>
</tr>
<tr>
<td>Component</td>
<td>Section</td>
<td>Description</td>
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</tr>
<tr>
<td>Air</td>
<td>4.1.1</td>
<td>Fugitive Dust Generation: The proposed activity will not result in any impacts not previously characterised. Sufficient mitigation plans are in place to minimise the generation of fugitive dusts. Noise Impacts: The proposed activity will not result in any impacts not previously characterised. Each of the proposed sites is in excess of 10km from any sensitive receptor and the likelihood of impacts very low.</td>
</tr>
<tr>
<td>Water</td>
<td>4.2.1</td>
<td>Impacts on localised water courses: No impacts are likely to be introduced onto localised creeks and water courses through the expanded program. The issue of mud containment and potential risks of land and groundwater contamination (e.g. percolation through walls/base of sump, accidental discharge (overtopping) during rainfall etc.) has been reviewed along with risk assessments carried out by Lucas/ESG prior to the commencement of drilling: Source: Water sourced will be from the sites stated in the REF.</td>
</tr>
<tr>
<td>Flora</td>
<td>4.5.1</td>
<td>Background Information: As stated in REF. Assessment of Significant Effects: The impacts on native vegetation characterised in the REF will be increased through the installation of four well pads (3.2ha) and up to 2km of access (2ha) resulting in a cumulative increase in vegetation clearance of 5.2 ha. The impacts likely to result from the proposed activity do not significantly differ from those described in the REF. Weed Species: As stated in REF. See following section 4.1 for discussion</td>
</tr>
<tr>
<td></td>
<td>4.6.1</td>
<td></td>
</tr>
</tbody>
</table>
| Fauna | Background Information: As stated in REF.  
Assessment of Significant Effects: The impacts on actual or potential habitat characterised in the REF will be increased through the installation of four well pads (3.2ha) and up to 2km of access (2ha) resulting in a cumulative increase in habitat clearance of 5.2 ha.  

The impacts likely to result from the proposed activity do not significantly differ from those described in the REF.  

**See following section 4.2 for discussion** |
<table>
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<tr>
<td>Cultural Heritage</td>
<td>4.7</td>
</tr>
</tbody>
</table>
| Background Information: As stated in REF.  
Assessment of Significant Effects: No impacts contrary to those characterised in the REF are likely. Work area clearances to be carried out across all proposed developments in consultation with the Narrabri Local aboriginal Land Council and Pilliga Forest Aboriginal Management Committee heritage advisors. |
| Waste Management | 4.4.1 |
| Drilling Fluid and Cutting Disposal: As stated in REF |
| 4.4.2 |
| Putrescible Waste Disposal: As stated in REF |
| Greenhouse Gas Impacts | 5.9 |
| Gas Management: No venting of any production gases planned. Gathering system installed to collect and transfer gas for consumption. |
| Conclusions | 10 |
| ESG remain confident that the proposed change to include a vertical production well will not create any long term, detrimental environmental impacts likely to alter the operational environment or the surrounding region. It is the opinion of ESG that the impacts created by the proposed activity when considered alongside the mitigation strategies in place will create no long term effect on the localised and regional environment. |
4.1 Project Specific Flora Assessment

The basis for the assessment of impacts on the native flora species and vegetation communities posed by the extension of the lateral pilot is the existing knowledge base used to formulate the flora impact assessments carried out to date. Survey reports from the following field surveys have been consulted and are considered sufficient to provide an understanding of the actual, likely and potential impacts associated with the proposed activity:


4.1.1 Background Information

The various databases available suggest that a number of threatened communities and species have been identified within the Narrabri region and the Pilliga State Forests and Nature Reserve.

Elks (2006, 2007) provides a comprehensive review of existing threatened species records across various State and Commonwealth registers (*Table 4.1*).
Table 4.1: Threatened communities, species and habitats occurring in the Pilliga State Forests

<table>
<thead>
<tr>
<th>Database Search</th>
<th>Threatened Community/Species/Habitat</th>
</tr>
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<tbody>
<tr>
<td><strong>EPBC (2000) Act threatened communities</strong></td>
<td><strong>Brigalow</strong> (Acacia harpophylla dominant and co-dominant). Endangered community known to occur with the study area <strong>Grassy White Box Woodlands</strong> endangered community may occur within area locality</td>
</tr>
<tr>
<td><strong>EPBC (2000) Act threatened species</strong></td>
<td><strong>Bertya</strong> sp. Cobar Coolabah (v) <strong>Cadellia pentastylos</strong> (v) <strong>Digitaria porrecta</strong> (e) <strong>Diuris sheaffiana</strong> (v) <strong>Goodenia macbarronii</strong> (v) <strong>Lepidium aschersonii</strong> (v) <strong>Philotheca ericifolia</strong> (v) <strong>Pterostylis cobarensis</strong> (v) <strong>Rulingia procumbens</strong> (v)</td>
</tr>
<tr>
<td><strong>NSW TSC Act Endangered Ecological Communities</strong></td>
<td>- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepain, Murray-Darling Depression, Riverina and NSW South western Slopes  - Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions  - Coolibah - Black Box Woodland of the northern riverine plains in the Darling Riverine Plains and Brigalow Belt South bioregions  - Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions  - Cadellia pentastylos (Ooline) community in the Nandewar and Brigalow Belt South IBRA regions  - McKies Stringybark/Blackbutt Open Forest in the Nandewar and New England Tableland Bioregions  - Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions  - White Box Yellow Box Blakely's Red Gum Woodland</td>
</tr>
<tr>
<td><strong>Threatened species records within 30km (centroid)</strong></td>
<td><strong>Bertya</strong> sp. Cobar-Coolabah Vulnerable <strong>Lepidium aschersonii</strong> Vulnerable <strong>Philotheca ericifolia</strong> Vulnerable <strong>Rulingia procumbens</strong> Vulnerable</td>
</tr>
<tr>
<td><strong>Bionet search (TSC Act listed species) for Pilliga East and Bibblewindi SF</strong></td>
<td><strong>Goodenia macbarronii</strong> Vulnerable <strong>Philotheca ericifolia</strong> Vulnerable <strong>Rulingia procumbens</strong> Vulnerable</td>
</tr>
<tr>
<td><strong>Threatened species known or predicted in the Pilliga Outwash CMA Subregion</strong></td>
<td><strong>Cyperus conicus</strong> (e) <strong>Dichanthium setosum</strong> (v) <strong>Swainsona murrayana</strong> (v) <strong>Tylophora linearis</strong> (e)</td>
</tr>
</tbody>
</table>

In summary, communities listed as threatened under the relevant state and federal jurisdictions are known to occur on the relevant 1:100,000 mapsheets or likely to occur within the locality of the shield laterals.
The dominant canopy species mapping sourced from Forestry NSW references two communities, Narrow leaf Ironbark/Bull Oak/White Cypress (COP) and White Cypress/Narrow leaf Ironbark/Bull Oak (PCO) as occurring at or around the proposed location, although field verification of these communities indicates no consistent difference between the stated dominance of any one species. Table 4.2 summarises the community assemblage which has undergone field verification at various locations across PAL 2.

Table 4.2: Summary of the *E. crebra* Dry Open Forest community

<table>
<thead>
<tr>
<th>Vegetation Community</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Eucalyptus crebra</em> Dry Open Forest</td>
<td>Narrow leaved Ironbark is always present and usually dominant. Other common species include White pine <em>Callitris glaucocephyla</em> and bull oak <em>Allocasuarina luehmannii</em>. Midstratum of hopbushes <em>Dodonea</em> spp, <em>Calytrix tetragona</em>, wattles <em>Acacia</em> spp, broom and bitter pea <em>Daviesia genistifolia</em>. Ground layer most diverse, with mat-rushes <em>Lomandra</em> spp, sawsedge <em>Gahnia aspera</em>, flax lily <em>Dianella longifolia</em>, wild onion <em>Bulbine semibarba</em>ita, <em>Laxmannia gracilis</em>, <em>Calandrinia</em> spp, <em>Goodenia</em> spp, bluebells <em>Wahlenbergia</em> spp, cutleaf daisy <em>Brachycome multifida</em> and the fern <em>Cheilanthes austrotenuifolia</em> very common. Open stands of narrow leaved ironbark at around 20m tall with or without white cypress and bull oak over the midstratum with scattered stands or sparse individual sclerophyllous shrub. Sparse to mid-dense ground layer of forbs, grasses and graminoids. Community occurs on silty sand with adequate drainage.</td>
</tr>
</tbody>
</table>

There are various other species assemblages common to the Pilliga East SF that occur within close proximity to the proposed site of the shield lateral extension. Redgum (*Eucalyptus sp.*), Rough Barked Apple (*Angophora floribunda*), Brown Bloodwood (*Eucalyptus trachyphloia*) dominate in smaller areas where substrate variation and micro climatic factors most often influence the species composition. The proposed activity will not impact on these species nor the understorey associations common to them.

4.1.2 Assessment of Significant Effects

The assessment of significant effect on threatened species, populations or ecological communities or their habitats as per S5A (2) of the *Environmental Planning and Assessment Act 1979*, as applied to the shield lateral extension are such that:

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
Flora surveys conducted across the project area have found no evidence of any threatened species, populations, communities or critical habitat associate with the Narrow leafed Ironbark Dry Open Forest described by Elks (2007). Given the limited impact of the activity, it is unlikely that this proposal will have any adverse effects on the life cycle of any threatened species such that a viable local population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Flora surveys conducted across the project area have found no evidence of any threatened species, populations, communities or critical habitat associate with the Narrow leafed Ironbark Dry Open Forest described by Elks (2007). Given the limited impact of the activity, it is unlikely that this proposal will have any adverse effects on the life cycle of any threatened species such that a viable local population is likely to be placed at risk of extinction.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No evidence of any endangered ecological community or critically endangered ecological community has been identified during the flora surveys,

(i) the proposed activity is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The *E. crebra* dry open forest community within which the proposed extension activity is to occur is the dominant vegetation community in the Pilliga East and Bibblewindi State Forests and is the most widespread of the White cypress forestry types occupying around 40 percent of the total area of managed cypress forests (Forestry Commission in Elks, 2007).
d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

Approximately 40,000 hectares of area mapped as the vegetation class ‘Pilliga Outwash Dry Sclerophyll Forest’ and a further 20,000 hectares of the floristically similar ‘Western Slopes Dry Sclerophyll Forest’ occurs in the locality but the habitat has been modified by grazing, modified fire regimes, and forestry activities (Elks, 2006).

The area impacted by the proposed extension activity represents a very small percentage of the dominant vegetation community mapped within PAL 2, and will impact on less than 0.01 percent of habitat of similar quality in the locality.

There is no discernible difference in ecological integrity between habitat to be affected and habitat to remain.

The small scale and spatial arrangement of the proposal is such that habitat is not likely to become fragmented or isolated from other areas of habitat.

The apparent absence of threatened flora species from the study area and the large areas of similar habitat in the region and locality suggest that the habitat to be removed is unlikely to be of importance for the long-term survival of the threatened species *Diuris tricolor*; Goodenia macbarronii; Philotheca ericifolia; Rulingia procumbens or Tylophora linearis in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DEC does not occur in the study area. The proposed extension activity is unlikely to have any adverse effect on critical habitat, either directly or indirectly.
f) **Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No recovery plans or threat abatement plans are currently listed for *Diuris tricolor, Goodenia macbarronii, Philotheca ericifolia, Rulingia procumbens* or *Tylophora linearis*.

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**g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

The proposed action will involve the key threatening process ‘Clearing of native vegetation’. It has the potential to contribute to the impact of ‘Invasion of native plant communities by exotic perennial grasses’. However this potential is likely to be low as most invasive exotic perennial grasses have been selected for their productive capacity in managed pasture and are likely to be poorly adapted for the relatively infertile sandy soils characteristic of forest in the study area. Clearing and weed competition are threats listed for *Philotheca ericifolia* and *Diuris tricolor*. Weed invasion is listed as a threat for *Goodenia macbarronii*, and soil disturbances area listed as a threat for *Rulingia procumbens*.

The importation of weed and pest species onto site via seed and vegetative material is mitigated through the wash down of vehicles in Narrabri prior to entry to Forestry Lands (see section 4.1.4).

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**4.1.3 Conclusions**

Given consideration of the above assessment, and in particular the small area of vegetation to be removed, both in absolute terms and in terms of the habitat for threatened species in the locality and region, and the apparent absence of threatened flora species from the subject site and study area, it is concluded that a Species Impact Statement would not be required.

Endangered communities listed in the NSW Threatened Species Conservation Act and Environmental Protection and Biodiversity Conservation Act (Cwth) have yet to be detected in the area and are assessed as unlikely to occur there.

Habitat requirements for five threatened flora species may be met in the study area, but as threatened flora species have not been previously recorded in the study area and have not been were not detected in surveying carried out to date, the possibility that they do occur there is considered to be low.
Given that the clearing of vegetation has been reduced to the smallest area possible and is spread across the landscape at known locations, it is considered that:

- the proposed activities would not be likely to have an adverse effect on the life cycle of a threatened flora species such that a viable local population is likely to be placed at risk of extinction;
- the extent to which habitat is likely to be removed or modified as a result of the action proposed is not likely to be significant;
- habitat is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed action;
- the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of Threatened flora species in the locality is not likely to be significant, and
- the action proposed is not inconsistent with the objectives or actions of a recovery plan or threat abatement plan.

### 4.1.4 Weed Species

The risk of introduction of weeds and pests species to the site via the entry of vehicles and plant will be mitigated by the wash down of all vehicles, plant and ancillary equipment new to the region at the ESG maintenance yard in Narrabri. This will entail the complete removal of soils and organic matter from wheels, wheels arches, chassis and other sites capable of holding any such material.

### 4.2 Project Specific Fauna Assessment

The assessment of impacts on the native fauna posed by the shield lateral extension relies on the existing knowledge base on fauna impact assessments carried out to date. Survey reports from the following field surveys have been consulted and are considered sufficient to provide an understanding of the actual, likely and potential impacts associated with the proposed extension activity:

- **Kendall, K. (2005).** Fauna Study PEL238 Coal Seam Gas Project - Bibblewindi Nine Spot, Kendall & Kendall Ecological Consultants, West Kempsey NSW
- **Kendall, K. (2006).** Fauna Study PEL238 Coal Seam Gas Project - Water Management Facility, Kendall & Kendall Ecological Consultants, West Kempsey NSW
- **Kendall, K. (2007).** Fauna Study PEL238 Narrabri Coal Seam Gas Project Pipeline, Kendall & Kendall Ecological Consultants, West Kempsey NSW
- **Smith, A. 2002.** PEL238 Pilliga East Seismic Survey: Fauna Review, AUSTECO Environmental Consultants, Armidale, NSW
4.2.1 Background Information

Records of threatened species, populations or communities as listed under the Threatened Species Conservation Act 1995 (TSC Act) known to occur within 5 kilometres of the study area were extracted from the New South Wales Wildlife Atlas database for the Baan Baa, Baradine, Narrabri and Wee Waa 1:100,000 map sheets. Under these search parameters, eight TSC Act threatened species recorded within 5 kilometre of the study area on the DEC wildlife atlas; they include:

- Glossy Black-Cockatoo *Calyptorhynchus lathami*
- Barking Owl *Ninox connivens*
- Brown Treecreeper *Climacteris picumnus*
- Speckled Warbler *Pyrrholaemus sagittatus*
- Painted Honeyeater *Grantiella picta*
- Hooded Robin *Melanodryas cucullata*
- Koala *Phascolarctos cinereus*
- Black-striped Wallaby *Macropus dorsalis*
- Pilliga Mouse *Pseudomys pilligaensis*

TSC Act threatened fauna species not recorded within 5 kilometre of the Study Area but known or predicted to occur in the Pilliga Outwash sub regions of the Namoi CMA and based on habitat requirements considered as possible or likely to occur on the study area:

- *Ninox connivens* Barking Owl
- *Hamirostra melanosternon* Black-breasted Buzzard
- *Melithreptus gularis gularis* Black-chinned Honeyeater (eastern subspecies)
- *Macropus dorsalis* Black-striped Wallaby
- *Burhinus grallarius* Bush Stone-curlew
- *Stagonopleura guttata* Diamond Firetail
- *Cercartetus nanus* Eastern Pygmy-possum
- *Anomalopus mackayi* Five-clawed Worm-skink
- *Pachycephala inornata* Gilbert's Whistler
- *Calyptorhynchus lathami* Glossy Black-cockatoo
- *Nyctophilus timoriensis* Greater Long-eared Bat (south eastern form)
- *Falco hypoleucos* Grey Falcon
- *Pomatostomus temporalis temporalis* Grey-crowned Babbler (eastern subspecies)
- *Melanodryas cucullata cucullata* Hooded Robin (south-eastern form)
- *Phascolarctos cinereus* Koala
- *Chalinolobus picatus* Little Pied Bat
- *Tyto novaehollandiae* Masked Owl
- *Grantiella picta* Painted Honeyeater
- *Hoplocephalus bitorquatus* Pale-headed Snake
- *Pseudomys pilligaensis* Pilliga Mouse
- *Aepyprymnus rufescens* Rufous Bettong
• Dasyurus maculatus Spotted-tailed Quoll
• Lophoictinia isura Square-tailed Kite
• Petaurus norfolcensis Squirrel Glider
• Neophema pulchella Turquoise Parrot

EPBC Act significant species whose mapped habitat may occur within 10 kilometres of the study area and have been subsequently assessed as possibly occurring within the study area:

**Birds**
- Swift Parrot Lathamus discolor
- Superb Parrot Polytelis swainsonii
- Regent Honeyeater Xanthomyza phrygia
- White-throated Needletail Hirundapus caudacutus
- Rainbow Bee-eater Merops ornatus
- Regent Honeyeater Xanthomyza phrygia

**Mammals**
- Large Pied Bat Chalinolobus dwyeri
- Eastern Long-eared Bat Nyctophilus timoriensis
- Pilliga Mouse Pseudomys pilligaensis

**Reptiles**
- Five-clawed Worm-skink Anomalopus mackayi
4.2.2 Field Surveying and Assessment Reporting

Field surveys carried out to date in PAL 2 have occurred on four separate occasions, the full results of which are contained within the aforementioned impact assessment reports. In summary, the impact assessments conducted to date conclude that:

- Critical habitat as listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation does not occur in the study area;
- No threatened ecological fauna communities or fauna populations listed on the schedules of the TSC Act occur in the study area;
- The cumulative study area is not potential habitat as defined in SEPP44 (Koala Habitat Protection);
- Many of the species identified during surveying are avian species with sufficiently large home ranges that, when combined with the extent of the regionally common *E. crebra* dry open forest habitat identified by Elks, is unlikely to result in any long term, significant impacts any species or community in the Pilliga East State Forests;
- Activities on this scale are such that habitat is not likely to become fragmented or isolated from other areas of habitat within the Pilliga Scrub;
- Sufficient mitigative action can be taken to limit the impact of the proposal on the hollow dependant species identified by Kendall;
- The proposed activity will not impact on habitat favoured by the Pilliga Mouse *Pseudomys pilligaensis* which includes recently burnt gullies, areas dominated by broombush and areas containing an understorey of kurricabah (*Acacia burrowii*) with a bloodwood (*Corymbia trachyphloia*) overstorey; and
- Habitat for the listed microbats is widespread and common in the study area, locality, and region.

4.2.3 Assessment of Significance

The assessment of significant effect on threatened species, populations or ecological communities or their habitats as per S5A (2) of the *Environmental Planning and Assessment Act 1979*, as applied to the shield laterals are such that

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Fauna surveys conducted across the project area suggest that no threatened species, populations, communities or critical habitat are at risk from the proposed activity. Given the limited impact of the activity, it is unlikely that this proposal will have any adverse effects on
the life cycle of any threatened species such that a viable local population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Flora and fauna surveys conducted across the project area have found no evidence of any threatened species, populations, communities or critical habitat or species/partial remnants that constitute a threatened, population, community or critical habitat. Given the limited impact of the activity, it is unlikely that this proposal will have any adverse effects on the life cycle of any threatened species such that a viable local population is likely to be placed at risk of extinction.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

As all endangered ecological communities are vegetation communities see section 4.1.2 (c) for consideration of this factor.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

Approximately 40,000 hectares of area mapped as the vegetation class ‘Pilliga Outwash Dry Sclerophyll Forest’ and a further 20,000 hectares of the floristically similar ‘Western Slopes Dry Sclerophyll Forest’ occurs in the locality but the habitat has been modified by grazing, modified fire regimes, and forestry activities (Elks, 2006).
The area impacted by the proposed activity represents a very small percentage of the dominant vegetation community mapped within PAL 2, and will impact on less than 0.001 percent of habitat of similar quality in the locality.

There is no discernible difference in ecological integrity between habitat to be affected and habitat to remain.

The small scale and spatial arrangement of the proposal is such that habitat is not likely to become fragmented or isolated from other areas of habitat.

The apparent absence of threatened flora species from the study area and the large areas of similar habitat in the region and locality suggest that the habitat to be removed is unlikely to be of importance for the long-term survival of the threatened species *Diuris tricolor*, *Goodenia macbarronii*, *Philotheca ericifolia*, *Rulingia procumbens* or *Tylophora linearis* in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Critical habitat as listed in the Register of Critical Habitat kept by the Director-General of DEC does not occur in the study area. The proposed activity is unlikely to have any adverse effect on critical habitat, either directly or indirectly.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Fauna surveys conducted across the project area have found no evidence of any threatened species, populations, communities or critical habitat in terms of the action being inconsistent with the objectives or actions of recovery and threat abatement plans.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

With respect to fauna, the removal of vegetation would not be likely significantly impact on the habitat of TSC Act threatened fauna species known to occur within the Study Area or considered as possible occurrences within the Study Area.
4.2.4 Conclusions

Based upon the assessment reports from the various fauna surveying and the available data from State and Commonwealth databases, the likelihood that the proposed shield lateral extension activity will impact on a species of significance is negligible. Furthermore, the extent of removal, modification and fragmentation of vegetation associated with this activity is not considered significant; the cumulative total area cleared within the Pilliga State Forests as a result of the exploration activity to date approximates 50 hectares which represents just 0.002 percent of the current 265 square kilometres project area.

Various strategies for the mitigation of threats to these species are discussed in the survey reports many of which are feasible for incorporation into the operational plans for the shield lateral program. They include:

- Finalising the sites for drill pads and routes for access ways that avoid environmentally sensitive areas and habitat elements,
- Large (>40cm a.b.h.) living or standing dead trees will be left undisturbed unless no practical alternative exists. Pre-felling surveys of habitat trees to occur should this be required.

Eastern Star Gas is confident that the planned activity will not introduce any long term impacts on threatened species or the habitat favoured by them. All attempts to minimise the overall footprint of the activity have been made to date and will continue to be an integral part of the planning process.
5 WATER AND GAS MANAGEMENT

Water and gas produced from the two additional lateral wells will be collected from the well head and transferred to the Bibblewindi water management facility via gathering system.

5.1.1 Gathering system

The gathering system which terminates at the Bibblewindi 17 and 13 pilot wells will be extended out to the Bibblewindi 27 and 29 wells as illustrated in Figure 5.1. Once in operation, water and gas will flow on via separate buried pipes through gathering infrastructure already in place and onto Bibblewindi water management facility.

The gathering system will be located alongside access roads installed prior to the commencement of drilling activities; by combining the working area for the roads and gathering system, the cumulative area of vegetation impacted by the proposal is reduced.

Figure 5.1: Proposed extension to the existing gathering system
5.1.2 GGS Specifications

The following specifications are based upon similar installations undertaken at the current Bibblewindi lateral pilot.

<table>
<thead>
<tr>
<th>GGS Component</th>
<th>Design Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>1 kilometres</td>
</tr>
<tr>
<td>Diameter</td>
<td>Up to 8 inches diameter</td>
</tr>
<tr>
<td>Material</td>
<td>High Density Polyethylene (PE100)</td>
</tr>
<tr>
<td>Static Pressure Rating</td>
<td>To AS4130</td>
</tr>
<tr>
<td>Depth Cover</td>
<td>Minimum 750 millimetres cover</td>
</tr>
<tr>
<td>Construction Right of Way</td>
<td>≈12 metres</td>
</tr>
</tbody>
</table>

5.1.3 Compliance with Australian Standards

The relevant Australian Standard for polyethylene pipes is AS4130; all construction materials, methods and work practices for the proposed GGS installation and operation will be designed in accordance with this and other pertinent standards (AS2885) to the satisfaction of DPI (Minerals and Petroleum).

5.1.4 Approvals Required

In order for the proposed GGS installation to proceed, ESG will seek the approval of DPI (Mineral Resources) in accordance with Part 5 of the Environmental Planning and Assessment Act 1979 and under the terms of Petroleum Assessment Lease No 2.

Consent to construct and operate the upgraded GGS will be sought from Foresty NSW via the amendment of the occupation permit (pending) issued under the Forestry Act 1916.

5.1.5 Construction Activities

The installation of the GGS between the lateral pilot production wells will require the following component activities (Figure 5.2):

Surveying the Gas Flow Line Corridor

The proposed gas flow line corridor will be surveyed by a registered surveyor before any preparatory activities take place. Within the forested area, the corridor will be marked clearly to avoid wherever possible any substantial trees, particularly hollow-bearing trees on or near the proposed route. In the
event the alignment of either the trench or adjoining access road cannot avoid a mature tree, it will be clearly marked for later logging and collection by Forestry NSW.

**Vegetation Clearance**
Within either the Bibblewindi or Pilliga East State Forests, all commercial forestry products will be removed and stored in the closest staging area for later collection by Forestry NSW or its contractors. All hollow-bearing trees felled will be relocated to adjacent bushland. All remaining vegetation will be cleared from the corridor and stockpiled at the extreme edge of the corridor.

**Topsoil Stripping and Stockpiling**
The topsoil within approximately 3 metres of the flow line trench will be stripped to a depth of at least 100 millimetres and stockpiled next to any retained vegetation.

**Trench Surveying**
The location of the trench centreline will be marked within the surveyed corridor.

**Trenching**
The trench will be formed by wheel or chain trencher or excavator. Subsoils will be stockpiled in a windrow adjacent to the topsoil stockpile. In the event that any hard rock or hardpan layer is encountered during trenching, a rock saw or other suitable machinery will be employed to achieve and maintain the correct trench depth.

**Pipe joining and laying**
The lengths of poly pipe will be strung out along the work area and joined together before being lowered into the trench.

**Backfilling and Restoration**
The backfilling of the trench will commence at the completion of the hydro or pneumatic testing procedures. A magnetic identification/warning tape will be installed approximately 300 millimetres above the gas flow line itself. The compaction of the backfilled subsoil will be closely monitored to minimise the chances of subsequent settling within the trench. Additional fill may be imported from suitable local supplies (subject to landholder approval). The topsoil stockpile will only be accessed once the trench has undergone sufficient backfilling and compaction. The resspreading of topsoil will be closely followed by the resspreading of retained vegetative material (where available) to assist in soil stabilisation in accordance with agreed forestry protocols for site rehabilitation.
Figure 5.2: Indicative GGS installation sequence

1. Surveyed GGS route corridor

2. Vegetation mulched and cleared from corridor

3. Trench excavated and GGS installed and backfilled

4. Mulch re-spread across majority of corridor, signage installed and corridor reduced to 3m
5.1.6 Equipment

The equipment utilised in the construction process will vary depending on the contractor employed, however the equipment listed in Table 5.2 should be considered generally required for the proposed activity.

<table>
<thead>
<tr>
<th>Proposed Use</th>
<th>Machinery / Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logging/Vegetation Removal</td>
<td>2-5 x Husqvarna 375 or Stihl 044 Chainsaws</td>
</tr>
<tr>
<td></td>
<td>1x Bell 125 Ultra Logger</td>
</tr>
<tr>
<td>Easement Preparation</td>
<td>1 x Caterpillar D6N Bulldozer</td>
</tr>
<tr>
<td></td>
<td>1 x Mulcher</td>
</tr>
<tr>
<td></td>
<td>1 x Caterpillar 140G Motor Grader</td>
</tr>
<tr>
<td></td>
<td>1 x Hyundai 210C Excavator</td>
</tr>
<tr>
<td></td>
<td>1 x Bobcat Skid Steer Loader</td>
</tr>
<tr>
<td>Pipe / Gas Flow Line Trenching</td>
<td>1 x Trenchor 760 HDA Chain Trencher or equiv.</td>
</tr>
<tr>
<td>Gas Flow Line Installation</td>
<td>1 x Flowline installer</td>
</tr>
<tr>
<td>Transport/Support</td>
<td>2 x Prime Movers &amp; Low Loaders</td>
</tr>
<tr>
<td></td>
<td>1 x 10 000L Water Cart</td>
</tr>
<tr>
<td></td>
<td>12 x Light 4WD Vehicles (Patrol/LandCruiser or equiv.)</td>
</tr>
<tr>
<td></td>
<td>1 x Off-road forklift/front-end loader</td>
</tr>
<tr>
<td></td>
<td>2 x Truck mounted HiAb flat-bed trucks</td>
</tr>
</tbody>
</table>

The equipment utilised in the construction process will vary depending on the contractor employed, however the equipment listed in table 1 should be considered the upper limits of requirements and any variation is likely result in a considerable reduction in overall equipment requirements.

5.2 Produced Water Treatment

The produced water from the additional lateral wells described in this REF, will be treated in the via the water treatment plant at Bibblewindi-1.

5.3 Rehabilitation

The rehabilitation of the GGS corridor will commence as soon as practicable after the construction activities have ceased. The main objective of the rehabilitation program will be to return a maximum area of the lands disturbed by the proposed GGS installation back to previous land use as soon as practicable.
Approximately 70 percent of the flow line corridor will be encouraged to regenerate naturally from seed stock contained within the topsoils and mulched material retained from the clearance process or as sought by the discretion of the land holder. The remaining 30 percent will be retained as access between the various well sites and water management facilities.

The retention and use of the mulch is expected to provide a means of encouraging vegetation regrowth across this area where soils are less fertile and are likely to contain seed stocks of slower growing native species. The primary goal will be the stabilisation of topsoils and therefore the minimisation of incidental erosion by surface flows during and after rainfall and wind. The method is quick, provides a physical barrier to incidental erosion, and does not introduce any new materials that may harbour weeds and diseases. This method, also used on the main gas flowline from Bibblewindi to Wilga Park, together with retention and replacement of topsoil, will also facilitate germination and establishment of seed from the soil seed bank.

No additional over sowing of the disturbance corridor is planned.

5.3.1 Site Rehabilitation Monitoring
The monitoring of the site will occur at least on a monthly basis during the 12 month period from the cessation of rehabilitation earthworks.

Aspects of the rehabilitation program that will be monitored for the duration of the operational period will include:

- Any evidence of slumping within the area of the GGS trench;
- Any suggestion of excessive erosion or topsoil instability;
- Any issues with the adequate drainage of the corridor; and
- Weeds regrowth

Remedial action will be taken where issues such as described or otherwise are evident. No time limits will be placed upon the duration of the monitoring and maintenance program. The success of the site rehabilitation will be assessed with the assistance of the landholder. After this initial 12 month period, the monitoring of the site will occur at least every three months or until such time as the rehabilitation is signed off by the landholder.

5.3.2 Waste Management
Waste materials generated during the construction period will include:

- construction materials waste such as timber, plastic and small amounts of metals;
- general domestic refuse; and
- wastes such as engine lubricants and coolant fluids.

In accordance with good field practice, work crews will be required to dispose of all waste materials in designated receptacles or collected for disposal offsite at the completion of each shift. Wherever possible, waste materials will be collected for recycling and/or reuse or otherwise be transported for disposal at the Narrabri Waste Depot.
6 LICENCES AND PERMITTING

6.1 Drilling Proposal:
This application forms the first part of this submission and will be forwarded to the appropriate department at DPI – Mineral Resources upon its completion.

6.2 Landholder Permitting:
Approval to conduct the proposed activity will be sought from Forests NSW as the landholder. The surface rights of Forests NSW in the Pilliga East State Forest will be honoured and traffic and fire management plans implemented based upon recommendations of the Senior Forester, Baradine. Forests NSW will be notified prior to the commencement of operations and be kept informed as to the status of those operations.
7 CONSULTATION

The planning of this drilling and fracture enhancement program will include consultation with the following Government and non-government agencies, and rely upon some degree of project endorsement from each. They include:

- NSW Department of Primary Industries - Mineral Resources
- NSW Department of Primary Industries - Forests NSW
- Pilliga Forest Aboriginal Land Management Committee
8 EVALUATION OF CUMULATIVE ENVIRONMENTAL IMPACTS

The assessment of the proposed activity and the characterisation of the cumulative impacts occur in response to S228 of the Environmental Planning and Assessment Regulation 2000 which suggests the factors that must be taken into account concerning the impact of an activity.

S228 (2) (o) specifies

that any cumulative environmental effects arising from the implementation of the proposal with other existing and likely future activities must be identified as part of the assessment process.

The proposed lateral pilot installation illustrated in figure 2 to which the REF refers includes the following activities (in general order of occurrence):

- The installation of up to 2km of additional access/construction area between existing well sites and the new locations
- The preparation of four (4) drill pads to a maximum of 100 metres by 80 metres at the locations indicated;
- The drilling of two (2) Vertical Production Wells (VPW) at Bibblewindi-27 and 29;
- The drilling of two (2) Horizontal Build Wells (HBW) at Bibblewindi-21H and 28H;
- The installation of gas and water gathering system;
- The management of gas and water under the approved water and operations management plan

The biophysical receptors that are likely to or have the potential to be impacted upon include biodiversity (flora & fauna).

The socioeconomic receptors likely to or have the potential to be impacted upon include the local economy and cultural heritage.

8.1 Cumulative Biophysical Impacts

The cumulative impacts on the biodiversity of the area are considered insignificant. The clearance of an additional 5.2 hectares of vegetation is considered a relatively minor impact due to the widespread and common nature of the Ironbark/White Cypress vegetation community across the region. No threatened species of flora have been identified during in this area during field assessment conducted thus far and the risk of impact on unknown threatened species or communities is negligible.

The direct impact of the activity on threatened species of fauna is considered small; the species identified during the fauna surveying programs in the area are highly motile avian and chiropteran species whose
home range is significantly large that the disturbance of actual or potential habitat will not introduce any significant impacts on the localised populations of the species.

The impact of soil resources is able to be accurately quantified and for the most part mitigated. The conservation of topsoil stocks is designed to maximise the effectiveness of the rehabilitation program. By doing so, the probability of regenerating the indigenous vegetation in situ from the existing genetic base is significantly increased.

The scale of fugitive particulate material generation and their impacts on the surrounding environment is generally thought to be negligible. Adequate mitigative measures are available during the construction phase to limit the generation of dust in the localised area and where the activity creates greater than normal levels of traffic on the unsealed access tracks inbound and outbound from the site.

8.2 Cumulative Socioeconomic Impacts

The scope for cumulative impacts on items or sites of cultural heritage significance remain absent from the proposed activity. Consultation with available heritage databases indicates that no known sites of significance will be impacted by the proposed activity. The predictive modelling carried out for the proposed CSG pipeline project indicates a clear link between water and shelter availability and the frequency of culturally significant sites. Further site specific heritage surveying will be completed on each site to account for residual risks of impacting unknown sites of significance.

Positive cumulative benefits for the local business community are an expected result of the proposed activity with the planning and construction phases utilising a range of local professional service providers. The value of the project to the local economy is be expected to approach 120 000 Australian Dollars, with all earthworks, site preparation and rehabilitation activity completed with the assistance of local contractors.

8.3 Cumulative Greenhouse Impacts of the CSG Projects

The operation of the CSG project carries a measurable impact on the environment in terms of greenhouse gases. Heggies (2007) conducted a comprehensive review of the potential impacts of the current situation should no action be taken to consume methane being vented to atmosphere from the Bibblewindi and Bohena CSG Pilots. Coal seam gas vented directly to the atmosphere has a greater global warming potential than combusted CSG due to the high (≈88 percent) methane content of the gas, coupled with the global warming potential (GWP) of methane (21 times the GWP of CO2). Calculations of greenhouse gases from venting, in terms of CO2-e were calculated by Heggies from modeled throughput values and thence compared in terms of State and National totals.
Table 8.1: Comparison Emissions Figures - Project, Venting Option, State and National Figures

<table>
<thead>
<tr>
<th>Source</th>
<th>Emissions (t CO₂-e)</th>
<th>% of National</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>204 193 (predicted)</td>
<td>0.0365%</td>
</tr>
<tr>
<td>Atmospheric venting option</td>
<td>1 431 624 (predicted)</td>
<td>0.256%</td>
</tr>
<tr>
<td>NSW annual total</td>
<td>158 200 000</td>
<td>28.29%</td>
</tr>
<tr>
<td>National annual total</td>
<td>559 100 000</td>
<td></td>
</tr>
</tbody>
</table>

The comparison of predicted emissions with the 2005 State and National emissions figures suggests that the proposed combustion of the produced CSG at the Wilga Park power station would represent an increase of approximately 0.0365 percent the total baseline Australian emissions for 2005 or 0.265 percent from the venting of the CSG to atmosphere. A comparison of the two options demonstrates that equivalent emissions would be in the order of 7.2 times greater if the gas was vented to atmosphere preferentially over its collecting and combustion at the Wilga Park power station.

The conclusions of this report and the findings of ESG as the proponent of the major project that would gather and transport all gas produced at these two pilots suggest that considerable environmental and economic benefits can be gained from the proposal. Similarly, it is ESG’s intention, as described in the approved water and operations management plan to collect all gas produced at the lateral pilot for consumption in situ (surface and subsurface equipment) or transportation via the gathering system back to Bibblewindi and into the main pipeline to Wilga Park. Therefore in terms of the potential greenhouse impacts of the gases produced at the lateral pilot, it is planned to capture and consume 100 percent of production for the life of the project and realise the considerable savings in terms of carbon dioxide equivalent emitted to the atmosphere.
9 PROJECT JUSTIFICATION

9.1 Environmental Impact:
The aim is to explore for petroleum by acquiring seismic data and if that work is successful in defining a hydrocarbon prospect an exploration well will possibly test that target. The most likely hydrocarbons in this area are likely to be natural gas and CSG.

The benefits of using natural gas and CSG to fuel economic development are widely understood. Natural gas is the environmental fuel of choice having lower atmospheric emissions than any other fossil fuel. Coal seam gas field development has a much smaller ‘footprint’ on the ground than any other fossil fuel extraction process.

A successful gas development project in this part of NSW will form the basis of an economic renaissance in the region by providing a clean, cost effective fuel for process, manufacturing and electricity generation. The net environmental impact for NSW could be positive with part replacement of coal fired electricity generation by gas fired electricity allowing additional coal to be released export and at the same time significantly reducing ‘greenhouse gas’ emissions (see section 8.3) whilst promoting new economic development in regional NSW.

9.2 Social Impact:
New oil, natural gas and CSG production in regional rural NSW will have a significant positive impact by providing a local energy source that will attract new industry and economic development and also replace existing more expensive energy sources. The process field development will not only provide new employment opportunities but also pump money into local business. It will also provide the community with an opportunity to diversify from and complement its agricultural base. In summary, if this project is developed it will provide the basis for significant new developments in north western NSW. In addition to attracting new businesses, the creation of new local job opportunities, additional revenue is being spent in the business community, an improvement in local infrastructure and a more diverse economic base for people living in the region.

9.3 Economic Impact:
New South Wales has no oil production and only very small gas production. All of the oil and the vast majority of gas consumed in NSW are imported from other Australian States or from overseas. While it is still too early to quantify the resultant economic rewards of a CSG production development it is generally recognised that such a development will have a major positive effect on the State, the region and the local community. At present all the natural gas consumed in NSW (approximately 150 petajoules per annum) is sourced from South Australia and Victoria and any opportunity to develop
significant gas production within the State will be of economic benefit. The dominant energy source in NSW is coal which although being present in abundance at a relatively low price is significantly, less environmentally friendly than the use of natural gas both from the effects of a mining operation and atmospheric emissions.

Populations and businesses based in regional NSW are rapidly declining with a movement to the major cities. Coal seam gas development within the Narrabri area will have a significant impact on the region by providing a cheap, clean energy source that will attract new business and employment. New and upgraded infrastructure is generally a component of gas field development. The local community will also benefit economically with the gas field operations directly purchasing services and equipment from local suppliers and businesses and the general knowledge that for every dollar invested in developing a property or installing facilities to deliver gas to market, the local economy benefits by approximately seven fold.
10 CONCLUSIONS

The proposed drilling and completion of an additional two lateral arms on the north-eastern and south-western flanks of the Bibblewindi lateral pilot does not represent a significant departure from the impacts described in the application to the NSW Department of Primary Industries (Minerals and Petroleum).

ESG is confident that:

- No ongoing land use practices will be impacted by the activity;
- A sufficient buffer zone (distance and physical barriers) exist between the drilling locations and the nearest inhabitation; and
- The bulk of the activity will occur over a relatively short time frame limiting any further impacts associated with noise, visual amenity and any other incidental impacts.

Existing flora, fauna and cultural heritage survey data suggests that the proposed activities for can be completed without any long term impacts on species or communities of significance and items of Aboriginal heritage. Eastern Star Gas is committed to the operation of its assets in line with the relevant statutory and regulatory guidelines and such issues of environmental and heritage concern remains at the forefront of the planning process.

The exploration well will utilise standard oilfield equipment and work will be conducted using good oilfield practice in line with the Petroleum (Onshore) Act (1991) and Regulations, the ‘Schedule of Onshore Exploration and Production Safety Requirements’ and ‘APPEA Code’. The operations are regarded, from an industry standpoint, as being of a small scale. In addition the majority of operations will be conducted a significant distance away from any habitation, town or workplace so that the impacts of activity will be minimised.

The provision of this document fulfills the company’s responsibility under Part 5, Section 111 of the Environmental Planning and Assessment Act 1979 in which the determining authority (NSW Department of Primary Industries – Mineral Resources) is required to consider the likely and actual environmental impacts of the activity. It is the opinion of Eastern Star that the impacts created by the proposed activity when considered alongside the mitigation strategies in place will create no long term effect on the localised and regional environment.
11 REFERENCES


Kendall, K. (2007). Fauna Study PEL238 Narrabri Coal Seam Gas Project Pipeline, Kendall & Kendall Ecological Consultants, West Kempsey NSW

Lindsay, A.D, (1974). Forest Types of the NSW Cypress Zone, Technical Paper 8, Forestry Commission of New South Wales


Trindall, E. (2007). Aboriginal Heritage Investigations for the Narrabri Coal Seam Gas Project Pipeline, Trindall Cultural Advisory Services, Narrabri NSW