



2009 Narrabri Coal Seam Gas Project

Bibblewindi Lateral Pilot

ESP Installation & Extension of GGS to BW 28H & 21H

Supplementary Review of Environmental Factors

Petroleum Assessment Lease 2

Gunnedah Basin, New South Wales

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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 2 Electric Submersible Pumps (ESPs) be installed at Bibblewindi 28H and 21H to assist in the effective operation of the production pilot. Following the installation of the ESPs water and gas gathering infrastructure will be constructed linking Bibblewindi 28H and 21H to the existing GGS at the Bibblewindi Lateral Pilot allowing all production gas and water to be transported to the Bibblewindi Water Management Facility in accordance with the current approved operations and water management plan.

The total area of land impacted by this activity will approximate 2 hectares based upon a construction Right of Way (ROW) 10 metres in width running for 2000 metres., however previously constructed access routes will be utilised for 1200 metres of this total length thereby reducing the direct area impacted to 0.8 hectares where existing vegetation will be modified.

The proposed activity will not create any permanent detrimental impacts on native vegetation resources in this locality, any threatened species 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 or 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.

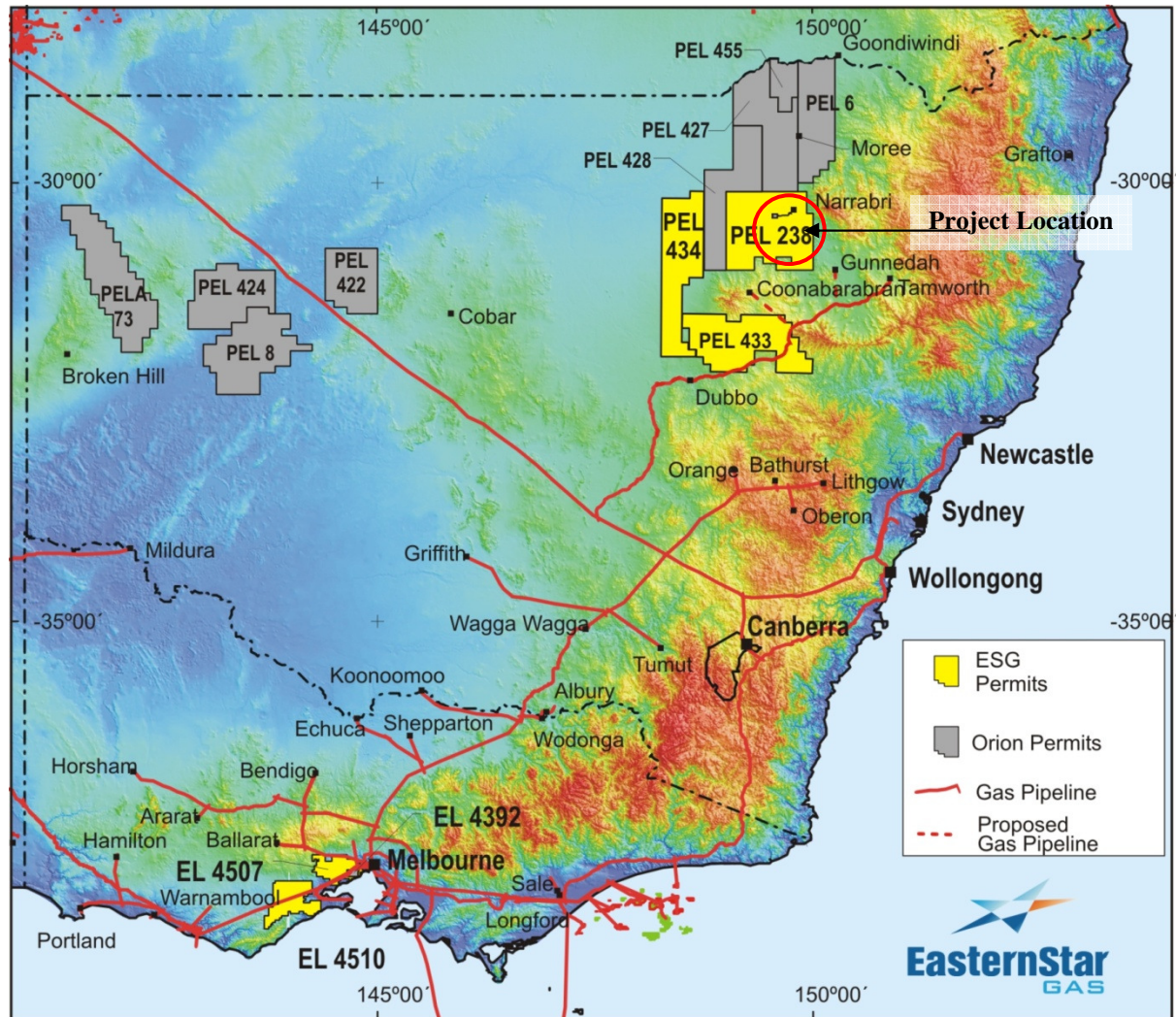
The provision of this document fulfils the company's responsibility under Part 5, Section 111 of the *Environmental Planning and Assessment Act 1979* in which the determining authority (Industry & Investment NSW – Minerals & Energy) is required to consider the likely and actual environmental impacts 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

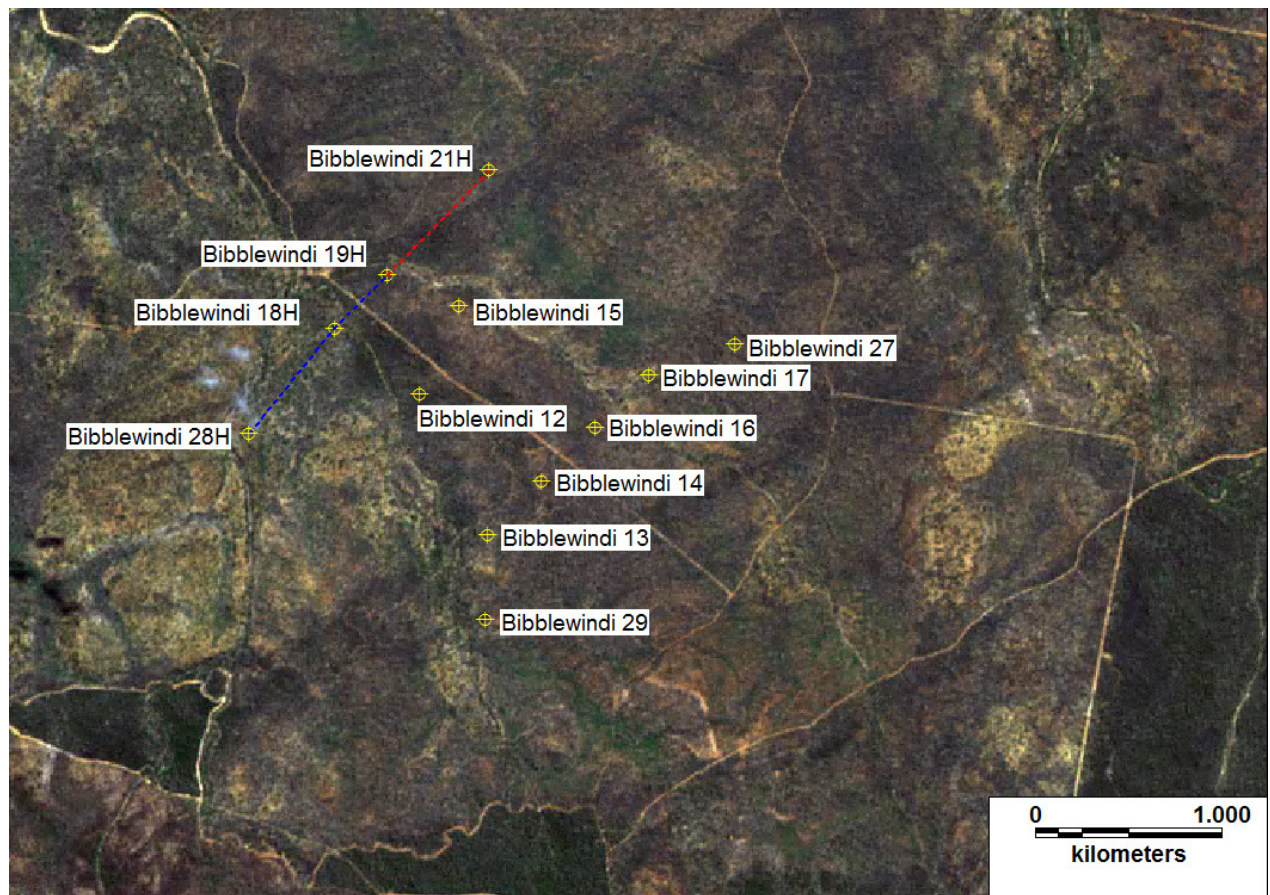
This supplementary Review of Environmental Factors (REF) has been prepared by Eastern Star Gas Ltd (ESG) for the continuing development of the Narrabri Coal Seam Gas (CSG) project in Petroleum Assessment Lease 2 (PAL 2) northern NSW (Figure 2.1).

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 (Figure 2.2)

Figure 2.2: Location of Bibblewindi Lateral Pilot and proposed & existing access roads

(note: Blue: pre existing access; Red: new installation of access required)

2.2 Description of the Activity and Justification

The proposed Electronic Submersible Pump (ESP) and GGS installation to which the following REF refers includes the following activities (in general order of occurrence):

- The installation of two (2) ESPs at Bibblewindi 28H and Bibblewindi 21H;
- The installation of gas and water gathering system linking Bibblewindi 28H & 21H via 18H and 19H; and
- The operation of the CSG production pilot in accordance with the existing operations and water management plan for PAL2.

The volumes of water flowing towards the vertical production wells on the inner laterals from adjacent coals are limiting the ability to effectively reduce the pressure between the lateral wells. It has therefore been proposed to install 2 ESPs at Bibblewindi 28H and 21H to assist the Bibblewindi 27 and 29 vertical production wells protect the inner laterals more effectively.

3 THE EXISTING ENVIRONMENT

The information on the environment surrounding the Bibblewindi Lateral contained in the previously approved Bibblewindi Pilot and Supplementary shield well REF's remains current and accurate as at the date of submission. The baseline information on topography, drainage, land use, Aboriginal heritage, flora and fauna of the localised area has not been reproduced.

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.

Table 4.1 summarises how the proposed amendments to the approved Bibblewindi Lateral Pilot REF and Bibblewindi Shield Laterals Supplementary REF will impact on key environmental factors.

Table 4.1: Proposed amendments to Original Bibblewindi Lateral Pilot REF

Factor	REF Section	Description
Land	5.2	<p>Access: Access to one (1) additional well site (21H) will require a new road to be installed from the nearest existing well pad (19H) (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 800 metres of new access with a right of way 10 metres in width. The existing access from 28H through to 18H and 19H will be used to install 1200 m of GGS and therefore no additional clearing will be required.</p> <p>Drainage: The proposed activity will not result in any impacts not previously characterised.</p> <p>Subsurface Impacts: The installation of two (2) ESPs will not have any impact on the subsurface environment.</p> <p>Plugging and Abandonment Procedures: There will be no variation to the plugging and an abandonment procedure is expected.</p>
Air	5.3	<p>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.</p> <p>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.</p>

Water	5.4	<p>Impacts on localised water courses: The access route and GGS will travel through a poorly defined ephemeral creek crossing. The GGS will be installed to Australian standards (AS2885).</p> <p>Rehabilitation of the creek crossing will occur as per previous works in this area and monitoring of creek bank stability undertaken.</p>
Flora	5.5	<p>Background Information: As stated in REF.</p> <p>Assessment of Significant Effects: The impacts on native vegetation characterised in the REF will be increased through the installation of up to 800 m of access (0.8ha).</p> <p>The impacts likely to result from the proposed activity do not significantly differ from those described in the REF.</p> <p>Weed Species: As stated in REF.</p>
Fauna	5.6	<p>Background Information: As stated in REF.</p> <p>Assessment of Significant Effects: The impacts on actual or potential habitat characterised in the REF will be increased through the installation of up to 800 m of access (0.8ha)</p> <p>The impacts likely to result from the proposed activity do not significantly differ from those described in the REF.</p>
Cultural Heritage	5.7	<p>Background Information: As stated in REF.</p> <p>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.</p>
Waste Management	5.8	<p>Putrescible Waste Disposal: As stated in REF</p>

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 further access road and GGS system in relation to the installation of 2 ESPs 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.

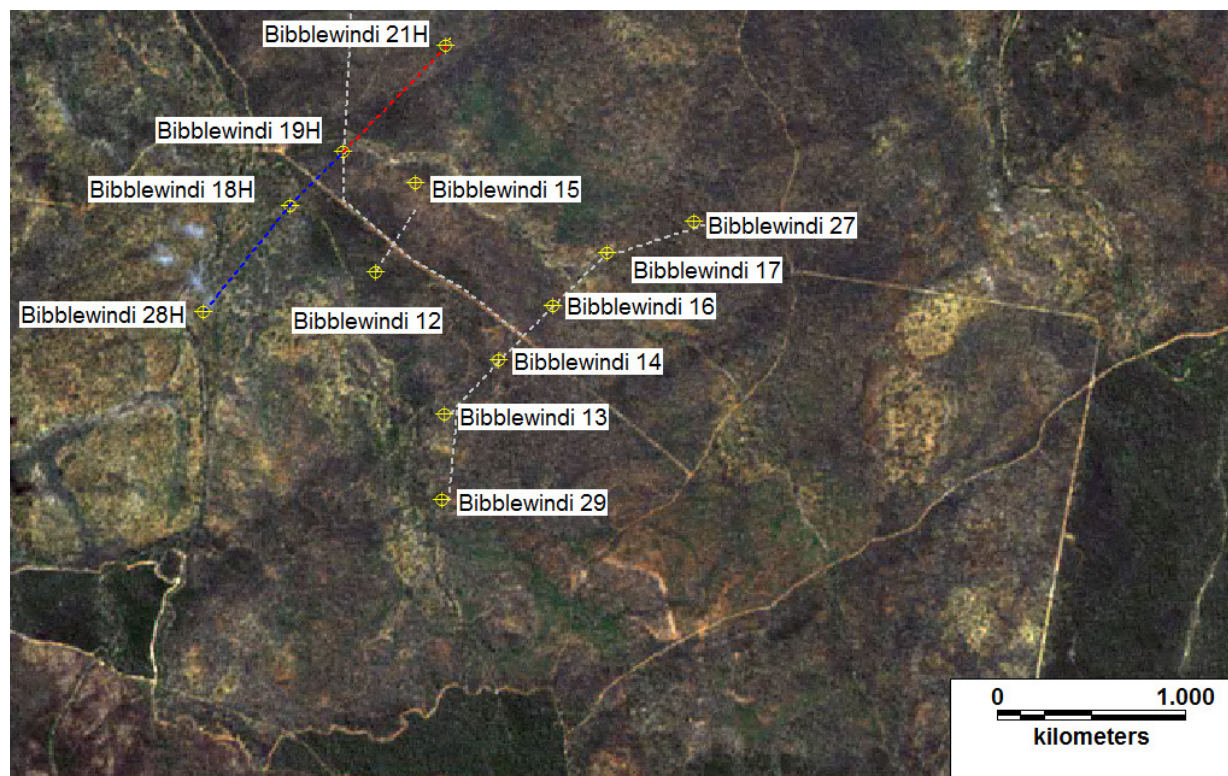
5 WATER AND GAS MANAGEMENT

Water and gas produced from Bibblewindi 28H and 21H will be collected from the well head and transferred to the Bibblewindi water management facility via the existing gathering system already in place at the lateral pilot. The proposed ESP installation in the outer shield lateral wells is aimed at assisting the Bibblewindi 27 and 29 vertical wells to work as designed and protect the inner lateral and production from excessive inflow of water from outside the pilot area.

5.1.1 Gathering system

Installation of the two ESPs will require additional GGS infrastructure to link Bibblewindi 21H and 28H to the existing gathering system which integrates the Bibblewindi Lateral Pilot 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; water will flow to the Bibblewindi water management facility, gas will continue on to be used at the Wilga Park Power Station.

The gathering system will be approximately 2000 metres in length and comprise approximately 1200 metres of lines installed alongside existing cleared access roads and the remaining 800 metres along a new construction 'Right Of Way' between Bibblewindi 21H and 19H. By combining the working area for the roads and gathering system, the cumulative area of vegetation impacted by the proposal is reduced by approximately 60%.

Figure 5.1: Bibblewindi lateral pilot and the proposed extension to the existing gathering system

Within Figure 5.1, the grey dashed line denotes the existing GGS System, blue denotes the proposed GGS system along existing access and red the proposed GGS System where new clearing is required.

5.1.2 GGS Specifications

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

Table 5.1: Gas Gathering system Specifications

GGs Component	Design Specifications
Length	2 kilometres
Diameter	Up to 8 inches diameter
Material	High Density Polyethylene (PE100)
Static Pressure Rating	To AS4130
Depth Cover	Minimum 750 millimetres cover
Construction Right of Way	≈10 metres

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 Industry and Investment NSW (Minerals and Energy).

5.1.4 Approvals Required

In order for the proposed GGS installation to proceed, ESG will seek the approval of Industry and Investment NSW (Minerals & Energy) 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 Forestry NSW via the amendment of the occupation permit (pending).

5.1.5 Construction Activities

The installation of the GGS between Bibblewindi 28H and 21H 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

The section of GGS between 19H and 21H will be assessed for commercial timber resources and 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.

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 5.2: Equipment required to install the GGS and water management facility

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

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 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 Bibblewindi 28H and 21H, will be transported to, and treated at the Bibblewindi water management facility.

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 Forestry. 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 Forestry.

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 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 GGS 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:

- Industry & Investment NSW – Minerals & Energy
- NSW Department of Primary Industries - Forests NSW
- Pilliga Forest Aboriginal 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 EPS installation and GGS extension illustrated in **Figure 2.2** to which the REF refers includes the following activities (in general order of occurrence):

- The installation of two (2) ESPs at Bibblewindi 28H and Bibblewindi 21H;
- The installation of gas and water gathering system linking Bibblewindi 29H & 21H to the existing Bibblewindi Lateral Pilot GGS system; and
- The operation of the CSG production pilot.

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 0.8 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.

The proposal as described will not result in any significant increase in cumulative impacts over the PAL2 project area such that additional mitigation measures are required. The increase in area occupied by the exploration and production assessment activities has been estimated at 0.8 hectares which represents 0.001% increase in the total area across the entire project, which currently stands at 87 hectares.

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.

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 modelled 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

Source	Emissions (t CO ₂ -e)	% of National
Project	204 193 (predicted)	0.0365%
Atmospheric venting option	1 431 624 (predicted)	0.256%
NSW annual total	158 200 000	28.29%
National annual total	559 100 000	

The comparison of predicted emissions with the 2005 State and National emissions figures suggests that 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 CONCLUSIONS

The installation of two (2) Electric Submersible Pumps at Bibblewindi 29H and 21H and the associated GGS system linking the wells to the pre existing Gas Gathering System (GGS) does not represent a significant departure from the impacts described in the previous applications made to the NSW Industry and Investment for the Bibblewindi lateral pilot.

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 clearing activities 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 (Industry & Investment NSW – Minerals & Energy) 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.