FINAL

Gloucester Gas Project

Submissions Report

Gloucester Gas Project

Submissions Report

Prepared for

AGL Gloucester L E Pty Ltd

Prepared by

AECOM Australia Pty Ltd
Level 8, 17 York Street, Sydney NSW 2000
T +61 2 8023 9333 F +61 2 8023 9399 www.aecom.com
ABN 20 093 846 925

24 May 2010

S70038

Quality Information

Document	**Gloucester Gas Project**	
Ref	S70038 60153577_Submissions Report_FNL_24May10	
Date	24 May 2010	
Prepared by	Kate Tilden	Author Signature _____
	Ruth Baker	Author Signature _____
Reviewed by	Michael England	Technical Peer Reviewer Signature _____

Distribution

Copies	**Recipient**	**Copies**	**Recipient**
1 Copy	**Stuart Galway** **AGL Gloucester L E Pty Ltd** 32 Tate Street Gloucester	**2 Copies** **2 CDs**	**Dinuka McKenzie** **Senior Environmental Planner** **Department of Planning** 23-33 Bridge Street Sydney 2000

Revision History

Revision	**Revision Date**	**Details**	**Authorised**	
			Name/Position	**Signature**
1	May 2010	Final	Michael England	

Contents

List of Appendices

1.0 Introduction

1.1 Overview of Proposed Project

The Gloucester Gas Project (the Project) includes works for the extraction of coal seam gas (CSG) from the Gloucester Basin within the PEL 285 area. The Project involves the development of gas wells and associated infrastructure, the development of a Central Processing Facility (CPF), and the construction and operation of a high pressure gas transmission pipeline from Stratford to a delivery station at Hexham, NSW. AGL Gloucester L E Pty Ltd (AGL) is the Proponent for the Project.

1.2 Overview of EA Approval Process

The Proponent is seeking the following approvals pursuant to Part 3A of the *Environmental Planning and Assessment Act* (EP&A Act):

- Concept Plan Approval for:
  - Staged well field development within the Concept Area, including development of wells, gas and water gathering lines, and associated infrastructure; and
- Concurrent Project Approval for:
  - Construction and operation of gas wells at proposed well site locations within the Stage 1 Gas Field Development Area (Stage 1 GFDA), access roads, gas and water gathering system and associated infrastructure;
  - Construction and operation of a CPF with an annual capacity of approximately 30 petajoules (PJ), which equates to an average of 80 terajoules (TJ) per day, on one of two potential sites within the Stage 1 GFDA, as well as associated water treatment plant, ancillary 15MW power generation plant, storage ponds and associated infrastructure; and
  - Construction and operation of the gas transmission pipeline within an assessed 100 m corridor from Stratford to Hexham; and
  - Construction and operation of a delivery station at Hexham.

An Environmental Assessment (EA) was prepared for the Proponent in accordance with the provisions of Part 3A of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation), together with the Environmental Assessment Requirements (EARs) issued by the Director-General of the Department of Planning in August 2008

The EA was placed on public exhibition from 18 November 2009 to 19 January 2010. The submissions received during this period form the basis of this Submissions Report.

1.3 Purpose of this Report

The purpose of this report is to detail and provide responses to submissions by private individuals, community groups and government agencies regarding the proposed Project which were received during the EA exhibition period.

1.4 Structure of this Report

This Submissions Report is structured as follows:

- **Chapter 2** presents a summary of the submissions received regarding the proposal
- **Chapters 3** provide responses to key issues raised in submissions as they relate to chapters of the EA document.
- **Chapter 4** provides responses to each of the issues raised in submissions received from State and Local Government agencies;
- **Chapter 5** provides responses to each of the issues raised in submissions received from community interest groups and businesses;
- **Chapter 6** provides responses to each of the submissions received from private individuals.

"This page has been left blank intentionally"

2.0 Summary of Submissions

2.1 Submissions Process

During the exhibition period, submissions regarding the proposed project were accepted by DoP from online, email and post sources. Submissions were numbered as received and provided to the Proponent for a response. All submissions were reviewed and issues raised have been addressed in this Submissions Report.

2.2 Submissions Received

In total, 147 submissions were received (not including duplicates from the same respondent which were received by both email and post).

Of these, the following is noted:

- 11 submissions were from State and Local Government agencies including:
  - NSW Office of Water (NOW);
  - Department of Environment, Climate Change and Water (DECCW);
  - Department of Industry and Investment (DII);
  - NSW Roads and Traffic Authority (RTA);
  - Gloucester Shire Council;
  - Great Lakes Shire Council;
  - Dungog Shire Council;
  - Maitland Shire Council;
  - Port Stephens Shire Council;
  - Hunter-Central Rivers Catchment Management Authority (CMA); and
  - Transgrid.
- 10 submissions were from community interest groups and businesses, all of which are located within the Project area, including:
  - Barrington-Gloucester-Stroud Preservation Alliance (two separate submissions were received from this interest group);
  - Garrigal Aboriginal Com Inc;
  - NSW Farmers, Stroud Branch;
  - Gloucester Coal;
  - The Wilderness Society Newcastle Inc;
  - Johnsons Creek Conservation Committee;
  - Rivers SOS;
  - Ironstone Community Action Group; and
  - The Gloucester Project Inc.
- 49 were from private individuals;
  - 2 from within the Project area;
  - 4 from within the 100 m pipeline corridor;
  - 19 from within the Concept area;
  - 23 from outside of the Project area;
  - 1 unknown;
- 77 were a form letter from private individuals;
  - 1 from within the Project area;
  - 1 from within the 100 m pipeline corridor;
  - 31 from within the Concept area;
  - 40 from outside of the Project/Concept area; and

- 4 unknown.

Figures 1, 2, 3, **4** and **5** outline the distribution of the submissions received, including the location from which the submissions were sent and the number of submissions concerning key issues.

Figure 1: Total Submissions Received

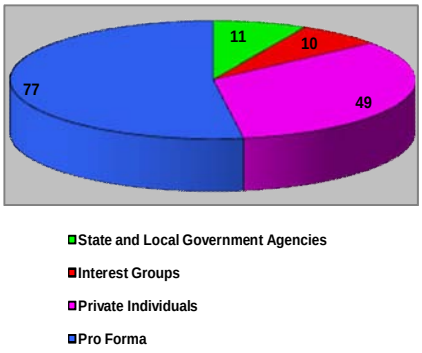

Figure 2: Submissions Received from Private Individuals

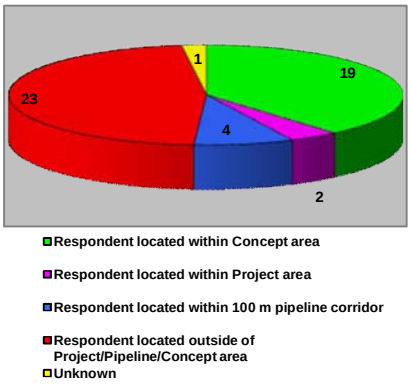

Figure 3: Form letter submissions received

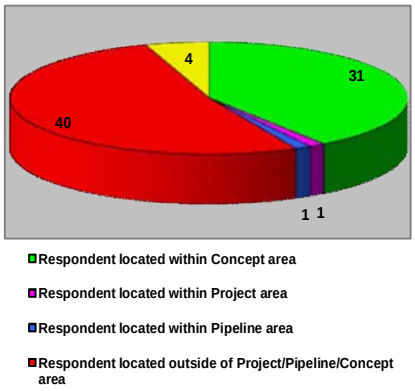

Figure 4: Total number of submissions for each key issue

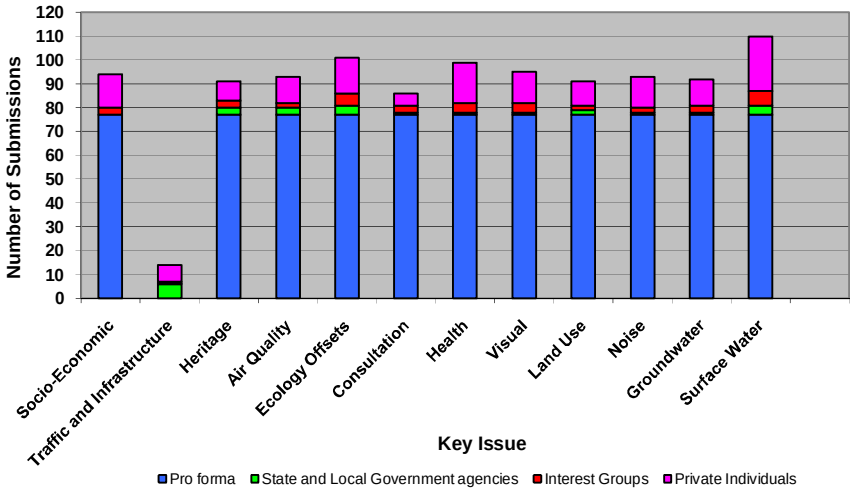

Figure 5: Distribution of submissions across key issues

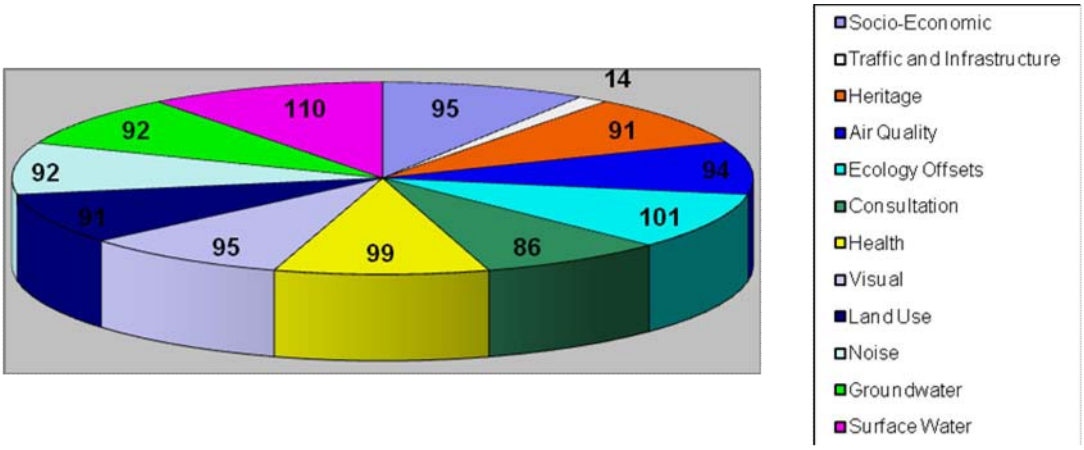

Figure 1 demonstrates that over half of the submissions received were a form letter, **Figures 2 and 3** depict how the approximately half of submissions received from private individuals and form letters were outside of the Project/Concept/Pipeline areas. **Figures 4 and 5** identify the key issues associated, with surface water and ecology offsets as the most prominent, followed by health, visual and socio-economic considerations. Issues associated with air quality, noise, ground water, heritage, land use and consultation were also significant, whereas traffic and infrastructure were of less concern.

2.3 Key Issues Raised in Submissions

Each submission was individually reviewed, and issues raised in each submission tabulated and a response provided. **Chapter 3** provides a discussion on each of the key issues raised identified in the majority of submissions. The key issues for which additional discussion is provided include:

- **Surface water quality** and potential impacts associated with management of water produced by the project;
- **Groundwater management** and concerns regarding the impact of the project on aquifers and other water sources;
- **Ecological impacts** of the project, in particular associated with clearing of vegetation during construction of the pipeline corridor;
- **Human health impacts**, including perceived risks to human health through emission of air pollutants, physical hazards associated with infrastructure and methane release/migration, and contamination of potential sources of drinking water;
- **Emission of air quality pollutants** to the atmosphere and cumulative impacts with existing coal mining operations;
- **Noise impacts** during construction and operation of the Stage 1 GFDA;
- **Land use impacts**, in particular loss of productive agricultural land;
- **Visual and socio-economic impacts**;

- **Impacts on items and vistas of heritage and cultural significance**, in particular impacts on the Vale of Gloucester; and
- **Consultation**, which was raised in a number of submissions from private individuals.

Chapters 4 and **5** provide tabulated response to issues raised in submissions received from statutory agencies (**Chapter 4**) and community interest groups, businesses and individual submissions (**Chapter 5**). Where relevant, responses to individual submissions refer to relevant discussions of key issues in **Chapter 3** of this Submissions Report.

"This page has been left blank intentionally"

3.0 Response to Key Issues Raised in Submissions

3.1 Surface Water Quality

Submissions from agencies, community interest groups and the public raised concerns regarding construction impacts to surface water quality including creeks, rivers and wetlands within and downstream of the Project Area, primarily relating to construction of the pipeline. Issues raised in the submissions included the following:

- Trenching and under-boring of watercourses and associated impacts to water quality and aquatic ecology within watercourses;
- Pollution of watercourses impacting quality of water extracted for town supplies of Stroud and Stroud Road;
- Downstream water quality impacts which may affect Port Stephens Marine Park;
- The EA does not detail volume, quality or specific management (i.e. discharge to environment) of produced water from dewatering of CSG wells. Activities should be designed and undertaken to ensure no pollution of waters within receiving environment in compliance with Section 120 of the *Protection of the Environment Operations Act* (PEOA Act);
- Potential adverse effects on potable and other water supply sources;
- The EA does not include an assessment of the existing quality of water in the local rivers, or the water quality of produced water that would be discharged or irrigated that may impact local watercourses;
- DECCW's conditions of approval do not propose any licensed point for discharge to waters; and
- Over-irrigation of treated discharge water could cause a lifting of the water table, leading to mineral redepositing at the surface.

These issues are discussed in the following sections. Responses to individual submissions are provided in **Chapters 4** and **5** of this Submissions Report.

3.1.1 Construction Environmental Management of Water Crossings

The pipeline route is likely to cross existing watercourses on approximately 187 occasions throughout the Stage 1 GFDA and pipeline route. Crossings would be undertaken by either Horizontal Directional Drilling (HDD) or open trenching (with stream diversions where required). Only one watercourse within the GFDA has been given consideration for the option to be thrust bored. These techniques are described in Section 5.6.4 of the EA.

HDD would be used to avoid impacts to surface water and riparian vegetation when crossing watercourses where flow regime may be significantly affected (for permanent watercourses identified with stream ordering greater than third order streams). Open trenching would be undertaken when crossing watercourses that are generally ephemeral or of low flow (and identified as third order or lower streams).

All open trench crossings, or crossings which may have a direct impact on the watercourse, would have site specific management measures implemented for sediment and erosion control as well as rehabilitation practices. These measures would be dependent on site characteristics such as soil stability, existing vegetation and water flow, and would be identified in a site specific management plan and included in the Construction Environmental Management Plan (CEMP) for the pipeline (refer to Volume 1 Section 25.2 of the EA). Site specific management would be dependent on further investigation of site characteristics as part of the CEMP, but would include appropriate methods of scour protection and stockpiling excavated bank material an appropriate distance from the watercourse. The construction of watercourse crossings would be done as rapidly as possible, with the open trench across the watercourse crossing left exposed for the minimal amount of time practicable to minimise the potential for erosion and sedimentation downstream.

Stream flow diversion techniques are used as a modification to the standard open trenching and are described in Section 5.6.4 of the EA. The use of stream diversions is deemed suitable for streams with flows greater than 1000 L/s and is recognised by industry standards (Australian Pipeline Industry Association Guidelines (APIA Guidelines)). Flow diversion is temporary to allow the laying of pipe across a dry construction area within the watercourse. This method is generally applied at crossings where water flow is required to be maintained for ecological, social or engineering reasons. As described above, site specific management plans would be prepared for each crossing to incorporate site characteristics and level of flow to be diverted.

HDD crossings would be managed by a Surface Water Management Plan (SWMP), Erosion and Sediment Control Plan (ESCP) and Landscape and Rehabilitation Management Plan (LRMP) contained within the CEMP (refer Section 25.2 of the EA). Site-specific geotechnical investigations would be undertaken prior to HDD work to identify the geology, potential issues and to select appropriate drill equipment. HDD work would allow sufficient setback distance from the stream bank in order to drill under the watercourse. Clearing of vegetation and the exposure of bare sediment would be minimised as much as practicable to minimise erosion, in addition to other erosion and sediment controls such as silt fencing, to ensure there is no impact on the water quality of the downstream environment.

The proposed construction environmental management regime would minimise the potential for pollution of waters within the receiving environment, in compliance with Section 120 of POEA Act. As such, indirect impacts on the water quality of receiving downstream waters, specifically as a result of erosion and sedimentation, on RAMSAR listed Hunter Estuary wetlands, Port Stephens Marine Park and other sensitive environments are not expected.

3.1.2 Rehabilitation of Water Crossings

Rehabilitation of water crossings has been addressed in Section 22 of the EA. Rehabilitation activities would generally follow those specified in the LRMP (refer Section 25.2.8 of the EA) and contained within the CEMP. However, site specific plans would also be prepared dependent on site characteristics and the nature of each crossing.

Rehabilitation would generally involve reconstruction of stream bed and banks and drainage lines to near original condition and profile, and provided with scour protection. Soil and mulched vegetation would be stockpiled for reuse during initial rehabilitation and re-establishment of native species or pasture would be undertaken, where required. Rehabilitation would be undertaken as soon as practical after construction and regular maintenance and monitoring would be carried out during the post construction maintenance period once rehabilitation works are completed.

3.1.3 Flooding Risk – Stage 1 GFDA

A number of community submissions raised concerns that a detailed flood risk assessment has not been undertaken as part of the EA.

During detailed design, AGL would develop a Flood Management Plan which would incorporate a Flood Risk Analysis and Flood Management Procedure. AGL currently implements a similar plan and set of procedures for AGL's Camden Gas Project in Sydney, which comprises well sites located in rural residential areas affected by the 100 year average recurrence interval event.

It is noted, however that the infrastructure that would be present in potentially flood prone areas is not anticipated to result in impacts to either the flood regime or flow of flood waters, nor is the infrastructure at well site locations likely to be significantly affected by the flow of flood waters.

In event of a flood, the well head production separator being mechanically connected to the well head with carbon steel piping would prevent external forcing dislodging or disconnecting the equipment. All ancillary well site equipment including the control box housing Supervisory Control and Data Acquisition System (SCADA) and local controls, site diesel generator, hydraulic skid and miscellaneous well control equipment are designed to shut down the production process. It is not expected the connected gathering systems would be damaged in event of flooding as they are anchored to the well head production separator, as well as being buried at depth as per Australian Standards.

If a well site is located within an area that is deemed to be at significant risk of flood inundation, safeguards include:

- The well site be located as far upslope as is practicable;
- If the well site is still at a significantly flood prone location, consideration should be given to elevating as much of the equipment as possible during its installation; and
- If there is specific equipment which would be substantially damaged by flood-borne debris, measures be put in place to protect those assets. This may include mounting equipment on trailers to facilitate easy removal from the site.

3.1.4 Produced Water Management

Submissions from agencies, community interest groups and the public raised concerns regarding the management, treatment and disposal of water produced during the extraction of CSG from the Stage 1 GFDA.

AGL is currently developing a detailed Water Management Strategy for the Project. The strategy would primarily consist of three core components, being:

- Water production and storage;
- Water treatment and storage; and
- Treated water management
- Disposal of waste products.

The Project is anticipated to result in the generation of up to 2 ML per day (during peak production) of water during extraction of CSG from the Stage 1 GFDA. This water is referred to as produced water. A water treatment facility, as detailed in Section 5.5.4 of the EA, forms part of the CPF to treat produced water from the Stage 1 GFDA. A number of options were identified in the EA for treatment of produced water from the Project. The treatment process and technology would be finalised during the detailed design phase, however at this stage, and as discussed in the EA, the preferred treatment technology is Reverse Osmosis (RO).

An overview of the strategy is outlined below.

Water Production and Storage

Water would be produced from the gas well during the extraction of CSG. Produced water would be transferred from well site locations via underground pipelines or water tankers to plastic lined holding ponds at the CPF and the Teidman Property, which contains the Stratford Pilot Project owned and operated by AGL. Storage for some 40 ML of produced water currently exists at the Stratford Pilot Project, which would be utilised as part of the Project. An additional balancing storage pond may be required for produced water, and would be constructed at the CPF site and/or the Tiedman Property, depending on water production rates and operational storage requirements.

These storage ponds would be fully lined and contain appropriate freeboard capacity to avoid overflowing during periods of high rainfall. Produced water would be stored in these ponds temporarily, prior to treatment.

Water Treatment and Storage

Currently, the preferred water treatment method for the Gloucester Gas Project is RO, which is a proven treatment technology for the removal of dissolved solids from brackish or saline water. The process uses high pressures to 'force' water through semi-permeable membranes, leaving behind the ions. The process results in two streams:

- **Treated water stream** – treated water, also referred to as permeate, would be stored in lined holding ponds at the CPF and Teidman property, prior to disposal. Produced water would be treated to the level required to suit the management method. The management of the treated water will initially be through reuse such as irrigation. If reuse is not possible the last option will be via discharge to surface water.
- **Concentrated brine waste stream** – the concentrated brine waste stream would be stored separately in lined holding ponds at the CPF and managed through either evaporation in an open air basin / brine pond, or zero-liquid discharge (ZLD) technology which uses mechanical evaporation processes to further concentrate the brine which produces a salt crystal product.

RO produces a high quality treated water stream, with recovery of up to 70-80% of the feedwater likely to be achieved. RO is capable of treating water to whatever standard is required, therefore the level of treatment would depend on the final use. The reuse of the treated water and concentrated brine waste streams are discussed in the following section.

Treated Water Management

Four primary options were considered in the assessment of alternatives in the EA (Section 4.4.2) for management of treated water:

- Aquifer re-injection;
- Discharge to surface water;
- Reuse via irrigation; and
- Sale of water to market.

A number of submissions raised concerns that the aquifer re-injection of produced water would be environmentally destructive and would have potential impacts to both groundwater and surface water quality. While aquifer re-injection is not proposed as the preferred management option for produced water from this Project, it is noted that the re-injection of produced water from coal seam gas production is a disposal method accepted by both industry and Government in Australia. Queensland's Department of Infrastructure and Planning has noted in its discussion paper titled *Management of Water Produced from Coal Seam Gas Production* (May 2009) that one of the preferred options for management of water generated by coal seam gas operations in Queensland includes *"injection into natural underground reservoirs or aquifers of equal or lesser water quality"* (Queensland Department of Infrastructure and Planning, 2009).

The preferred water management option would be via re-use such as irrigation for improved pasture and high water use crops, however it is likely that a combination of irrigation and discharge to surface water would be utilised to manage treated water. AGL owns approximately 330 ha in the Stage 1 GFDA which would be used for improved pasture and crop production. These two options are discussed below.

Reuse of Treated Water

An Irrigation Drainage Management Plan (IDMP) would be prepared as part of the Water Management Strategy to manage irrigation and discharge requirements. This plan would be developed in accordance with DECCW and DII guidelines. The IDMP would include:

- Treated water quality and suitability for irrigation;
- Analysis of soil, water and climate to determine the suitable areas for irrigation;
- Impacts of climate, in particular rainfall, and impact on irrigation requirements;
- Analysis of soil characteristics including fertility, texture, structure, clay percentage, water-holding capacity, cation exchange capacity, exchangeable sodium percentage, leaching fraction, pH, organic matter and trace elements; and
- Monitoring of plant health/vigour through both visual inspection and photographic records.

AGL would comply with relevant water quality standards for irrigation as required by DECCW, regulatory authorities and relevant guidelines issued by these authorities, in particular the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) which includes water quality guidelines recommended for agricultural use, including irrigation.

Monitoring of the river water would be part of an ongoing water quality monitoring program. Comparisons would be made with available data from other sources, in particular for salinity levels. It is well documented that the Avon River has dramatically variable salinity levels, so monitoring would occur both up and downstream of the irrigation site to ensure accurate baseline data for comparison at the time of sampling.

River Discharge of Treated Water

During periods of high rainfall and when the treated water holding ponds are at capacity, there would be a requirement to discharge treated water to a local waterway. A River Discharge Contingency Plan (RDCP) would be prepared that would include:

- Water quality of receiving waters;
- Downstream uses, environmental values and water quality objectives for the river and its catchment;
- Hydrological characteristics;
- Quality of treated water;
- Locations for treated water discharge;

- Scenarios under which treated water discharge would be required including timing and frequency of discharge; and
- Water quality monitoring both upstream and downstream of river discharge points.

This RDCP would determine suitable discharge points and baseline water quality for the nominated waterway. The water quality baseline would then be used as part of detail design to determine the level of treatment and water quality criteria for treated water discharge.

This IDMP and RDCP would form part of an application to DECCW to include irrigation of land and discharge to waters as part of an Environment Protection Licence (EPL), under which these activities would be regulated by DECCW. Consideration of relevant Water Sharing Plans administered by the NSW Office of Water would also be incorporated into the IDMP.

It is noted that AGL would comply with all relevant water quality standards for both irrigation and river discharge as required by DECCW, regulatory authorities and relevant guidelines issued by these authorities, in particular the ANZECC guidelines which include guidelines for agricultural use including irrigation.

Further environmental studies are also proposed as part of detailed design into the possibility of rehabilitating an existing wetland, and discharge of the treated water upstream of the wetland. Drainage of the treated water through a wetland would also assist with filtering the water prior to entering the waterway. If wetland rehabilitation is determined to be a viable option this would also form part of the IDMP and EPL licence conditions as required by DECCW and regulatory authorities.

Treatment and Disposal of Concentrated Brine Waste Stream

The proposed water treatment process would generate a concentrated brine waste stream, as discussed in **Section 4.4.2** of the EA. A number of alternative options for the disposal of the waste stream have been considered for the project in Section 4.4.2 of the EA. The preferred approach involves the evaporation of the waste stream in an open air basin / brine pond, with evaporation further enhanced by using waste heat from the gas compressors at the CPF to heat the brine in the pond. This preferred option would be subject to further detailed design to ensure that the size of the pond would be sufficient to accommodate the anticipated concentrated brine waste stream.

Zero-liquid discharge (ZLD) technology also presents a viable alternative to evaporation ponds. This is likely to include a Brine Crystal Concentrator (BCC) – which uses mechanical evaporation processes to further concentrate the brine – followed by a Crystalliser that evaporates any remaining water and produces a salt crystal product. Opportunities to utilise waste heat captured from the CPF would also be explored for this alternative. Detailed engineering design is required to confirm the viability of the preferred approach for enhanced evaporation ponds to be constructed.

The evaporation of the waste stream would result in the production of up to 4 tonnes of salt per day, based on a volume of 2 ML of produced water per day and total dissolved solids (TDS) of 2000 mg/L. The extent of salt production depends on quality and quantity of the produced water which would vary across the Stage 1 GFDA. A storage shed would be necessary to stockpile the salt, as well as a loading point for its removal from the site. It is estimated that one to two trucks per week (removing approximately 20 tonnes each) may eventually be required for salt transport.

Options for management of salt are currently being investigated. In the event that the salt cannot be reused, it would be disposed of at an appropriately licensed landfill facility. It is noted that the Gloucester Landfill does not accept salt waste, and an appropriately licensed waste management facility outside the Gloucester LGA would be required.

In the longer term it is preferable that the salt may either be transported to a salt producer for further processing, or processed locally into saleable products, however this option is not presently available. Consideration in detailed engineering design would be given to adjusting the treatment process to limit the contamination of the salt product so the opportunity for its processing/re-use is maximised. Opportunities in this regard would continue to be pursued into the future.

3.1.5 Comparison to Management of Produced Water Elsewhere in Australia

A number of submissions from the community raised concerns regarding environmental degradation associated with practices utilised elsewhere in Australia and overseas for the treatment of produced water. In particular, reference was made to environmental impacts associated with treatment of produced water in Queensland. The water volumes likely to be generated at Gloucester for this Project are much less than volumes produced from Bowen Basin and Great Artesian Basin aquifers in Queensland. The primary method for disposal of produced water generated in Queensland is typically by placing untreated produced water in unlined evaporation ponds, which can be up to 100 ha in surface area. In cases where these evaporation ponds are not lined, impacts have included concentrated salts and other contaminants leaching directly into the ground surface and consequently impacting on nearby agricultural land uses, rivers, aquifers and ecosystems (Queensland Department of Infrastructure and Planning, 2009).

The method of produced water treatment and management proposed for this Project differs to the abovementioned practice. Firstly, all storage ponds for produced and treated water, as well as the concentrated brine stream would be fully lined to prevent leaching of potential contaminants through the ground surface. Secondly, the produced water from the Project would initially be treated to relevant standards as required, depending on the final management method (e.g. irrigation or river discharge) utilising RO.

While evaporation ponds would be used to treat the concentrated brine waste stream, these evaporation ponds would be significantly smaller in scale than the evaporation ponds referred to in Queensland for produced water, and would be fully lined to prevent leaching of potential contaminants through the ground surface. This would subsequently avoid potential impacts to agricultural land uses, rivers, aquifers and ecosystems.

Water treatment is an emerging area, particularly in CSG production. Ongoing research and development in this field is being completed and the technology is being continually improved. AGL will keep abreast of all new and improved technology as part of its detailed design for the project.

3.2 Groundwater Management

Submissions from agencies, community interest groups and the public raised concerns regarding impacts to beneficial aquifers (shallow alluvial aquifers and shallow bedrock aquifers) through hydraulic connectivity, as well as impacts to the deep bedrock aquifers contained within the coal measures as a result of the drilling and construction of wells. A number of specific concerns were raised by submissions from community interest groups and the public which are addressed in **Chapter 5**, however the majority of concerns broadly included:

- Dewatering of aquifers;
- Groundwater migration between aquifers;
- Draining of water from shallow aquifers;
- Underestimation of permeability of aquifers;
- Water quality impacts within beneficial aquifers;
- Geological constraints; and
- Impacts to stream flow in water courses.

As discussed in Section 13.4.1 of the EA, these issues would be managed through the preparation of a Groundwater Management Plan (GWMP). A GWMP would be developed for the project prior to construction, which would include development of a groundwater monitoring program, and development and ongoing review of a hydrogeological (conceptual) model. Development of a numerical model is only justified if the monitoring data and conceptual model suggest there is connectivity between shallow aquifers and deeper aquifers in the coal seams and impacts to shallow aquifers are possible.

A groundwater monitoring network would be established in the Project Area and surrounds to monitor water level and quality of the groundwater resources (superficial/alluvial aquifer, shallow bedrock aquifers and deep bedrock aquifers). The monitoring network would have the following functions:

- Monitoring of water quality, monitoring of water levels and storage, and recharge/discharge characteristics (i.e. permeability, hydraulic conductivity, hydraulic gradients, rates of rise and fall etc) in individual aquifer units;
- Baseline dating of aquifers using isotope techniques or carbon dating. Isotopes will confirm the origin of waters (most are rainfall derived) while radio carbon/tritium dating of the water samples allows determination

of residence times, and an approximate natural recharge rate for each aquifer. Water quality and isotope analysis will further improve the conceptual model and understanding of connectivity (if any) between aquifers; and

- Establish the origin, age and quality of each aquifer and identify any interconnectivity and the primary recharge/discharge flow paths. This will determine the hydrodynamic functioning of the multilayer aquifer system and provide a baseline against which subsequent analyses can be compared in order to trace changes in groundwater hydrology during CSG extraction.

A conceptual hydrogeological model would be developed for the Project Area broader basin region based on baseline and ongoing results from the groundwater monitoring program, which would include reviewing the geological mapping, interpretation of geophysical information, analysis of water levels and groundwater quality, identification / confirmation of hydrological catchments and hydrogeological units, and identification of significant water-bearing geologic structures and evaluation of hydraulic characteristics. The hydrogeological model would be regularly reviewed and updated, and along with results of the groundwater monitoring network, would be used to develop a long term groundwater monitoring program.

The Groundwater Management Plan would be implemented for the duration of the Project and would include ongoing monitoring of water levels of the shallow alluvial aquifers, shallow bedrock aquifers, and deep bedrock aquifers. Water quality from each of these aquifers would also be monitored periodically.

During construction within the Stage 1 GFDA, the extraction of groundwater in association with the gas would result in drawdown of groundwater levels within the deep bedrock aquifer (coal measures) in the vicinity of each well. As the number of operational wells increase (up to 110 in the Stage 1 GFDA), so too will the volume of groundwater being extracted and the subsequent area of drawdown. However, the lowering of groundwater levels is expected to take place wholly within the deep bedrock aquifer from where the groundwater is being extracted, and as the aquifer is not used for beneficial use in the vicinity of the Project area (due to its significant depth and brackish nature), adverse impacts are not expected. The potential for any connectivity between the deep bedrock aquifers and the shallow aquifers will be identified by the baseline monitoring program and review of the hydrogeological model . If adverse impacts to beneficial aquifers were detected, the GWMP and hydrogeological model would allow the responsible well sites to be identified, and investigated.

Potential for cross contamination of shallow and deep aquifers would be minimised through the use of a pressure-rated steel casing in the production well design. All wells would be cased-off and cemented in accordance with the requirements of the Department of Industry and Investment (DII). The steel casing allows the Proponent to isolate specific horizons of interest from the other formations intersected by a well. The production well design allows for the installation, and subsequent cementing of the casing which not only provides support for the well when subjected to the pressures associated with well completion and production operations, but would also maintain the natural integrity of aquifers that may be intersected (i.e. any intersected aquifers would be effectively isolated from the borehole).

3.3 Ecological Impacts

3.3.1 Width of Pipeline Corridor

A number of submissions from the community raised concerns that construction of the pipeline would result in the disturbance of a 100 m corridor along the length of the pipeline.

As described in Section 3.3.3 of the EA, a 100 m wide corridor along the length of the pipeline route was assessed as part of the EA. A 100 m wide corridor was assessed to allow flexibility in the final location of the pipeline route, to accommodate minor route amendments within the 100 m wide corridor based on constraints during the final route selection, such as ecology, land owner preferences and construction issues.

The final corridor would be a maximum of some 30 m wide area of disturbance, referred to as the Right of Way (ROW), located within the 100 m wide corridor. The area of clearing / disturbance would be limited to a maximum 30 m width along the pipeline route. In sensitive areas, such as through Wallaroo National Park, the ROW would be reduced where possible to existing cleared areas to minimise ecological impacts. Additionally, approximately 30% of the 30 m ROW would be within existing cleared powerline easements to further limit disturbance where possible.

3.3.2 Inadequate flora and fauna survey methodology

DECCW raised concerns in its submission in relation to the following:

- Inappropriate timing of surveying – many predicted species may be inactive. Additional targeted surveying in spring not adequate to detect all likely flowering threatened flora given extent of study area.
- Recommended fauna detection techniques in DECCW guidelines not utilised. Survey relies on opportunistic habitat searches and incidental records.
- No details of timing / duration of surveying provided, nor the prevailing weather conditions. Clear indication of total survey effort conducted across development footprint should be provided.
- Targeted flora surveying for some threatened species inappropriate or inadequate (in particular for cryptic species) - No details of timing / duration of targeted surveying provided.
- DECCW's submission lists 12 species for which additional targeted surveying is recommended.

Initial field surveys were carried out during 28 August to 5 September 2008. The field surveys were conducted by two AECOM flora ecologists and two AECOM fauna ecologists. Additional surveys were conducted by an AECOM senior ecologist on 17 October and 19 November 2008, and an AHA Ecology senior ecologist on 8, 9, 10, 11, and 12 June 2009.

The objective of the field surveys was to confirm the presence and / or potential presence of the threatened species and ecological communities identified in the desktop assessment or the presence of their preferred habitat(s). Detailed fauna survey techniques (e.g. trapping) were not undertaken. The linear nature of the 100 km long and 30 m wide alignment is not suited to intensive trapping at spot locations as recommended in the Draft *DECCW Guidelines.* Intensive trapping surveys at a small number of spot locations removes resources from surveys for potential habitat. Determining the distribution of potential habitats for threatened species is crucial to the assessment of potential impacts. Analysis of the list of potential threatened fauna species along the alignment (derived from desktop assessment) revealed few species that could be reliably detected using general techniques such as Elliot traps, cage traps, pit traps or even spotlighting. Species such as Koalas, Spot-tailed Quolls, Parma Wallabies, Pale-headed Snakes, Sooty Owls (to name but a few) require specific targeting using non-conventional techniques. The threatened bird species potentially occurring on the alignment are mostly not species that are sedentary with small home ranges, and are therefore not detected efficiently using transect surveys. Nocturnal birds and frogs were surveyed using call play-back in potential habitat that was identified during habitat surveys.

Flora field surveys were conducted at 81 sites and fauna ground surveys were conducted at 82 sites, mostly within timbered areas selected through aerial photograph interpretation. Of these, detailed assessments were made at 22 flora sites and 21 fauna sites, while briefer observation records were made at 59 flora sites and 61 fauna sites. The locations of the flora and fauna survey sites are shown in Figures 10.1.1 to 10.1.19 of Volume 4 of the EA. Incidental fauna observations were recorded and these were supplemented by limited spotlighting, ultrasonic bat detecting and call-playback activities. Survey sites and vehicular traverses were distributed so as to sample as much environmental variability within the study area as possible, within practical time and accessibility constraints. The exact time and weather conditions at 81 flora sites and 82 fauna sites surveyed during 28 August to 5 September 2008 is unlikely to provide extra information for assessing the presence of threatened species in the survey area. However, this information can be obtained from the data sheets attached to Appendix G of the EA.

Overall, the field survey comprised approximately 10 hours per day for 9 days by four ecologists plus 2 days more for two people (about 376 person hours).

It is not practical or economically feasible to undertake flora and fauna surveys in all seasons in the hope of finding cryptic species within suitable habitats across the extensive areas traversed by the proposed pipeline and GFDA. Additionally, year to year variations may render approximate seasons as being non-representative. For this reason a combination of desktop assessments, field survey focussed on habitat assessments, and Threatened Species Assessments of Significance was used to identify and assess potential impacts and develop effective mitigation strategies.

It is acknowledged that targeted surveys were not conducted for threatened species. The pipeline and GFDA traverse extensive areas, so targeted surveys for the numerous threatened flora and fauna species in suitable habitats at multiple periods throughout the year was not considered to be practicable. It is considered to be more practical, more economically feasible and more precautionary to consider appropriate offsets for these species where potential habitat is disturbed.

3.3.3 Threatened Species Assessments of Significance

DECCW stated in its submission that it did not concur with the conclusions from the assessment of significance that concluded a significant impact on a threatened species life-cycle and/or habitat was unlikely on the basis of species not being recorded in the survey, removal of vegetation in narrow strips hence reducing fragmentation, and habitat to be cleared is minimal compared with other undisturbed habitat surrounding the proposal. In addition, a number of submissions from community interest groups and the public raised general concerns regarding overall ecological impacts of the project.

The assessments of significance for each of the TSC listed species were based on numerous criteria. For each of 71 threatened species and communities, the presence of potential habitat, the known distribution, the likelihood of occurrence along the alignment, the amount of habitat to be cleared, the amount of similar habitat nearby, the species' ecology, the species' behaviour, the species' mobility, the feasibility of implementing appropriate and effective mitigation measures, and other details pertinent to a particular species were taken into consideration in assessing whether the proposed Project was likely to have a significant impact. Whether or not the species was recorded along the route was not considered except when the detection proved the presence of a species or community. AECOM acknowledges that extensive targeted surveys were not conducted for most species. Therefore no assumptions of absence were made for any of the 71 threatened species and communities that received Assessments of Significance. The consistent conclusions that impacts could be mitigated effectively did not eventuate from incorrect conclusions.

The outcomes reflect the situation that a 30 m wide corridor through highly fragmented and degraded agricultural country can be effectively managed so as not to bring about significant ecological impacts. As shown in **Section 3.3.5** of this report, the total area of remnant vegetation proposed to be cleared is approximately 18.17 ha over a 100 km alignment. 'Removal of narrow strips of vegetation' was considered in the assessments to have less impact on fragmentation than 'large scale clearing through remnants'. There is no intended meaning that 'removal of narrow strips of vegetation' would have less impact on fragmentation than 'not clearing any vegetation' would have.

3.3.4 Release of captured fauna during pre-clearance surveys

DECCW and one submission from the community raised concerns regarding the effectiveness of pre-clearance surveys during pipeline construction, and the capture and release of fauna if detected.

Pre-clearance surveys would to be conducted by qualified personnel, licensed to handle and release animals in NSW. Fauna captured during pre-clearance surveys would be released adjacent to the ROW where they were found in appropriate habitat at a time suitable for the species in question (e.g. at dusk for nocturnal species and early morning for diurnal species). Care would be taken to ensure that individuals are not left exposed and without the necessary microhabitat requirements.

Releasing any animal into nearby similar habitat is likely to place the relocated animal into habitat already occupied by a conspecific. In this proposal the majority of movements would be a distance of at least 15 m but not more than 30 m. Birds, bats, larger mammals, snakes larger lizards and amphibians species are mobile and have large and flexible home ranges, so are unlikely to be affected by such a small move. Moving these types of animals such a short distance would not be translocation, but merely removal from danger. For small mammals and reptiles there is a chance that some would be translocated out of their home ranges. There is very little that can be done to mitigate the impacts on the relocated animal and the adjacent population. However, these potential impacts are more about animal welfare than conservation. This issue is not unique to this development proposal, but is common to a majority of land developments, whether or not it is acknowledged. Handling of animals would to be conducted by qualified personnel, licensed to handle and release animals in NSW.

3.3.5 Biodiversity Offsets

Offset Requirements

A Habitat Offset Strategy would be prepared for the project to compensate for loss of biodiversity values that cannot be adequately avoided or mitigated. Offset strategies are specifically required for:

- Clearing of native vegetation totalling up to 18.17 ha, comprising:
  - 17.94 ha (excluding EECs) for pipeline construction (and comprising 9 vegetation species that could represent habitat);
  - Clearing / disturbance of approximately 0.23 ha of an EEC, Hunter Lowland Redgum Forest; and

- Removal and / or disturbance of one recorded population of *Grevillea parviflora* (Small-flowered Grevillia), a listed threatened species under both State and Commonwealth legislation.

The Habitat Offset Strategy would aim to offset residual impacts to biodiversity that cannot be mitigated through the extensive range of measures provided in the EA, in particular impacts to threatened ecological communities and habitat for threatened and endangered species.

The Ecological Assessment in the EA (refer Appendix G of Volume 2 of the EA), took a precautionary approach and assessed potential impacts to flora and fauna species on the basis of potential direct impacts to habitat types. The vegetation types (that also represent potential habitat) being impacted by the project are summarised in the table below.

Table 1: Summary of Vegetation Types to be Impacted

Vegetation	Area Removed (ha)
Dry foothills spotted gum	9.2
Rainforest	0.3
South Coast Shrubby Grey Gum	1.4
Ironbark	2.6
Redgum / apple	0.1
Spotted Gum - Ironbark Forest	1.5
Grey Gum – Stringybark – Bloodwood ± Spotted Gum Ironbark Forest	2.6
Riparian Communities	0.2
Wetlands (including SEPP 14 wetlands)	0
Total Area	**17.94 ha**
Forest Red Gum / Spotted Gum Woodland (corresponds to Hunter Lowland Redgum Forest EEC – listed under TSC Act)	0.2
Total Area	**18.17 ha**

A list of threatened species that were identified in the Ecological Assessment for the EA as potentially having habitat along the pipeline corridor is provided in **Appendix B** to this report. This includes 14 flora species and 47 fauna species that have the potential to be present within these habitat types.

Offset Framework

The following framework is proposed for identifying, assessing and securing offsets required for the project:

1) Initial identification of suitable offset areas;
2) Confirmation of likelihood of impact to refine the flora and fauna species to be offset;
3) Confirmation of offset areas and assessment to ensure appropriateness of offset package;
4) Preparation of Draft Habitat Offset Strategy, and presentation to DoP, DECCW and DEWHA; and
5) Implementation of Habitat Offset Strategy.

1) **Initial Identification of Suitable Offset Areas**

AGL has engaged a qualified ecologist to identify vegetation / habitat areas in the region that may provide suitable habitat and/or biodiversity values which would provide offsets for the project. AGL has already investigated a potential offset area adjacent to an existing National Park in the region. The site is 134.9ha, thereby providing ample opportunity to provide offsets.

The site provides a range of fauna habitat types. An initial assessment of the property by Alison Hunt and Associates indicates that the property potentially provides offsets for species identified in **Table 2** below which would potentially be impacted by the project.

Table 2: Habitat values provided at identified offset site

Fauna Species	Habitat Types
Endangered Ecological Communities	Potential for the site to contain the EEC *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion*
Four threatened flora species	• Slaty Redgum • Small flowered-grevillea • Tall Knotweed • Black eyed Susan
Sixteen threatened fauna species	• Bushstone Curlew • Brown Treecreeper • Swift Parrot • Barking Owl • Speckled Warbler • Regent Honeyeater • Eastern Pygmy-possum • Eastern False Pipistrelle • Eastern Free-tail Bat • Yellow bellied glider • Squirrel glider • Brush-tailed Phascogale • Grey headed flying fox • Greater broad-nosed bat • Gold-tipped bat • Southern Myotis
Seven threatened fauna species that have been recorded within or near the property	• Koala • Powerful owl; • Little Bent-wing bat; • Eastern Bent-wing bat; • Spotted tail quoll; • Grey crowned babbler; • Glossy Black cockatoo.

AGL is considering options for this site. The formal mechanism by which it is then kept in perpetuity, would be investigated as part of the ensuing steps, once the full package has been identified.

2) **Confirmation of Likelihood of Species Occurrence**

A number of species were identified in the EA as having some potential to occur within the habitats along the pipeline corridor. The likelihood of the impact would be considered during the development of an offset package.

This includes species as follows:

- Low potential to occur:
  - Four endangered populations associated with some or all of the vegetation/habitat types shown in **Appendix B** but which are all identified as **Low** Likelihood of occurrence in the impact area;
  - Seven threatened flora species identified as having **Low** potential to occur within the vegetation types;
  - Fifteen threatened fauna species identified as having **Low** potential to occur within the vegetation types;
  - One endangered population, two flora species and one fauna species considered to have a **Low-Moderate** potential for occurrence within the impact area.

- Moderate potential to occur whose presence would need to be confirmed:
  - One flora species with a **Moderate** potential to occur; and
  - Three fauna species with a **Moderate** potential to occur.
- Moderate-High or High potential for occurrence:
  - Seven fauna species with a **Moderate-High** potential to occur; and
  - One fauna species with a **High** potential to occur.

The rationale for the Low, Moderate or High ranking for potential occurrence is provided in **Appendix B** of this Submissions Report.

Confirmation of the presence/absence of these species would include additional review of each species and may include additional surveys. The approach, scope and methodology for the confirmation of absence or presence of species would be developed in consultation with DECCW but would focus primarily on those species with a Moderate to High likelihood of occurrence.

3) **Verification of Further Offset Areas**

If required, on the basis of the work noted above, AGL would identify additional offset areas that cater specifically for the identified species. The following species (listed in **Appendix B**) are those that have a Moderate-High or High potential of occurrence:

- Gang-gang Cockatoo (Moderate-High);
- Square-tailed Kite (Moderate-High);
- Black-chinned Honeyeater (Moderate-High);
- Turquoise Parrot (Moderate-High);
- Diamond Firetail (Moderate-High);
- Large Footed Myotis (Moderate-High);
- Yellow-bellied Sheath-tail bat (Moderate-High); and
- Masked Owl (High).

Whilst these species have specific habitat requirements, such as favoured feed trees, hollow bearing trees or open woodland areas, the majority do not possess needs that would be difficult to meet. Therefore these species should be easily offset.

4) **Preparation of a Draft Habitat Offset Strategy**

A Draft Habitat Offset Strategy would be prepared which would comprise a package of offset measures aimed at maintaining or improving biodiversity values. The package may contain a range of biodiversity offset areas, revegetation, bushland regeneration, and ongoing monitoring and management strategies for identified areas.

The Draft Habitat Offset Strategy would detail the proposed legal mechanisms to secure offsets proposed as part of the package. Legal mechanisms would likely include either a covenant under the Conveyancing Act, or a Conservation Agreement.

The Habitat Offset Strategy would be developed according to the following principles:

- Impacts must first be avoided as far as possible by using prevention and mitigation measures;
- All regulatory requirements must be met;
- Offsets should complement other government programs;
- Offsets must be underpinned by sound ecological principles;
- Offsets should aim to result in a net improvement in biodiversity over time;
- Offsets must be enduring – they must offset the impact of the development for at least the period that the impact occurs;
- Offsets should be agreed prior to the impact occurring;
- Offsets must be quantifiable – the impacts and benefits must be reliably estimated;
- Offsets must be targeted – they must offset impacts on a like-for-like or better basis;
- Offsets must be located appropriately – they must offset the impact in the same region;
- Offsets must be supplementary – they must be beyond existing requirements and not already be funded under another scheme; and

- Offsets and their actions must be enforceable – through development consent conditions, licence conditions, conservation agreements or a contract.

The Offset Strategy would also include specific maintenance measures for the offset areas which would become a requirement of their management going forward. This might include measures such as:

- Specific areas to be fenced;
- Requirement for no planting of inappropriate species within offset areas;
- Requirement for no stock or grazing;
- Specific measures around weed control etc.

The Offset Strategy, management measures and the mechanism to ensure the offset area in perpetuity, would be developed in consultation with DOP, DEWHA and DECCW.

5) **Implementation of the Habitat Offset Strategy**

The Habitat Offset Strategy would be implemented in consultation with DECCW, DEWHA, DoP and relevant agencies.

3.4 Human Health Impacts

Eighty two issues in 24 separate submissions (including the form letter submission) related to various aspects of human health. The health issues related primarily to:

- Air quality:
  - PM2.5 and PM1 – these issues are addressed in **Section 3.5** of this Submissions Report in relation to air quality impacts; and
  - Fugitive emission of methane from the well sites.
- Hazards (the risk of mass release of methane);
- Water quality:
  - Contaminants in fraccing fluids affecting bore water;
  - Risk of contamination from drilling fluids; and
  - Effects to the domestic water supply via discharge to rivers.

It should be noted that human health was not a requirement of the Director-General's EARs in accordance with which the EA was prepared. The EARs were however specific in their requirements for air and water quality, the assessment methodology and criteria which include the prevention of effects to human health. Given the level of concern in this area however, further discussion on each of these issues is provided in the sections below.

3.4.1 Air Quality

Fugitive Emissions from Methane Leakage

The Preliminary Hazard Analysis (PHA) undertaken by Sherpa Consulting was provided in Appendix I of the EA. In Section 11.2 of that report, it was stated that:

The following potential methane release scenarios have the potential to occur at the well-sites, Central Processing Facility (CPF) and Hexham Delivery Station (HDS):

- Loss of containment during pigging operations.
- Loss of containment from pipework (from holes in pipework due to corrosion, impact, etc.).
- Loss of containment from flanged connections, valves, filters, meters, heaters due to flange leaks, instrument tapping point failures, etc.
- External events (bushfire, ground movement, lightning, flooding).

The PHA provided a series of safeguards and mitigation and management measures at the well-sites, CPF and HDS to prevent, control and mitigate jet fire incidents at these sites, which are listed below.

- Leak prevention and minimisation measures, including ;
  - No free oxygen present in the coal seam methane
  - Painting of aboveground pipework
  - Coating of underground pipework
  - Maintenance/ inspection
  - Spiral wound gaskets on HP flanged equipment
  - Pressure control and shutdown valve on pressure regulating skid
  - High fracture tough steel
  - Permit to work system
  - Management of Change system
  - Security fencing
  - Vehicle barriers
  - Hydrostatic testing of equipment
  - 100% radiography of all circumferential welds
  - Security fencing around aboveground facilities
  - Hazardous area classification as per AS 2430 to minimise the risk of ignition sources
  - Gravel or hardstand area inside aboveground facilities around gas filled equipment to minimise the risk of grass fires
  - Lightning protection at the CPF and HDS site
  - Maintenance procedures
  - Standard operating procedures
- Control
  - Monitoring of field, CPF and pipeline process parameters via SCADA system
  - Automated shutdown of wells when process parameters exceed range detailed in HAZOP
  - Relieving of stress where ground movement stresses pipework
- Mitigation
  - Separation distance between release point and site boundary
  - Development of emergency response procedures
- Safeguards and mitigation were also included in Section 12.1.4 of the PHA for the pipeline, and included the following:
- Designing the pipeline with appropriate design factors and in accordance with relevant Australian Standards (AS 2885.1);
- Mitigation measures to protect the pipeline against external damage, including visible marker signs, pipeline patrols, ‘dial-before-you-dig’ services and marker tape;
- Corrosion protection, including external coating of pipeline, testing of coating protection prior to burial, cathodic protection system, gas quality with minimal corrosion enhancing components, and intelligent pigging to assess pieline condition throughout the life of the pipeline; and
- Ongoing liaison with the Mine Subsidence Board to determine future potential for subsidence.

The PHA provides detailed requirements for the construction of key elements of the project. In addition, it notes that:

“The effects of an accidental emission of methane gas are unlikely to threaten the long-term viability of the ecosystem or any species within any sensitive natural environmental areas which may exist near the proposed development.” (Section 15.8 of Appendix I of the Gloucester Gas Project EA)

It should also be noted that the PHA is the preliminary step in a broader assessment process dealing with hazard and risk. AGL would be required to complete further studies as the design progresses as part of DOP's Seven Stage Assessment Process. Initially, this would include:

- Hazard and Operability Study;
- Final Hazard Analysis;
- Final Safety Study; and
- Emergency Plan.

These studies are undertaken post approval as part of, or after, the detailed design phase. Upon completion of these studies, further analyses are required throughout construction and operational phases.

3.4.2 Hazards

Reference is made to the section above dealing with methane leakage from the well sites and CPF. However, reference was also made in submissions to migration of methane gas in the Stratford area in 2004. The incident which occurred was the result of communication between an old coal exploration well which was in close proximity to the production test well. The old coal exploration well had not been completely plugged and abandoned by the coal title operator and both wells penetrated the same coal seams.

On this basis, AGL has developed a management procedure as part of the overall safety management procedures. To overcome gas migration via old coal exploration wells, exploration wells which may communicate with a future production well due to the penetration of the same coal seam and are in close proximity, would be plugged with cement in accordance with the DII's guideline. In addition, Gloucester Coal would be consulted in regard to location of old coal exploration wells.

3.4.3 Water Quality

A number of submissions were received in relation to fraccing fluids. The key concern raised was that the component elements of the fraccing fluid are toxic with the potential to cause severe health effects. The key pathway raised in submissions is via groundwater migration. The management of groundwater is discussed in **Section 3.2** of this report. The section below provides additional detail on the fraccing fluids themselves.

Fraccing fluid typically consists of 90% water, 9.5% sand and 0.5% additives by volume. The main purpose of the majority of the additives is to form a gelled frac fluid allowing the sand to be suspended within the frac fluid. Some of the constituents of the frac fluid are utilised to breakdown the gel once the frac is completed. These are highly diluted and are then further diluted by the groundwater in the coal seam.

The additives used may include:

- Sodium hypochlorate (commonly used in swimming pools)
- Hydrochloric acid (commonly used in swimming pools)
- Surfactants (used in soaps)
- Cellulose (an organic compound derived from plants)
- Acetic acid (used in vinegar)
- Bactericides (to prevent bacteria from forming corrosion)

Some of the additives have a toxic nature when they are in a pure form, however many of these are commonly used in households and in a diluted form (as for fraccing) they present a minimal risk for a variety of reasons:

- The fraccing fluid is only injected into coal seams, and does not come into contact with shallow beneficial aquifers;
- When the fracc fluid is injected, the well has been encased with steel and concrete which is perforated only across the coal seam;
- From a health perspective there are typically less than 0.5%of the total fracc fluid volume is made up of additives and it is therefore very diluted as compared to their natural form and further diluted by the groundwater within the coal seam.;
- The vast majority of the frac fluid injected into a well is recovered and removed for treatment and reuse. This leaves only a very small proportion of the frac fluid within the coal seam/non beneficial aquifer and, notwithstanding this, the dilution factor, as noted above, would further reduce the concentration.

Risk of Contamination from Drilling Fluid

A number of submissions were received in relation to drilling fluids, and potential risks associated with contamination of beneficial aquifers and water sources.

The management of drilling fluid was considered in Section 5.4.3 and 5.4.7 of the EA. A range of mitigation measures for drill fluid management would be implemented at each drill site, and would include the following:

- All fluids are contained within a closed system (ie contained in sealed tanks);
- Each drill pad is constructed with a bundwall that fully encloses the pad and a small lined sump is constructed to one corner of the pad to capture runoff from the pad;
- The bundwall provides a second barrier of containment in the unlikely event of drill fluid spills on the pad;
- Sediment fencing is also installed around the drill pad as a third line of defence;
- Each drill pad site is inspected by AGL to ensure compliance with both construction and environmental aspects. A "Daily Shutdown Checklist" has also been developed to ensure maintenance and compliance of the drill site. The checklist, completed each day by the drilling supervisor on site, includes:
    - Checks on the drilling mud management, including the closed tank system;
    - Confirmation that erosion and sedimentation controls are in good condition, including if the sump requires pumping out;
    - Inspection of the general housekeeping of the site to ensure all is secure and well maintained;
    - The completed checklist is then submitted to AGL daily. An internal site audit/checklist is also randomly conducted by AGL staff to ensure compliance to environmental controls.

It is worthy of note that the drill fluids are all biodegradable and consist primarily of water and bentonite.

Domestic Water Supply

Submissions were received regarding the potential for the project to impact the quality of the Karuah River system, from which drinking water supplies are drawn. However, there are several reasons why this would not be considered an issue of concern or potential health effect pathway.

As noted in **Section 3.1** above in relation to Surface Water, all water would be treated. The level to which it would be treated prior to its disposal is mandated by established guidelines. For example, if the treated water does not meet the guidelines for irrigation, then the water would not be used for such a purpose until proven that it is of adequate quality.

Discharge to surface water has been included by AGL as a possible management measure, in particular for during high rainfall events, which will only be utilised as a final option. This could only happen on the basis of there being a licensed discharge point agreed by DECCW included in the EPL for the project. A discharge point identified in the EPL would include specific criteria for the disposal water to be protective of the receiving water. AGL plans to undertake water quality monitoring at agreed locations on the river, to enable DECCW to license a discharge point and attach appropriate criteria. The criteria would be specific to the current quality of the river and, as with the example noted above, if the water did not meet those criteria, the water could not be discharged until such time as it did.

Given that additional water reaching the river would be of the same or better quality than the current river system, this is not considered to represent a human or environmental health issue.

3.5 Air Quality

A number of agency, community interest group and individual submissions raised concerns regarding air quality, including the following:

- DECCW's submission raised concerns that nitrous oxide (NO_x) emission rates for the five 3 megawatt (MW) power generators used in the CPF dispersion modelling in the Air Quality Impact Assessment (Volume 2 Appendix F of the EA) were underestimated.
- Cumulative impacts associated with air emissions from the Project and existing industrial activities in the Gloucester area (primarily Stratford Colliery) were not assessed; and
- Exhaust emissions from construction activities and heavy vehicle movements, in particular emission of particulate matter less than 2.5 micrometers (µm) ($PM_{2.5}$) were not properly assessed.

These issues are discussed in the following sections and in **Chapter 4** and **5** in response to individual submissions received.

3.5.1 Volumetric Flow Rates used in Dispersion Modelling

DECCW's submission raised concerns that nitrous oxide (NO_x) emission rates for the five 3 megawatt (MW) power generators used in the CPF dispersion modelling in the Air Quality Impact Assessment (Volume 2 Appendix F of the EA) were underestimated. A review of the technical parameters of the power generators indicated an error in the flow rates used in the dispersion modelling. An Air Quality Impact Assessment Addendum Report, Provided in **Appendix A**, has been prepared which assesses the impacts of the revised volumetric flow rate on nitrogen dioxide (NO_2) and carbon monoxide (CO) emissions from CPF Site 1 and Site 7.

Ground level concentrations of NO_2 and CO resulting from operation of the proposed facility at the CPF Site 1 and CPF Site 7 locations were re-modelled using the amended volumetric flow rate from the five 3 MW power generators at the CPF. NO_X emissions were converted to NO_2 using the ozone limiting method and average and contemporaneous ambient ozone concentrations from the DECCW monitoring station at Wallsend. Dispersion modelling was undertaken in accordance with the DECCW *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) (DECCW's Approved Methods).

Predicted annual average NO_2 concentrations are shown in **Appendix A** Table 5 of this Submissions Report for both CPF Site 1 and Site 7. These data represent 100% conversion of NO_X to NO_2. No exceedences of the guideline levels were predicted. Maximum predicted ground level concentrations of CO resulting from operation of the CPF at Site 1 and Site 7 are shown in **Appendix A** Table 10. All predicted concentrations of CO were well below the impact assessment criteria.

Results of the dispersion modelling predicted no exceedences of the DECCW's guideline criteria for these pollutants at either proposed project site. As such, the project is not expected to adversely affect air quality in the area.

3.5.2 Cumulative Air Quality Impacts

In accordance with DECCW's Approved Methods, dispersion modelling incorporated background concentrations for pollutants. Data were obtained from the DECCW monitoring station at Wallsend, which is the closest source of monitoring data available. Actual NO_2 concentrations at the proposed project sites would be expected to be lower than those recorded at Wallsend due to the rural nature of the project sites and the relative lack of pollution sources in the area. As such, the background emissions from existing industrial sources in the Gloucester Valley, including the Stratford Colliery, are considered to be represented in the air quality impact assessment. This method is in accordance with DECCW's Approved Methods.

3.5.3 Particulate Matter

A number of submissions raised that impacts from the PM_1 and $PM_{2.5}$ size fractions were not assessed as part of the Air Quality Impact Assessment (Volume 2 Appendix F of the EA) for the Project. Heavy vehicle and construction emissions were discussed in Section 9.4.1 and 9.4.2 of Volume 1 Chapter 9 of the EA, and in the Air Quality Impact Assessment in Volume 2 Appendix F of the EA.

Suspended particulate matter refers to the fraction of particles that remain suspended in the atmosphere for relatively long periods of time and is typically smaller than 20 µm (total suspended particulate matter (TSP)). Particulate matter greater than 10 µm in diameter is non-inhalable, as these particles do not penetrate further than the mouth and nose. Particulate matter smaller than 10 µm in diameter (PM_{10}) is inhalable and smaller fractions (particulate matter less than 2.5 µm in diameter, $PM_{2.5}$) can enter the respiratory system. In general, the smaller particles (e.g. PM_{10}, $PM_{2.5}$ and PM_1) are more strongly associated with potential health effects.

Current ambient air quality criteria for particulate matter in NSW are set for PM_{10}. The only criteria relevant in NSW relating to $PM_{2.5}$ is the National Environment Protection Council criteria (published as an advisory standard in the Air Quality NEPM document). The purpose of the $PM_{2.5}$ advisory standard is to *"gather sufficient data nationally to facilitate a review of the Advisory Reporting Standards as part of the review of this Measure scheduled to commence in 2005"*. However, in relation to $PM_{2.5}$, from a state based perspective, DECCW states that *"The NSW Government is committed to the development of a $PM_{2.5}$ standard but further research is necessary to achieve this. NSW will set a $PM_{2.5}$ goal as soon as sufficient information is available."* (http://www.environment.nsw.gov.au/air/actionforair/actionforair-06.htm). There has been no advice from DECCW as to when sufficient data will be available and no review date has yet been set. There are no relevant ambient air criteria set in NSW or Australia for PM_1, in part also because of limitations in data.

In the absence of relevant criteria for PM_1 and $PM_{2.5}$ in NSW, PM_{10} was assessed as part of the investigation. As discussed in the Air Quality Impact Assessment (Volume 2 Appendix F of the EA), the maximum ground level concentrations predicted by the dispersion modelling for CPF Site 7 in isolation for PM_{10} are well below the relevant NSW DECCW criteria i.e.:

- Maximum predicted concentration of ~0.7 µg/m³ as a 24 hour average compared with 50 µg/m³, and
- Maximum predicted concentration of < 0.1 µg/m³ as an annual average compared with 30 µg/m³.

As a conservative approach, if it is assumed 100% of the PM_{10} is in the $PM_{2.5}$ size fraction and compare the predicted concentrations (above) with the advisory reporting standards of the Air Quality NEPM set for $PM_{2.5}$ as follows:

- 25 µg/m³ as a 24 hour average; and
- 8 µg/m³ as an annual average.

The predicted concentrations are also well below the advisory reporting standards for $PM_{2.5}$.

It is also noted that the primary emission sources - gas combustion flue gases are only a minor source of $PM_{2.5}$ when compared with other regional sources of $PM_{2.5}$ such as diesel and coal combustion. It is considered unlikely that $PM_{2.5}$ would be considered an issue in relation to the Project.

3.6 Noise

A number of submissions from community interest groups and the public raised concerns that the noise impact assessment undertaken for the project was inadequate. Issues raised included the following:

- Cumulative impacts of noise from the project with Stratford Colliery;
- Project noise goals did not take into account the existing background noise levels at residences;
- Detailed operational noise assessment of the plant and equipment should be undertaken following final plant and equipment selection; and
- Noise control and mitigation measures should be mandatory.

Construction noise and construction traffic noise impacts were assessed in accordance with the DECCW's *Interim Construction Noise Guideline* (DECCW, 2009). Chapter 14 of the EA noted that exceedences of the daytime noise goal were likely to occur during some activities throughout the duration of construction. Consultation with landowners would be undertaken, and potential impacts would be minimised as far as practicable during construction.

The operational noise assessment for the CPF and Stage 1 GFDA was undertaken in accordance with the DECCW's *NSW Industrial Noise Policy* (INP), which is the regulatory guideline for assessing noise impacts from developments in NSW. The methodology used for the project is described below. As the majority of concerns raised in submissions relate to operational noise impacts, further discussion in relation to the methodology is provided below.

3.6.1 Background Noise Levels

Background noise levels were measured at representative locations (referred to in the EA as Reference Measurement Locations) within the Stage 1 GFDA and in the vicinity of each of the potential CPF locations. This included installing noise loggers and monitoring noise levels for at least seven days at these locations (identified as R1, R2, R4, R5, R7 and R8) in Section 14.2.1 of the EA to continually monitor background noise. This methodology is in accordance with requirements of the INP.

A representative selection of Reference Measurement Locations were selected to encompass the range of background noise that might be experienced throughout the Stage 1 GFDA. Receptors likely to be affected by noise from Stratford Colliery (R1, R2, and R8) were selected in the vicinity of CPF Site 7 to ensure background noise contributions from the Colliery were included in the assessment. Receptors away from industrial noise sources were selected in the vicinity of CPF Site 1 (R4, R5 and R7) to measure background levels not currently affected by significant noise sources.

3.6.2 Project Noise Goals

The INP describes the methodology for calculating project specific noise goals. Two separate noise criteria are identified in the INP: the intrusiveness criterion, which accounts for intrusive noise; and the amenity criterion, which protects the amenity of a particular land use. The INP requires that both criteria are calculated, and the more stringent of the two is adopted as the project specific noise goal. The intrusiveness criterion was the more stringent for the Project, and was adopted for the assessment.

The intrusiveness criterion is based on the average background noise levels recorded during the background noise monitoring. The intrusiveness criterion is defined as the average background level, plus 5 dBA. As the intrusiveness criterion is calculated based on the background noise level, the criterion includes cumulative impacts associated with other existing noise sources, including Stratford Colliery. The intrusiveness criterion was the most stringent for all assessment locations within the Stage 1 GFDA and was adopted as the project specific noise goal at each assessment location which included a representative number of receptors both affected (R1, R2, R4, R5, R7 and R8) and unaffected (R4, R5 and R7) by existing industrial noise sources.

Project specific noise goals were adopted based on the intrusiveness criterion for each of the assessment locations assessed in Section 14 of the EA, which were considered to be representative of the different levels of background noise experienced throughout the Stage 1 GFDA.

3.6.3 Cumulative Noise Impacts with Existing Land Uses

As described above, the project noise goals are based on existing noise levels measured throughout the Stage 1 GFDA, and as such incorporate existing noise emissions from the Stratford Colliery which would have contributed to existing background levels. The noise impact assessment considers the incremental noise impact the project is likely to have on the existing background noise levels in the area, and therefore provides an assessment of cumulative noise impacts.

3.6.4 Mitigation, Further Assessment and Consultation with Affected Residents

As identified in Volume 1 Section 14.6 of the EA, further detailed noise impact assessments would be undertaken specific to each well site location to determine appropriate noise mitigation measures to mitigate potential impacts. All feasible and reasonable mitigation measures to reduce noise emissions at the source would be considered.

Additionally, a further noise impact assessment would be undertaken for the CPF once the location and detailed design has been confirmed. This would incorporate further modelling of the plant equipment selected during detailed design. The modelling would be used to assist selection of acoustic control measures where exceedences of the project noise goals are identified at nearby receptors. All reasonable and feasible mitigation measures would be implemented to ensure project noise goals are met. Ongoing monitoring and compliance auditing would be undertaken as required.

3.7 Land Use

The submissions received from DII, as well as a number of submissions from community interest groups and the public raised general concerns about the loss of productive agricultural land and rural residential land as a result of the Project.

3.7.1 Impacts on Agricultural Land Use

Gloucester LGA and the Hunter Region have a large agricultural industry (4,569 establishments in the Hunter Region in 1996, of which 432 were within Gloucester LGA). Agriculture, forestry and fishing accounted for 10% of all businesses in the Hunter Region. Gloucester LGA had the second greatest proportion (19.6%) of persons employed in this sector than other LGAs in the Hunter Region, and this sector is the principal source of employment within Gloucester Shire (HVRF, 2008).

A review of the current agricultural activities being undertaken within the Stage 1 GFDA was undertaken to determine the types of agricultural land uses that would be impacted by the project. Approximately 43 landowners would be affected by the Project (predominately in the Stage 1 GFDA Area). The predominant land use that would be affected by the proposed works are grazing activities for beef and dairy cattle. Land uses within the GFDA include the following:

- Grazing – Beef;
- Grazing – Dairy;
- Mining;
- Rural Residential; and
- Crown Land.

It is expected there would be minimal loss of productivity of agricultural land as a result of the proposed works due to the following:

- Environmental envelope approach to assessment - well site locations have been chosen in consideration of the locational principles and in consultation with landowners.
- Rehabilitation practices – initial and final rehabilitation phases reduce the footprint of well sites, minimising the area of impact to agricultural activities.
- Existing use – the existing agricultural use is predominately grazing activities and as such subsurface infrastructure including the pipeline route, gas gathering system, and well site locations following initial rehabilitation would have a negligible impact on the availability of pasture for grazing.

The majority of infrastructure for the Project would be located within the Stage 1 GFDA. Within the GFDA, land use is predominately used for grazing activities as described above. The impact on grazing activities would be temporary during construction of well sites with the only exclusion zone to grazing activities comprising the construction footprint (approximately 90 m x 90m). Once well sites have been commissioned and initially rehabilitated, grazing activities could resume with the exception of exclusion within the production footprint (hardstand area of around 15 m x 15 m and a fenced area of 6m x 4m for a single well). Though unexpected, in some cases, wells may be co-located in which a larger area may be required. If wells were co-located, a final footprint of up to 40 m x 15 m would be required.

It is noted that wells sites would be located in accordance with the locational principles detailed in the EA, and in consultation with landowners.

Upon final rehabilitation of the well site, the affected area would be returned to as close as possible to pre construction condition, exclusions would be removed and previous grazing activities could continue.

Impacts on agricultural land as a result of the pipeline are expected to be minimal and limited to the construction phase. Once the pipeline has been constructed and surface rehabilitation is completed, the presence of the underlying infrastructure would have a negligible impact on grazing and cultivation activities on the surface.

Landowner agreements will include conditions which will restrict certain activities over buried infrastructure such as building of structures, and the depth of ploughing. Ploughing will still be allowed over buried pipelines, however will be depth restricted in order to protect the buried infrastructure. Where possible, buried pipelines will be constructed adjacent to tracks or fence lines in order not restrict any cultivation activities. . Pipelines will be designed and constructed in accordance with the relevant Australian standard and the *Australian Pipeline Industry Association – Code of Environmental Practice*. Where the potential for a change in agricultural activity exists due to a change in landowner ownership or other reason, the agreement including any land use restrictions would pass on to new landowners when acquiring land with subsurface infrastructure present.

When considering the impact of field infrastructure on agricultural activities, it can be assumed that approximately 110 well sites (some 15 m x 15 m gravel hardstand) would exclude only about 0.05% of the total 50km^2 area within the GFDA. Along with the locational principles and consultation with landowners, it is expected that the overall impact on agricultural activities would be minor.

3.7.2 Impacts on Future Rural Residential Land

DII raised concerns that the EA did not refer to the Mid North Coast Regional Strategy regarding potential for future rural residential development of agricultural lands, nor State Environmental Planning Policy (Rural Lands) 2008 (Rural SEPP).

Mid North Coast Regional Strategy

The Mid North Coast Regional Strategy (the Strategy), prepared by the DoP, aims to ensure that adequate land is available and appropriately located to accommodate the projected housing and employment needs of the Region's population over the next 25 years. The proposed pipeline corridor passes through the southern section of the area covered by this Strategy, west of Stroud, over land zoned as Environmental Assets and Rural Land. This land is to be protected from further urban settlement. The proposed pipeline corridor passes within 1km (west) of the designated Growth Areas located at Stroud Road and Bucketts Way. These Growth Areas include all land zoned for various urban purposes and all future urban land release areas, and provide for housing, business, industrial, infrastructure, community facilities, urban open space and environmental uses.

During construction, the Project may result in some temporary impacts to these Growth Areas, however once operational it is considered unlikely that the Project will impose constraints on future uses in these areas.

State Environmental Planning Policy (Rural Lands) 2008

State Environmental Planning Policy (Rural Lands) 2008 (Rural SEPP) applies to the State and its aim is to:

(a) facilitate the orderly and economic use and development of rural lands for rural and related purposes;

(b) identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State;

(c) implement measures designed to reduce land use conflicts;

(d) identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations; and

(e) amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.

The Project area does not include State significant agricultural land and the proposed works take into account the Rural Planning Principles detailed in Section 7 of the Rural SEPP.

The Project would provide numerous benefits associated with the provision of an essential and valuable indigenous energy resource to NSW. The Project recognises the importance of rural lands and would result in environmental benefits associated with the provision of an alternative and less carbon intensive fuel to that of coal, in addition to wider economic benefits to the State of NSW and the provision of an important energy resource for commercial and industrial users. The Proposal would therefore have resultant benefits for the local and wider community and the surrounding rural environment, as well as for present and future generations.

Environmental compatibility with current and future rural land uses has been facilitated through extensive consultation with affected landowners and other stakeholders with regard to the design and siting of the various project components, as well as use of extensive environmental investigations of the Project Area in order to allow for the upfront consideration of environmental constraints in the design process.

In these ways, the Project takes into account the Rural Planning Principles detailed in Section 7 of the Rural SEPP.

3.8 Visual Impacts

Ninety five submissions (including 77 of the form letter submission) were received in relation to visual impacts. The key concerns raised were related to:

- Direct visual impacts resulting from well sites and the CPF;
- Sweeping views across the broader landscape;
- Impacts to the existing rural character of the landscape;
- Changing of the landscape to "industrial"; and

- Visual impacts from lighting and flaring.

These are discussed further in the sections below.

3.8.1 Direct Visual Impacts

Direct visual impacts caused by the development during and post construction of both well heads and the CPF were considered from a number of locations including The Bucketts Way at Stratford and The Bucketts Way near the south west corner of the Stage 1 GFDA.

The visual impacts caused by the well heads will be limited as there are no permanent (residential) receptors located within 200 m of a well site.

Well sites would be dispersed at a minimum of 600m intervals and are not obviously visible beyond 200m as shown in **Figure 6** (Post construction the view of wells will be limited to a number of slim vertical structures and pipes to approximately 2.5m above ground, within an approximately 15m x 15m hardstand footprint which will be reduced to a fenced 6m x 4m footprint.

The most significant visual impact would occur during the construction phase of the Project, however this would be of a temporary nature as shown in **Figures 7** (during construction) and **Figure 8** (following initial rehabilitation) which show before and after photos of wells during construction and wells that have been rehabilitated on the Teidman property as part of the Stratford Pilot Project. Note site landscaping will be undertaken where required.

Figure 6: View from 200m towards an existing production well on Tiedemans Property which is part of the Stratford Pilot Project

Figure 7: Well heads before initial rehabilitation on the Teidman property

Figure 8: Well heads after initial rehabilitation on the Teidman property

3.8.2 Sweeping Views

Distant, sweeping views or key vistas are difficult to quantify and assess. These views can be considered as "extensive" and those seen by a majority of receptors i.e. primarily those viewed from main arterial routes.

The main arterial routes through the Gloucester Vale are located on low lying relatively flat land. The Bucketts Way is a primary tourist route through the Vale and descends from approximately 130m Australian Height Datum (AHD) in the south at Stratford to heights of 140m, 130 m and 120m along its 12km course, north towards Gloucester. These changes in height occur gradually over relatively long distances.

Therefore as the road traverses the valley floor there are no obvious or significant sudden increases in height to afford a receptor wide or sweeping views of large areas of the Vale.

In the case of The Bucketts Way, it is unlikely that transient receptors (local and tourist users of the road) would be exposed to views which comprise multiple well head sites or more than four at any one time. Isolated and local changes in topography may allow intermittent wider views into the site, however it is unlikely that the field of view would take in more than two or three well head sites at a time, due to their dispersal, distance from the road and speed of travel. It is more likely that the transient viewer will see glimpses of individual well sites located within 250m of the road.

In addition the extent of the view to well sites from roads is affected by many variables. These include the presence of existing roadside vegetation, small changes in local topography, the location and nature of farm buildings, machinery and stock and the speed at which drivers are travelling, for example, The Bucketts Way has an open road speed limit of 100kph.

Tourist related walking tracks, bike trails, lookouts and picnic areas etc. are located in and around the Vale. Most of these facilities are located within Barrington Tops National Park, located some 21km west of the proposed project area. Others such as Kia Ora Lookout and Bucketts Scenic Walk are located approximately 9km and 5km from western boundary of the project area respectively. Mograni Lookout and Oakey Falls are located approximately 6km north and 4km north-east of the Project Area. Refer to Figure 5 below. After approximately 500m the well heads blend into the landscape. Whilst these locations are elevated and afford views of the valley, distances from the Project Area and the small scale of well heads are such that their visual impact within the landscape is likely to be very limited.

Faulkland Road, Gloucester Tops Road and Crowthers Road all lead west towards Barrington Tops from The Bucketts Way to heights of 125, 150 and 200m AHD respectively. Extensive views of the Vale or significant vistas available to receptors of the wells sites from such vantage points will be seen in context with other built structures in the landscape such as existing colliery sites and electrical power transmissions lines which traverse the valley from north to south. Two 33Kv lines are located either side of the north coast railway line and one larger (double pole) 132Kv transmission line traverses the valley through private agricultural land from north to south east of McKinley's Lane. Whilst power lines are man-made vertical structures they are typical and visually accepted features in the local vernacular of a working agricultural landscape particularly in the Hunter Regions. Visual impact associated with the well sites would be limited and would be in context with these existing built structures in the Vale.

Figures 10 to 18 show the above mentioned vantage points overlooking the Project Area, which are identified in the Visual Assessment Map shown in **Figure 9.** It should be noted that as Oakey Falls is located on private property and is not a tourist location it is not included as one of the vantage points.

Figure 9: Visual Assessment Map

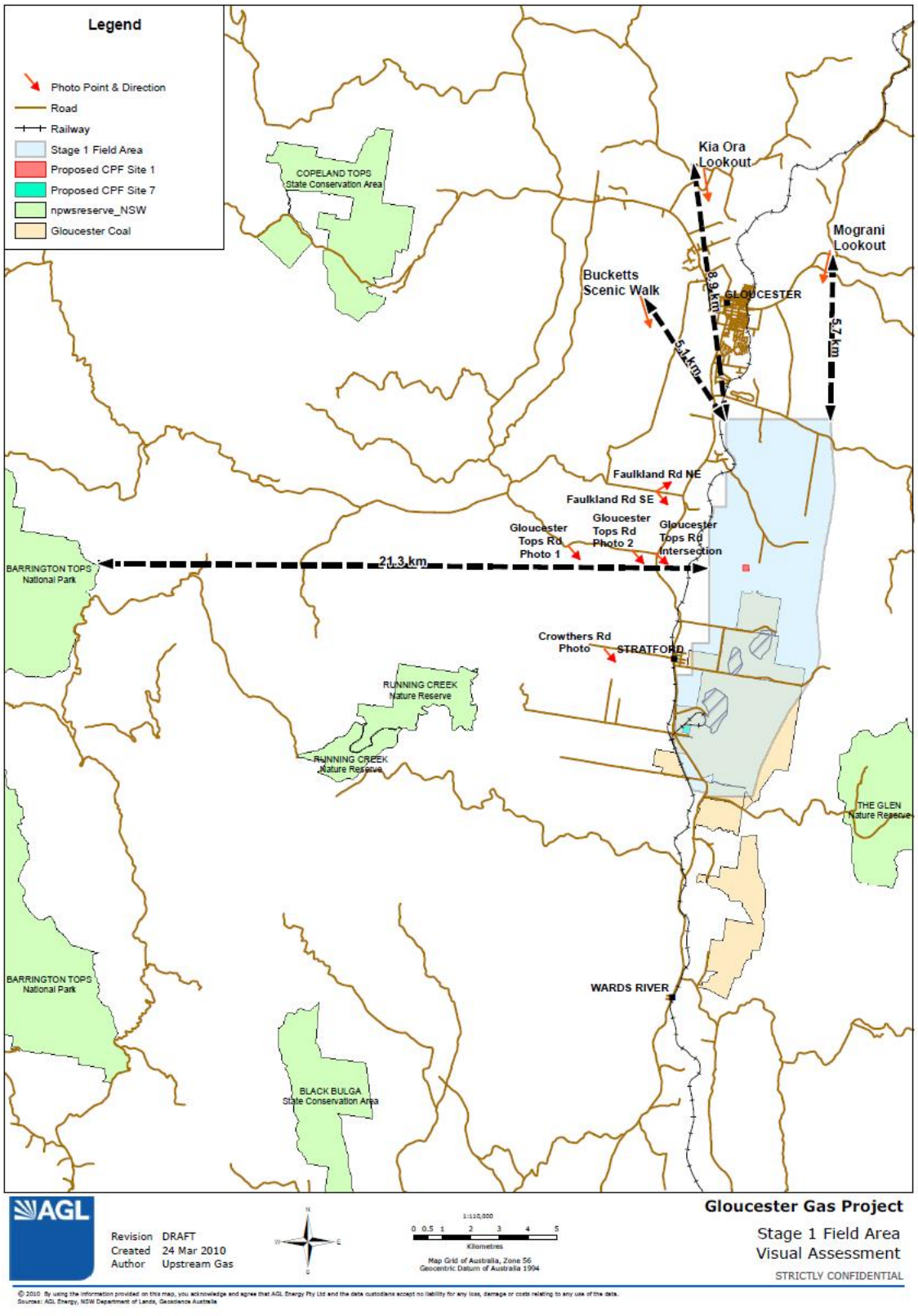

Figure 10: The Bucketts Scenic Walk. The Bucketts Scenic Walk is located 5.1 km to the northwest corner of the Stage 1 GFDA.

Figure 11: Kia Ora Lookout. Kia Ora Lookout is located 8.9 km due north of the northern most boundary of the Stage 1 Field area. The field is visible from the lookout in the far distance. The Stratford Coal mine is barely visible as seen in this photo.

Figure 12: Mograni Lookout. Mograni Lookout is located 5.7 km to the most northern section of the Stage 1 Field area. From the lookout no part of the Stage 1 Field area is visible as evidenced in this photo. The view of the field area is blocked by The Mograni range.

Figure 13: Faulkland Road looking North East

Figure 14: Faulkland Road looking South East

Faulkland Road is located due west of the Stage 1 GFDA and connects to Gloucester Tops Road and Barrington East & West Roads.

The western edge of the Stage 1 GFDA is approximately 2km from this photo point (at 130m AHD) along Faulkland Road.The Stage 1 GFDA is not visible along this road at any point due to the undulating landscape.

Figure 15: Gloucester Tops Road

Figure 16: Gloucester Tops Road

Gloucester Tops Road is located to the west of the Stage 1 GFDA and runs due west. The two photos above were taken at elevation of 150m AHD along Gloucester Tops Road. At neither of these locations or nearby was any part of the Stage 1 GFDA visible. The undulating landscape and scattered vegetation prevent the GFDA from being visible along this road.

Figure 17: Gloucester Tops Road Intersection (with Bucketts Way)

At the intersection of the Gloucester Tops Road and the Bucketts Way is the only section of Gloucester Tops Road that part of the Stage 1 GFDA is visible. This location is approximately 1.7km west of the western boundary of the Stage 1 GFDA.

Figure 18: Crowthers Road

Crowthers Road is located due west of Stratford and the Stage 1 GFDA. This photo was taken 3km due east of Stratford, at an elevation of 200m AHD and the washery of the Stratford Mine (Gloucester Coal) was barely visible to the naked eye through a gap in the vegetation. No part of the Stage 1 GFDA was visible at this location of the road due to the undulation and vegetation in the area.

As shown through these vantage point photographs, due to the undulating landscape and scattered vegetation of the area, the CPF and well sites will be difficult to see from vast distances even if the vantage point is elevated.

3.8.3 Rural Characteristics of the Landscape

The predominant visual character of the valley is of an open rural river valley largely utilised for agricultural purposes. The area has been identified as having scenic value.

The proposed development will include the establishment of one main building precinct (the CPF). This precinct will comprise a number of built elements including water treatment ponds, power generation facility, laydown areas, office control room and other plant and equipment which will be approximately 60,000m² in size. This built precinct will comprise less than 0.5% of the total Project Area of approximately 50km². It is noted that the CPF Site 7 would be located on land zoned for industrial use.

Well sites will be selected in consultation with landowners. They will be widely dispersed at a minimum of around 600m apart. Exact locations would be determined where local undulations in the landscape allow the sites to be further screened or hidden where possible.

The landscape surrounding the initial 90m x 90m well head footprints will not be altered. The visual integrity of these areas will remain rural in character, comprising paddocks, livestock , farm buildings, existing tracks, vegetation etc. Post construction this rural landscape will be rehabilitated as the well sites are reduced to a 6 m x 4 m gravel compacted fenced footprint.

3.9 Socio-economic

Thirteen submissions were received in relation to impacts on tourism from the development. The Socio-Economic Chapter of the EA recognised the top ten employment industries in the Gloucester LGA. 'Tourism' was not among the top 10, however, 'cafes and restaurants' (which would directly be supported by tourism) was in the top 10. It was also recognised in that chapter that Gloucester LGA has specifically identified tourism as an area of potential future economic growth as part of its Strategic Plan for the Economic Development of the Gloucester District.

In addition, Section 11.3.1 of the EA recognises the importance of tourism in the area, stating that *"Tourism is an important contributor to the local economy with tourist expenditure in 2004/05 reaching $21 million (Hunter Development Brokerage Pty Ltd, 2006) and relying largely on the natural attributes of the area."*

The key impacts to a growing tourism industry might include:

- Restriction of access to tourism locations;
- Impact of ability of tourists to find accommodation in the locality for vocational stays;
- Impact on tourist's ability to enjoy tourism activities from noise, traffic or dust emissions.

3.9.1 Access to Tourism Locations

Section 11.5.1 states that *"Tourism is a vital component of the local economies of many of the LGAs affected by the proposal, particularly those in the north of the Project Area and Concept Area. Tourism in these areas is largely focussed around the natural and scenic attributes of these areas such as Gloucester and Barrington Tops and the associated National Park and World Heritage Area."*

It continues that *"The proposed Stage 1 GFDA and CPF are located some distance from Gloucester and Barrington Tops and the surrounding National Park and avoid lands zoned for environmental protection for their scenic value within the Gloucester Shire."*

3.9.2 Restrictions on Tourist Accommodation

Section 20.2.1 of the EA outlines the key strengths on which a tourism industry would be based. *"The key strengths of the Gloucester Shire which form the basis of the tourism industry are centred on the cultural and landscape values of the Shire, including the agricultural and pastoral lands which characterise the Gloucester Basin, and natural heritage values of the surrounding areas, including Barrington Tops National Park. The scenic values of the area near Gloucester along The Bucketts Way are also nominated on the Register of the National Estate as the Vale of Gloucester, although heritage values of the area have not been formally listed. These scenic values contribute to the appeal of the area to tourists. The tourist industry is supported by a range of boutique accommodation in the LGA including farmstays and bed and breakfast lodges, as well as motels, caravan parks and camping areas."*

Chapter 4 of the EA looks at temporary accommodation alternatives as a means of avoiding potential impacts on local tourism accommodation and supporting industries. The use of a construction workers camp was deemed to be a viable alternative to avoid saturation of temporary accommodation that would impact on the tourism economy of Gloucester. While local amenities would be used by construction workers, a construction workers camp would also provide additional amenities and facilities (including messing) that would avoid a saturation of other facilities within the local town.

3.9.3 Enjoyment of Tourist Activities

The EA has been undertaken in accordance with the Director-General's EARs. This means that all air, noise and traffic emissions have been assessed and appropriate mitigation measures identified where necessary to avoid or minimise potential impacts to the local and broader community. In seeking to avoid potential impacts on local residents, this also achieves the aim of avoiding potential impacts on temporary visitors and tourists.

3.9.4 Impacts on Visual Characteristics

The EA recognises the value of views in the area and the Vale of Gloucester. It states in Section 18.2.1 that "The Vale of Gloucester and its associated scenic and landscape qualities cover the northern portion of the Stage 1 GFDA and surrounding areas. The visual and landscape character of the Vale of Gloucester provides a base for tourism in the area."

The visual aspects relating to the project were discussed in **Section 3.9** above. This indicates that the visual characteristics of the area would not be significantly impacted. As a result, this would not represent a significant impact to tourism.

3.10 Heritage and Cultural Significance

Several submissions were received in relation to heritage including:

- Identification of heritage as a low priority issue;
- Cultural heritage values can only be determined by the Aboriginal community; and
- Potential heritage impacts to the Vale of Gloucester and the potential impacts to views across the valley.

3.10.1 Identification of Heritage as a Low Priority Issue

Neither cultural heritage nor historic heritage was not identified as a low priority issue. The risk assessment process was set out in the Concept Plan and Preliminary Assessment Report (GHD, 2008) and Chapter 8 of the EA which identified a range of issues of potential interest to the project. This risk assessment process did not identify heritage as a low issue nor that heritage was of low significance - the process is merely to prioritise those issues which are seen as having a higher level of potential risk (such as air quality or loss of habitat as shown in Table 8-2 of the EA). Extensive heritage surveys covering both cultural and historic heritage aspect were completed for the project as detailed in Chapter 18 of the EA along with consultation with Aboriginal groups in accordance with established guidelines.Cultural Heritage Values

It was noted in a submission that only the Aboriginal community can determine cultural heritage values. This is agreed. The EA did not presume to provide a cultural significance assessment on behalf of the Aboriginal community. The Aboriginal community was consulted in accordance with the Interim Community Consultation Requirements (ICCRs) as required by DOP and DECCW. The community was requested to provide specific information on cultural significance. However, no comments relating to social or cultural significance were provided by the community representatives. All correspondence with Aboriginal representatives is provided in Appendix B of the Heritage Assessment (located in Appendix K of the EA).

Groups were sent a draft report 17 November 2008 with a request for comment. This was followed by an additional request for comments on 24 March 2009. A final request was made with the provision of the amended draft on 18 August 2009.

Every effort has been made to obtain the Aboriginal community's view of the cultural significance of the sites identified and the country in question. The Heritage Assessment undertaken for the EA was undertaken in full consultation and participation, in accordance with the ICCRs (refer Appendix B of Appendix K of the EA).

3.10.2 Visual Impacts Affecting Heritage Values

The Vale of Gloucester has an Indicative listing on the Register of the National Estate (RNE). The RNE is no longer an "active" list (ie no sites are being added to it) and the register was made inactive before the Vale received its fully listed status. However, its place on the RNE as an Indicative site, still identifies the site as having heritage interest and significance, as outlined in the EA.

The values for which the Vale is indicatively listed are:

- *Scenic value: the town of Gloucester is surrounded by a series of low hill ranges which dominate the valley floor and provide a spectacular backdrop to the agricultural activity that takes place in the valley.*
- *Historical: the Vale of Gloucester was discovered in 1826 by the chief agent of the Australian Agricultural Company, Mr Robert Dawson. During development of the Vale for sheep raising and later for cattle, the homestead was built. Presented at AHC 13. Panel recommended it be included. Commission deferred it.*

As noted in the EA, the Gloucester Gas Project poses no risks or impacts to the historical value of the Vale of Gloucester.

The scenic values would similarly not be significantly affected. In this sense, it is useful to break down the Indicatively listed value to provide a more meaningful discussion. The scenic value is based on:

- *"the town of Gloucester is surrounded by a series of low hill ranges which dominate the valley floor…"; which*
- *"provide a spectacular backdrop to the agricultural activity that takes place in the valley."*

In relation to the first point, the Gloucester Gas Project does not pose risks or impacts to this aspect.

In relation to the second point, the Gloucester Gas Project would not compromise the dominating hills and ranges as a backdrop. Nor would the Project change the presence of agricultural activity within the valley. As noted previously, the preferred CPF site is situated within the context of the existing mine operations. In addition, well sites have been located in consultation with individual landowners to ensure that they are placed in the least inconvenient, or (where possible) at best locations to facilitate landowner agricultural works and operations.

It is appreciated however, that views within a whole landscape can be highly subjective and personal to the viewer. **Section 3.8** of the Submissions Report provides additional detail on the visual aspects of this project including sweeping views in relation to the ability to see large scale landscape changes, before and after construction photographs and the ability to see well sites from 200m away (the maximum distance to any resident).

Section 3.8 relates specifically to visual aspects. The heritage aspects relate to similar themes however and with both the lack of compromise to the indicatively listed values, nor the significant impacts to the broader visual aspects within the landscape, the Gloucester Gas Project is not anticipated to result in a significant impact to the heritage of the area.

3.11 Consultation

A range of consultation has been undertaken as part of the EA process to date, including both formal consultation undertaken by the DoP with relevant regulatory authorities and independent consultation undertaken by AGL with regulatory authorities, the local community and other stakeholders.

A number of submissions were received with regard to feelings of lack of community and stakeholder consultation. The main issues raised in these submissions included:

- Community meetings and drop-in sessions were poorly advertised;
- AGL did not provide the community with sufficient time to consider the ramifications of the Project on the Region; and
- Meetings were not provided for the community in Port Stephens, Great Lakes, Dungog, Maitland and Newcastle local government areas (LGAs).

The following sections provide an overview of the consultation undertaken in respect of the Project. The level of consultation undertaken within LGAs affected is commensurate with the extent of activities undertaken within each LGA as part of the Project. As the Stage 1 GFDA and Concept Area are located predominantly within the Gloucester LGA, a high level of consultation was undertaken in this area. Commensurately, as other LGAs are primarily affected by pipeline construction, consultation was typically limited to statutory authorities within these LGAs.

3.11.1 Community Consultation

A Community Consultation Strategy was implemented for the Project which involved a program of community consultation targeting local landowners and stakeholders through a series of community information sessions meetings and an open day. The overall objective of the Community Consultation Strategy implemented for the Project was to ensure clear, effective, open, two-way communication at all times by listening, recording and responding to issues.

Community Consultation Program

An extensive community consultation program has been undertaken from February 2008 to December 2009, to ensure community views have been captured, and these have been incorporated into the EA.

A variety of consultation techniques were implemented in order to enable information to effectively reach target audiences, to interact with the local community and landowners, and to obtain community feedback. These techniques included:

- Meetings with community organisations within the Project Area, including the following:
  - Gloucester Rotary Club;
  - Barrington, Gloucester, Stroud Preservation Alliance Management Group;
  - Gloucester Chamber of Commerce presentation;
  - Gloucester Environment Group;
  - Gloucester Project;
  - Gloucester Probus Group;
  - Gloucester Lions Club;
  - NSW Farmers Association Gloucester branch;
  - Dairy farmers from Gloucester district;
  - Gloucester Anglican Men's Dinner; and
  - Gloucester Town Fire Brigade members.
- Information nights in June 2008 at the Gloucester Country Club and Wards River Hall;
- Drop-in sessions in 2008 at the following locations:
  - Gloucester Country Club 11 September and 30 October 2008;
  - Stratford Hall 15 October 2008;
  - Clarence Town Sport and Recreation Club 25 September and 16 October 2008.
- General discussions with landowners affected by the proposed development.
- An Open day was held in September 2008 at the Tiedemans Property where the Stratford Pilot Project is located, in order to enable the community to visit the field under operation. Members of the public were invited by Newspaper advertising to drive to the site and were then provided with static displays of equipment as well as a bus tour of operating well sites and water storage facilities.
- During the exhibition period for the EA, drop-in sessions were held at the following locations:
  - Gloucester Country Club 8 December 2009 4pm – 8pm (five attendees);
  - Wards River Hall 10 December 2009 4pm – 8pm (eight attendees);
  - Stratford Hall 15 December 2009 4pm – 8pm (four attendees); and
  - Clarence Town Sport & Recreation Club 17th Dec 2009 4pm – 8pm (two attendees).

All drop-in sessions, including those in 2008 and in 2009 during public exhibition were advertised in the Gloucester Advocate, Dungog Chronicle, Maitland Mercury, Port Stephens Examiner. Advertisements were placed at least two weeks in advance and were advertised over a full two week period.

The community consultation program primarily focussed on the Gloucester LGA as over half of the Concept Area, the entire Stage 1 GFDA and the start of the proposed pipeline corridor are located within this LGA. The proposed pipeline corridor also travels through the Great Lakes LGA, Dungog LGA, Port Stephens LGA, Maitland LGA and Newcastle LGA. All of these LGAs were consulted by AGL as key Local Government agencies and the LGAs of Dungog, the Great Lakes and Port Stephens were also involved in the Community Consultative Committee (CCC).

Community Consultative Committee

A CCC was formed in September 2008 to provide a forum for discussion and exchange of information between the community, Government agencies and AGL. The Committee assists AGL in identifying project related local issues for consideration during the development, environmental, construction and operational phases of the Project. It also acts as a communication link between AGL, the community and other stakeholders.

CCC membership is currently made up of:

- Local Community, including residents and community groups;
  - Two individual community representatives;
  - Barrington – Gloucester – Stroud Preservation Alliance Inc.;
  - Avon Valley Landcare;
  - The Gloucester Project;
  - Lower Waukivory Residents Group;
- State Government agencies (DII and DWE were invited, however no response was received);
- Local Government (Port Stephens, Gloucester Shire, Dungog and Great Lakes Councils);
- Representatives from the AGL project team; and
- An Independent Facilitator.

The first meeting was held on Friday 26 September 2008 at the Gloucester Country Club. Subsequent meetings have been held regularly with the CCC providing ongoing updates of the Project status, and outcomes of ongoing environmental investigations. Meetings were held on 14 November 2008, 13 February 2009, 9 April 2009 and 27 July 2009. The most recent CCC meeting was held on 27 Nov 2009 to present the EA and answer questions the members had. The next CCC meeting will be held once this Submissions Report is lodged with the DoP.

Landowner Consultation

Extensive consultation has been undertaken with landowners potentially affected by both the proposed Stage 1 GFDA and the preferred pipeline corridor for the Stratford to Hexham Pipeline.

AGL staff conducted initial meetings with each landowner within the Stage 1 GFDA to discuss the Project requirements and review the potential to locate gas wells within their property. Follow up meetings were held with each landowner to discuss the potential well locations and associated infrastructure. Consent to survey was also obtained from each landowner to allow investigation surveys to be undertaken for the proposed well locations and associated gathering pipelines.

Land Agents acting on behalf of AGL carried out landowner negotiations along the pipeline corridor. The Land Agents met with landowners along the proposed corridor and provided them with an introduction letter and an information brochure to provide an overview of the Project.

Follow up meetings were held with each landowner to discuss obtaining permission to access their property to undertake investigation surveys. During this meeting, the Land Agent discussed with the landowner the potential location of the pipeline and whether they had any concerns prior to ground truthing surveys commencing. On completion of the surveys, plans of each property were prepared and hand delivered to each landowner for discussion.

3.11.2 Statutory and Other Relevant Authorities

AGL has undertaken consultation with key local and State Government agencies as specified in the EARs during the preliminary design phase and preparation of the EA. The purpose of this consultation was to provide an overview of the Project and to seek input into matters to be addressed in the EA.

In this regard, face to face meetings, where possible, were held with relevant statutory agencies and written comments sought from those parties identified in the EARs to assist with the preparation of the EA. The statutory and other relevant authorities involved in this consultation included:

- Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA);
- Department of Environment Climate Change and Water (DECCW);
- Department of Water and Energy (DWE);
- Department of Industry and Investment (DII);
- NSW RTA;
- Rural Fire Service;
- Australian Rail Track Corporation (ARTC);
- Mine Subsidence Board;
- Gloucester Shire Council;

- Great Lakes Shire Council;
- Dungog Shire Council;
- Port Stephens Shire Council;
- Maitland City Council; and
- Newcastle City Council.

AGL has also undertaken extensive consultation with utility providers regarding the engineering design requirements for co-locating the gas pipeline adjacent to existing infrastructure. This consultation would be an ongoing process through the detailed design process of the Project.