2.0 Project Description

2.1 Introduction

This chapter provides a description of the Project, the land within which the Project will be developed and the design process undertaken to inform the layout of the Project.

The chapter discusses site infrastructure including the turbines, access tracks, electrical components and temporary works associated with the construction phase of the Project. It provides an overview of the likely construction methods and the likely timescale over which various construction activities will take place. An overview of the operational phase of the Project and a statement regarding decommissioning after the operational period is also provided.

This chapter also provides some key construction and operational assumptions that were used in the preparation of the assessment of potential environmental impacts.

2.2 Context and study area

The Project is located approximately 180 kilometres (km) north-west of Brisbane and is situated approximately:

- 50 km south-west of Kingaroy
- 70 km east of Chinchilla
- 65 km north of Dalby.

The closest townships to the Project are Bell approximately 30 km to the south and Kumbia approximately 30km to the east. The existing land use in the area is predominantly rural, characterised largely by cattle grazing within the localities of Cooranga North, Bilboa, Boyneside and Ironpot. Figure 1.1 in Volume 2 provides the location of the Project in a regional context.

The Project is located within the local government areas of Western Downs and South Burnett Regional Councils and is bounded to the east by the Bunya Highway, between Cooranga North and Kingaroy. Local roads provide access to properties from the Highway, with major connecting roads including Niagara Road and Ironpot Creek Road.

The land available for development (the Study Area) covers approximately 10,200 ha (the combined areas of all participating properties), with the Project Site (land which the Project infrastructure will be located, allowing for micro siting) occupying a smaller area within the Study Area; approximately 2,048 ha (see Figure 2.1 in Volume 2).

The Project Site represents approximately 20% of the Study Area. However, the construction footprint of the Project will be much less (approximately 360 ha). The operational footprint will occupy approximately 100 ha. Land not occupied by infrastructure following the construction and rehabilitation period will continue to be used for rural and agricultural purposes.

The Study Area involves 12 landowners and 36 properties. These properties are listed in Table 2.1 and are shown in Figure 2.2, Volume 2.

A 1,500 m setback from existing or approved sensitive land uses has been applied and is shown on Figure 2.3, Volume 2. Where wind turbines are within 1,500 m of existing or approved sensitive land uses, a written agreement (deed of release) has been obtained from the affected owners accepting the reduced setback.

Table 2.1 **Properties comprising the Study Area**

Lot	Plan	Area (ha)	Lot	Plan	Area (ha)
1	RP75408	261.23	48	LY402	381.27
2	BO409	51.03	79	BO469	355.96
3	BO21	50.49	80	BO457	476.16
4	LY1065	517.91	81	BO192	491.82
6	LY1065	485.07	83	BO192	501.04
8	LY249	214.39	85	BO192	324.82
9	LY436	288.34	85	BO192	57.21
10	LY355	261.06	86	BO192	439.60
11	LY499	526.72	86	BO192	53.01
13	LY500	258.37	89	BO193	510.44
15	LY500	258.85	90	BO470	476.09
16	LY500	255.68	91	BO458	513.32
17	LY1065	256.11	192	AG782	71.46
32	LY250	259.02	192	AG782	114.67
34	LY250	477.60	193	AG797	98.92
37	LY209	109.23	193	AG797	148.38
37	LY209	73.01	195	AG797	252.95
46	LY401	212.91	195	AG797	44.16

2.3 Design considerations and refinement

The design of the Project has been optimised in order to produce a layout that maximises the use of the land available for wind power generation, balanced against the overall environmental impact of the development, utilising the Queensland Wind Farm State Code and supporting Planning Guideline (DILGP 2016) as the assessment criteria. The optimal layout of a wind farm is influenced by a range of technical, economic and environmental criteria as follows:

- Local topography affecting wind flow across the Project Site and therefore detrimentally affecting turbine performance. Site topography must be carefully considered in the layout design process to ensure any detrimental effects are minimised
- Ground conditions must be suitable for the installation of wind turbines, access tracks and cables, for example avoiding areas of unstable ground or steep slope gradients
- Turbines must be separated by specific distances to minimise turbulent interaction between the wind turbines which can reduce turbine performance. Spacing requirements vary between turbine manufacturers and are also subject to wind conditions
- Wind turbines have to be located in accordance with the amenity requirements of the Wind Farm State Code and supporting Planning Guideline (DILGP 2016)
- The implications of locating turbines near environmentally sensitive features and areas (ecology, archaeology, hydrology, etc.) need to be carefully considered
- Landscape and visual design considerations also need to be taken into account
- Planning guidance and discussion with statutory and non-statutory consultees, the local communities and the landowners influence the evolution of the design.

In addition to the design criteria, a number of maximum specification criteria for the Project have been used for the purposes of assessing potential impacts (see Table 2.3 and Section 2.3.3). These are based on the historical development of the Project, potential environmental impacts and maintaining a degree of flexibility for the construction of the Project. Further details of the Project refinement and specifications are provided in Sections 2.3.1 and 2.3.2.

2.3.1 Project Site refinement

The Project Site has been refined through an iterative process and has been influenced by a combination of wind resource, economic, constructability and environmental considerations. An indicative wind farm layout was developed by Investec Wind Holdings Pty Ltd in December 2008. A number of technical studies into the potential impacts of the Project were commissioned and these have been used as reference documents for the EIS.

After AGL acquired the Project, a revised wind turbine layout (Design Iteration 1) of the Project was developed based on a revised Study Area. This layout was used as the basis for the Project Site for the Initial Assessment Report that was submitted for public review as part of a Community Infrastructure Designation approval process in 2011 (now ceased) and included the indicative layout of the Project's infrastructure.

Following the Initial Assessment Report that was submitted in 2011, a more detailed review of Design Iteration 1 was undertaken in response to a number of issues raised in regulator and community submissions and in doing so a layout was developed that could be appropriately accommodated within the Project Site.

The revised layout responded to the available wind resource and was intended to be used to demonstrate that a wind farm layout within the Project Site can comply with required environmental outcomes. The Project Site was updated to respond to the layout which, while not substantially different from the Project Site in Design Iteration 1, did include an additional 273 ha of land. This Project Site iteration was referred to as Design Iteration 2.

Based on Design Iteration 2, a detailed assessment of the Project Site and the layout was undertaken to further refine the Project Site and ultimately produce the final layout (Figure 2.1 in Volume 2). The updates in this third design iteration included revised noise modelling as well as consideration of constructability, environmental and site-based constraints in order to develop a Project Site that could accommodate a realistic wind farm design that also complied with the Queensland Wind Farm Code and Planning Guideline. Table 2.2 provides greater detail on the design considerations and changes made at each design iteration.

Table 2.2 Project Site iterations

Project Site iteration	Project Site name	Reason for change	Design considerations and changes
Initial layout	Wind Holdings Layout	N/A	- Where practicable, avoiding the removal of any remnant vegetation - Positioning wind turbines to ensure optimal wind yield therefore reducing the overall number of turbines - Noise emissions experienced at all dwellings being within limits designed to protect residential amenity - Residential dwellings not becoming adversely impacted by shadow flicker.
Design iteration 1	Revision "AA"	AGL acquired the Project from Investec Wind Holdings Pty Ltd and undertook a revised planning application process.	- Changes to the participating and non-participating properties - Inclusion of the wind farm's ancillary infrastructure (for example, access tracks and transmission lines) in the Project Site - Responding to a greater understanding of the available wind resource - Consideration of the Powerlink transmission line - Minimising potential noise and shadow flicker impacts on all participating and non-participating residences.
Design iteration 2	Revised Layout	Responding to submissions by regulators and the community and further understanding of the wind resource.	- Further understanding of the wind resource allowing for greater wind energy capture - Development of a realistic layout in order to demonstrate compliance with required environmental outcomes.
Design iteration 3	Final Layout for the EIS	Responding to the Queensland Wind Farm State Code and supporting Planning Guideline. Revised noise assessment and consideration of the constructability, environmental and site-based considerations for the layout informing the Project Site.	- Ability of the wind farm layout to meet noise requirements at participating and non-participating residences - Detailed consideration of the potential layout for underground and overhead electrification infrastructure - Revision of the potential layout for access tracks with particular attention to responding to the site's topography, constructability and ongoing usability - Providing an adequate setback from adjoining property boundaries - Avoidance of remnant vegetation where possible and requirements of participating landowners.

2.3.2 Project specifications

Turbines

The final selection of turbines will be determined as part of the detailed design following approval of the Project. However, the Project Site has been designed to accommodate the following maximum turbine dimensions so any potential impacts of the Project on environmental values can be adequately considered.

The Project Site will accommodate turbines in the 2.5 MW to 4 MW range with a maximum height to blade tip of approximately180 metres (m) above the base of the wind turbine tower. The turbines will be of the horizontal axis type, with a rotor consisting of three blades with a maximum rotor diameter of approximately 140 m. The blades will be mounted to the wind turbine hub at an appropriate height to allow for a maximum height to blade tip of approximately 180 m. These maximum specifications are summarised in Table 2.3.

Table 2.3 Key generation and turbine specifications

Feature	Statistic
Project generation capacity	Up to 460 MW*
Turbine electrical output	2.5 - 4 MW
Number of turbines	Up to 115
Tip height**	Approximately 180 m
Rotor diameter**	Approximately 140 m

*The actual output of the wind farm will depend on the size and type of turbine chosen during the detailed design phase. Regardless of the size of the wind farm generation capacity, the Project will still need to comply with the Queensland Wind Farm State Code and supporting Planning Guidelines, particularly in relation to acoustic amenity and setback criteria. The maximum specifications listed in the table provides flexibility for any innovation in turbine design between now and the time of detailed design and construction.

**Dimensions are approximate to allow for innovation in turbine design prior to construction. Final dimensions will be confirmed during the detailed design phase of the Project.

The turbines will be coloured light grey or white with a semi-matt finish to reduce their contrast with the background sky and minimise reflections. The turbines will be uniform in colour and will not contain any prominent company logos.

The maximum turbine tip height of approximately 180 m and rotor diameter of approximately 140 m listed in Table 2.3 is based on estimated wind turbine dimensions to allow for future flexibility and innovation in wind turbine design and development. Generally, larger turbine models on higher towers will more efficiently harness the available wind resource. Furthermore, larger wind turbines are generally installed in lower numbers, thereby reducing the on-ground impacts for a given level of energy generation.

The final choice of turbine will be based on an assessment of the most suitable turbine available at the time of procurement taking the following criteria into account:

- Ability of the turbine to maximise power output based on the wind resource at the Project Site
- Aesthetics of the turbine based on subtle variations in the blades, motor, hub, etc. that vary across manufacturers and turbine models
- Availability of the turbine will also affect the final choice of turbines
- Turbine which provides the optimal financial outcome for the Project.

One of the key selection criteria for final turbine choice will be the ability to satisfy the environmental constraints and approval conditions. For example, the chosen turbine must achieve the determined noise criteria and not exceed any of the maximum design specifications.

Turbine foundations

Each turbine foundation will comprise a reinforced concrete slab. Turbine foundations may vary in size depending on imposed loadings, ground conditions, construction methodology and the drainage design. Each turbine manufacturer has individual foundation requirements which will need to be adhered to.

The detailed design of the foundations will be undertaken following approval of the project by the Coordinator-General and following the final selection of turbine model to be installed at the Project Site. The final design will also take account of the geotechnical conditions identified through detailed, micro-siting site investigation.

Foundations will be laid at sufficient depth so the top of the foundation is flush with the highest surrounding ground level.

Much of the excavated material will be reinstated following construction; however each turbine foundation is likely to result in surplus material. It is envisaged this surplus material will be reused on site for landscaping. Any necessary approvals will be obtained for excavating material at the Project Site (see Chapter 3 Legislative Framework).

Concrete batching plants

Concrete batching plants will be required to supply concrete for the construction of turbine footings and hardstands. It is anticipated that two batch plants will be required to produce approximately 42,000 tonnes of concrete per year. The batching plants will likely be located in the temporary construction laydown areas as shown on Figure 2.1 in Volume 2; however final batching plant locations will be confirmed prior to construction. The concrete batching plants will be bunded and, where possible, located on cleared, elevated land away from drainage lines.

Each batching plant will be approximately 150 m by 150 m and contain the following:

- Concrete truck loading hardstands
- Loading bays
- Hoppers
- Cement and admixture silos
- Water tank
- Stockpiles for aggregate and sands
- In-ground water recycling/first flush pit.

Sand and aggregate for the production of concrete is anticipated to be sourced from the excavation of turbine footings, where possible, or from on-site borrow pits. If additional sand and aggregate is required, this would be sourced from local quarries. The area where the batching plants are located will be restored following the completion of the construction program.

Access

The three principal elements to be transported via the road network are the workforce, construction materials and construction equipment. For the purpose of this assessment, indicative transport routes (referred to as Transport Corridors) for each of these three elements have been developed.

Three primary Transport Corridors have been identified, with one Transport Corridor splitting into four possible transport routes between Dalby and the Project Site locations providing alternate transport routes. These Transport Corridors include sections of the Gateway Arterial Road (U13A – Gateway Motorway South), Cunningham Highway/Ipswich Motorway (17A and 17B), Warrego Highway (18A and 18B), the Bunya Highway (45A), Dalby-Jandowae Road (421) and Kingaroy-Jandowae Road (424). A full assessment of the traffic and transport routes and potential impacts is provided in Chapter 13 Transport.

On-site access tracks

The onsite access track layout will be designed to utilise the existing topography of the land, avoiding steep areas where possible and minimising the amount of land required. It is likely that approximately 85 km of access track will be required (see Figure 2.1 in Volume 2).

The following design criteria and mitigation measures were applied to the access track layout to mitigate potential impacts:

- The access tracks will typically be 6 m wide, which may be expanded to 12 m to accommodate crane and delivery vehicle requirements during construction, and subsequently rehabilitated to a 6 m width for operation

- Regular passing places and turning areas
- Tracks will be non-metalled and constructed from locally sourced aggregate
- Tracks will be flush with the ground level
- The number of water course crossings will be minimised
- Track margins will be vegetated to reduce potential sediment-laden run-off.

The construction of access tracks will vary depending on localised ground conditions. Conditions impacting construction include the existing vegetation, nature of the topsoil, level of moisture in the ground, geotechnical base and localised topography.

Once the Project has been commissioned, access tracks greater than 6 m will be reduced with the edges dressed back and the margins re-vegetated.

The number of water course crossings will be minimised. The exact requirement and design of the water course crossings will be agreed during the detailed design and will be based on the detailed geotechnical site investigation and through discussions with the relevant State authorities.

Public access

The Project Site is intersected by several registered public access roads, including Niagara Road and Cooranga North Road, and private dwelling access roads. All public access roads will be maintained during construction, however public access to construction areas will not be permitted.

Appropriate signage will be provided during the construction period for health and safety reasons. Temporary construction signage will be erected following consultation with Western Downs and South Burnett Regional Councils.

Temporary construction laydown areas

As illustrated in Figure 2.1 in Volume 2, there are four potential locations for temporary construction laydown areas, namely:

1. At the north western area of the Project Site, situated at the intersection of Jarail Road and Sarum Road
2. At the eastern area of the Project Site, where it intersects Bilboa Road (approximately 400 m north of the intersection of Bilboa Road and Niagara Road)
3. At the centre of the Project Site, approximately 1.1 km south east of the intersection between Jarail Road and Niagara Road
4. At the eastern extent of the Project Site, adjoining Niagara Road.

The temporary construction laydown areas are likely to be no larger than 440 m by 340 m and will accommodate portacabins (site offices, welfare facilities, toilets); storage containers for tools and equipment; storage areas for plant, material and components; wash down facilities; and sufficient parking for the workforce, deliveries and visitors. The temporary construction laydown areas will be formed into hardstand. Prior to forming the hardstand area, the topsoil will be removed and stockpiled adjacent to the hardstand area. Following the completion of the construction phase, the temporary construction laydown area will be reinstated using the stockpiled topsoil and reseeded in accordance with the landowner requirements.

The exact locations and nature of the temporary construction laydown will be established in consultation with the relevant landowners when a full construction methodology is determined.

Additionally, turbine locations will require an area of hardstand adjacent to the turbine foundation, (approximately 60 m by 60 m, depending on turbine type). This hardstand is intended to provide a stable base on which to place turbine components ready for assembly and erection, and to locate the crane necessary to lift the turbine components into place.

The crane pads will be left in place following construction to allow for the use of similar plant should major components need replacing during the life of the Project, and for use during decommissioning at the end of the operational period. The crane pad area may be dressed back with topsoil and landscaped into the surrounding area upon completion of turbine erection.

Permanent meteorological masts

Locations for permanent meteorological monitoring masts at the Project Site have been assessed primarily in order to establish measurement of the free stream wind from all directions, and where possible to meet the criteria in the International Electrotechnical Commission (IEC) 61400-12-1 for power performance testing. These requirements include restrictions on the distance between mast and turbine, complexity of the terrain around the test site and the influence of obstacles and other turbines on the wind.

It is likely that lattice masts with concrete footings at mast base and guy wire anchor points will be used for the Project. Full engineering design and certification will be carried out during detailed design once the turbine type and layout of the wind farm has been confirmed. Figure 2.1 in Volume 2 provides the indicative position of the permanent meteorological masts for the Project. However, the final number and position of the meteorological masts will be determined during the detailed design phase of the Project.

Electrical connections, substation and grid connection

The electricity generated by harnessing the wind's energy must go through a transformer in order increase its voltage and successfully transfer it across long distances. The wind turbines will be connected to cable marshalling points and the onsite transformer through underground and some overhead cabling.

The underground cables will be laid in cable trenches of approximately 0.5 m to 1.5 m in width and a minimum fill of 800 mm to allow for continued agricultural activities. The majority of the cable trenches will be located adjacent to the onsite access tracks, though in some limited cases the underground cabling may be required to be independent of the access tracks. Approximately 93 km of cable trenches will be required, but will be dependent on the final layout. Once the trenched areas have been backfilled, the disturbed area will be reinstated to promote the establishment of vegetation of the same species and density of cover to that of the surrounding undisturbed areas.

In addition to the underground cabling, there is likely to be overhead conductors connecting the cable marshalling points to the substation. The overhead cables will be of sufficient height to allow for site vehicles to pass beneath.

The substation will connect the Project to a Powerlink switchyard, which will be the point of connection to the National Electricity Market (NEM) via Powerlink's 275 kV transmission lines.

The switchyard and substation are proposed to be co-located on the eastern edge of the Project Site (Figure 2.1, Volume 2). It is also possible that a second substation on the western portion of the Project Site may be required. The precise details of the substations cannot be defined at this stage as they are dependent on the turbine model and high voltage electrical design which will not be known until the completion of the detailed design and tender process. However, it will be an area measuring approximately 200 m by 150 m and it will include the main transformer, switchgear, protection, metering, associated electrical infrastructure and the operation and maintenance buildings.

The main switchyard will be located on up to 4 ha of land (LotPlan 92BO469) which will be subdivided under an agreement with the landowner. Further detail on the subdivision of the land is provided in Chapter 11 Land Use and Planning. Indicative imagery of the switchyard is provided in Chapter 6 Landscape and Visual Assessment.

2.3.3 Indicative wind farm layout

The local wind resource is well understood and this has informed the choice of the Study Area. The wind resource, physical and environmental considerations, constructability, electrification, tender process and detailed design will all inform the final layout of the Project. However, for the purposes of the approval process, a potential turbine layout based on the wind resource, physical and environmental considerations, constructability and electrification were modelled to produce a maximum envelope for development based on turbine height and potential noise impacts.

With respect to understanding potential environmental impacts and documenting these for the approval process, the majority of the environmental impacts and reporting will rely on the wind farm maximum specifications outlined in Table 2.3 and the Project Site. That is, the majority of physical and environmental assessments have assumed a "worst case" turbine that can fit within the Project Site.

The layout is used to demonstrate that a realistic turbine layout can comply with required environmental outcomes of the Queensland Wind Farm State Code and supporting Planning Guidelines (DILGP 2016).

It is important to note that the proposed Project layout may change as part of the detailed design of the Project. However, the final specifications of the wind farm will not exceed those that are outlined Table 2.3. Decisions on the final location of infrastructure (micro-siting) during detailed design and construction will potentially allow for the further protection of species, habitat and features of localised conservation significance.

2.4 Project alternatives

2.4.1 Comparison with other forms of electricity generation

Wind turbines are one of the most established forms of renewable energy technology, with other technologies (such as tidal, wave and solar) less developed in generating potential and commercial terms. Under current government policies, the financial cost of wind power is falling close to that of conventional sources of electricity. In addition, the life cycle carbon cost of wind power is significantly smaller than that of other forms of conventional and renewable energy production.

As well as their environmental benefits, wind farms offer other important advantages. Firstly, they contribute to a reduction in our dependence on the finite reserves of fossil fuels, which are being rapidly depleted. Secondly, they reduce dependence on oil and gas imports and increase self-sufficiency in energy production. Wind farm developments are also reversible. This key feature allows a site to be decommissioned to the extent that no visible trace of the wind farm is apparent, thus allowing a site to retain its environmental legacy.

2.4.2 Consequences of not proceeding

Should the Project not proceed, there would be no change to the current natural environment and grazing would continue to be the predominant land use. There would also be a loss of economic potential in the nearby towns where construction and operation workers are likely to be sourced from.

Not proceeding would result in the available wind resource not being captured and converted into electricity to power Australian homes. This electricity demand would subsequently be sourced from traditional fossil fuel sources which significantly contribute to annual greenhouse gas emissions. The significant displacement of carbon dioxide by the Project would also not be realised.

Renewable energy only accounts for approximately 6% of the total installed generating capacity in Queensland (Department of Employment, Economic Development and Innovation, 2009). Renewable energy from wind only accounted for approximately 1.4% (12.45 megawatts) of this capacity. Successful implementation of the Project is anticipated to significantly increase the amount of energy generated from wind in Queensland and contribute towards meeting Australia’s renewable energy targets.

Should the Project not proceed, there will be an increasingly weak diversification of energy supplies throughout Queensland, reducing Queensland’s resilience of energy security.

2.5 Overview of construction methodology

The chosen Engineering, Procurement and Construction (EPC) contractor will be ultimately responsible for the detailed construction methodology for the Project.

A Construction Environment Management Plan (CEMP) will be prepared by the EPC contractor prior to the commencement of any construction activities. The CEMP will include details of the construction programme, construction techniques to be employed, mitigation measures to control construction impacts, and contact details for queries and reporting incidents.

The following sections describe a typical construction methodology that is likely to be similar to that used for the Project.

2.5.1 Timing and sequencing

The construction period for the Project will be agreed between the EPC contractor and AGL and will be subject to change depending on the weather conditions, availability of materials and construction speeds. However, it is assumed that the construction period will be approximately two to two and a half years. Subject to Project approvals, construction is anticipated to commence mid-2017.

During the construction phase, works could potentially occur for six days during each week, 12 hours per day (06:00 to 18:00). Under such a scenario, materials would be transported to the Project Site for up to 24 days per month (assuming a four week month). On occasion, it may be necessary for construction activities to take place on a Sunday or during the night time. In such instances, appropriate mitigation and management measures will be incorporated into the CEMP. These assumptions will be revisited and modified as necessary during detailed design.

Some enabling works will be required between approval of the Project and commencement of construction. This will include:

- Detailed site investigations for the purposes of micro-siting the turbines
- Obtaining all necessary consents for construction.

For the construction of the Project, the following activities are expected to occur:

- Site establishment (temporary site facilities, lay down areas, equipment and materials)
- Earthworks for access roads and wind turbine hardstands
- Excavation for the foundations
- Construction of wind turbine foundations (bolt cage, reinforcement and concrete)
- Installation of electrical and communications cabling and equipment (including overhead feeders from cable marshalling points to the substation)
- Installation of wind turbine transformers, in parallel with electrical reticulation works
- Installation of towers for the wind turbines, delivery of the wind turbine components to the Project Site
- Erection of wind turbines, using high-level mobile cranes
- Construction of the Project substation and Powerlink substation (progressed in parallel with the construction of the Project)
- Commissioning of wind turbines, followed by reliability testing
- Rehabilitation and restoration of the Project Site following commissioning.

The activities listed above will predominately occur in the order listed, however some of these activities will be carried out concurrently to minimise the overall length of the construction programme.

2.5.2 Equipment and machinery

The major equipment and machinery that is likely to be used in the construction of the Project includes:

- Site mobilisation – track loader, grader, backhoe, trucks, small crane and generators
- Access roads and hardstands – track loaders, excavators, graders, trucks (with trailer), water carts and rollers
- Wind turbines – excavators, rock breaker, concrete trucks, trucks (with trailer and vacuum), larger crawlers cranes, medium crawler cranes, small crawler cranes and generators
- Electrical reticulation works – trencher, backhoe, excavator, grader, tractor and small terrain crane
- Concrete batching plant.

Other equipment and machinery may be required, depending on the nominated construction techniques.

2.5.3 Construction workforce

It is estimated that the workforce required to construct the Project will peak at approximately 350. Typically these workers will be accommodated in local rental houses, hotels and motels in the surrounding localities and towns.

2.5.4 Construction water supply

The provision of water is essential for the construction of the Project. The construction activities likely to require water are:

- Bulk earthworks and material conditioning
- Stripping
- Dust suppression

- Concrete batching.

Water demand will vary over time, depending on the stages of the work. The total expected water requirement over the assumed two to two and a half year construction period by construction activity is estimated to be approximately 250 ML. This requirement will be further refined during the detailed design of the Project.

Water demands for the Project will require different water quality standards. Potable water fit for human consumption will be required at the site offices, while both medium (suitable for use in the concrete batching) and low quality raw water (for earthworks and dust suppression) may be used for construction purposes. Water will be tested from various supply options and allocated to the most appropriate use. AGL aims to require no on-site treatment, however this will be dependent on the quality of water available.

A water sourcing strategy will be developed so that water used during the construction phase does not cause issues to adjacent landowners or other stakeholders. Generally, potable water will be obtained from the local government water reticulation network while the proposed source of raw water (medium and low quality) is likely to be sourced from either:

- Groundwater – to include artesian and sub-artesian
- Surface water – to include watercourses, springs and overland flow.

Discussions were held with the Queensland Department of Natural Resources and Mines (DNRM) in Bundaberg and Toowoomba with regard to gaining access to water from surface water streams within the Burnett River and Condamine River catchments respectively.

DNRM (Bundaberg and Toowoomba Offices) advised in 2016 that under the current climate conditions groundwater was the preferred water supply resource for construction. Further detail regarding groundwater use is presented in Chapter 15 Groundwater.

AGL will also consider whether water supply can be obtained from stock dams through negotiation with the landholder. It is noted that stock dams may not provide a sustainable supply of water for the construction period as water availability in stock dams is dependent on factors such as catchment area, consistent rainfall, farm use requirements and groundwater recharge. Construction of new dams will require relevant planning and environmental approvals.

Based on the available information it is considered that using groundwater (under a Water Permit) will be the most appropriate option for the construction period (further discussed in Chapter 15 Groundwater). Access to groundwater via current landholders with a water allocation is anticipated to be procured through negotiations with nearby landholders where the volume of groundwater to be extracted is limited by the water permit obtained by AGL. Construction water supply options will be determined during the detailed design of the Project and confirmed prior to construction.

2.5.5 Air quality

A preliminary site investigation prior to construction would be undertaken to reveal the quality of the sub-grade material. This would enable an estimation of the quantity and source of road stone to be used and the likelihood for air quality impacts to occur.

The construction period may last for two to two and a half years, from commencement of access track construction through to the installation and commissioning of the turbines, ending with reinstatement. The following activities could potentially give rise to impacts on air quality:

- Mobilisation, including construction of site laydown areas for off-loading materials and components and to accommodate site offices and mess facilities
- Construction of site tracks for access to turbine locations by civil engineering plant and other vehicles including the excavation of cable trenches and laying of electricity and communications cables
- Construction of turbine foundations
- The delivery and erection of turbine towers and installation of nacelles and blades
- Construction of the site office and grid connection building
- Site re-instatement
- Vehicular movements to the Project Site.

An estimate has been made of the vehicular movements associated with the construction phase which are considered to present the greatest potential for effects upon local air quality. These movements are detailed in Chapter 13 Transport.

Potential air quality impacts from the construction works phase have been considered through a qualitative assessment of potential sources of air pollutant emissions from construction activities. Prior to construction the formulation of appropriate mitigation and control measures to be placed within a formal CEMP will be developed with consideration of sensitive receptors (surrounding landowners) (Figure 2.2, Volume 2).

Atmospheric emissions resulting from construction activities will depend on a combination of a specific activity's potential for emission and the effectiveness of control measures that may be applied. In general terms, during construction of a wind farm there are two sources of emissions that will need to be controlled to minimise the potential for significant adverse environmental effects:

- Exhaust emissions from site plant, equipment and vehicles
- Fugitive dust emissions from site activities.

Exhaust emissions

Operation of vehicles and equipment powered by internal combustion engines results in the emission of waste exhaust gases containing the following pollutants:

- Mono-nitrogen oxides (NO_x)
- Particulate matter (PM_{10} and $PM_{2.5}$)
- Volatile organic compounds (VOC)
- Carbon monoxide (CO).

The quantities emitted depend on a range of factors including engine type, service history, pattern of usage and composition of the fuel used. Whilst the operation of site equipment, vehicles and machinery would result in emissions of exhaust gases, such emissions are not considered likely to result in a significant adverse impact, particularly in comparison with levels of similar emissions from road traffic sources.

The main air quality impact of vehicular emissions associated with the Project would be realised along the traffic routes employed by haulage vehicles, construction vehicles, employees and visitors. The effects of these traffic movements on the local air quality in the vicinity of the Project Site have been qualitatively assessed on the basis of the construction activities described above. Emissions from construction traffic are anticipated to have a minimal impact on nearby sensitive receptors provided standard mitigation measures are adopted within the overall site management procedures.

Operational maintenance requirements for the Project are not expected to be frequent and therefore impacts on air quality from vehicular sources during the operational phase, including upset conditions, are expected to be minimal and not significant.

Fugitive dust

Fugitive dust emissions from construction activities are likely to be variable and will depend on the type and extent of the activity, soil conditions (soil type and moisture) road surface condition and weather conditions. Fugitive dust arising from construction activities is generally of a particle size greater than the 10 micrometre (PM_{10}) fraction.

In assessing the impact of fugitive dust there are two different effects that need to be considered: the effects of dust nuisance and the effects on human health. The former relates to the amount of dust falling onto and soiling surfaces (or rate of dust deposition) and the latter relates to the concentration of dust in suspension in the atmosphere. If not effectively controlled, fugitive dust emissions can lead to dust nuisance. Furthermore, soils are inevitably drier during the summer period, and periods of dry weather combined with higher than average winds have the potential to generate the most dust.

Most of the dust emitting activities described above respond well to appropriate dust control measures. Furthermore, mitigation measures will be required within site control procedures and a CEMP (see mitigation in section below) to ensure that potential adverse effects are minimised or eliminated. Dust is therefore not expected to be a significant issue for properties in the vicinity of the Project. No fugitive dust effects are expected during the operational phase, including during upset conditions.

Air quality mitigation

Prior to commencement of construction activities, a CEMP will be developed to ensure the potential for significant adverse environmental effects on local receptors is avoided. The following air quality mitigation measures reflect what is expected to be included within the CEMP:

- No fires on the Project Site
- Plan construction by locating dust activates away from sensitive receptors where possible
- Identify a responsible person in charge
- Regular cleaning of Project Site entrances
- Damping down of access tracks during prolonged dry periods
- Washing facilities to prevent mud from construction operations being transported on to adjacent public roads
- Restricting vehicle speeds on haul roads and other un-surfaced areas of the Project Site
- Vehicle engines to be switched off when not in use. Avoid idling vehicles where possible
- Ensuring that dusty materials are stored and handled appropriately (e.g. wind shielding or complete enclosure, storage is away from site boundaries, drop heights of materials are restricted, water sprays are used where practicable to reduce dust emissions)
- Ensuring that dusty materials are transported appropriately (e.g. sheeting of vehicles carrying spoil and other dusty materials)
- Minimise dust generating activities on windy and dry days
- Appropriate dust site monitoring included within the site management practices to inform site management of the success of dust control measures used.

Impacts on local receptors will be temporary and negligible during construction, and no air quality impacts are anticipated during operation. There are no health risks associated with air quality emissions from the Project.

Cumulative air quality impacts

The Project is relatively isolated in terms of other existing or planned major developments. The nearest development of significance is the Tarong Northern Land Ash Emplacement Project located approximately 60 km east of the Project Site boundary, north-west of Yarraman (between Tarong and Yarraman State Forests). It is not expected that the Project will significantly contribute to the regional air shed following the application of the mitigation measures described in the previous section. Therefore, any cumulative impacts from other established or planned developments will likely be negligible.

2.6 Operation

2.6.1 Wind farm operations

The power output from an operational wind farm largely depends on the strength of the wind blowing across the site. During the operation of the Project, the turbines will automatically start, stop and alter their output as determined by wind speed and other environmental and electrical conditions.

Usually, wind turbines start to generate electricity at a wind speed of between 3 metres per second (m/s) and 5 m/s, and the output increases up to their maximum rated power at a wind speed which varies significantly between the various turbine models. The wind turbines will also have a wind speed at which they automatically shut-down. This also varies amongst the different turbine models available.

It is anticipated that existing land management practices will be largely unaffected by the Project, with the participating properties continuing to be used for grazing and animal husbandry activities once rehabilitation is complete. Although approximately 2,251 ha of land will form the Project Site, once the construction area has been rehabilitated after construction, the wind turbines, wind turbine laydown area, substation and access roads will occupy a much smaller area of approximately 100 ha being approximately 1% of the land available for development (11,340 ha). This represents a minor reduction in land that could be used for agricultural purposes.

2.6.2 Operational workforce

AGL is expected to be responsible for the operational phases of the Project. During operations, the Project will be managed by both on-site and off-site personnel, employed by, or contracted to AGL.

Aspects of the Project operation dealt with by on-site personnel include:

- Operations staff
- Safety management
- Environmental conditions
- Landowner management
- Malfunction rectification.

Those functions to be managed by the off-site personnel include:

- Australian Energy Market Operator (AEMO) coordination
- Performance monitoring
- Wind farm reporting
- Remote resetting.

2.7 Maintenance

AGL will be responsible, either directly or via a contractor, for the ongoing maintenance of the turbines following their commissioning and reliability testing. Maintenance personnel will be on site and responsible for the scheduled and unscheduled maintenance of the wind turbines and associated connection works.

AGL, either directly or via a contractor, will undertake routine inspections of the wind turbines and other electrical infrastructure and complete the necessary scheduled (planned) maintenance activities. A schedule for routine maintenance of the turbines, including major and minor servicing intervals, will be developed once the final choice of wind turbine has been decided.

Additionally, ongoing maintenance of the access tracks and the electrification network will be required to maintain safe access at all times. It is likely that significant maintenance will be undertaken during the dryer Autumn/Winter months. However, safe access to all components will be maintained throughout the year.

2.8 Decommissioning and rehabilitation

At the end of the operational life of the Project, AGL may repower the wind farm (replace the wind turbines) or replace the wind turbine components, such as the gearbox and generator.

Alternatively, and for the purposes of this EIS, the Project may be decommissioned, which will involve the turbines and all other above-ground infrastructure on-site being dismantled and removed from the Project Site. This includes all the interconnection and substation infrastructure unless the infrastructure which, as at the relevant date, is owned by a network operator. The tower bases will be cut back to below ploughing level or top soil built up over the foundation to achieve a similar result. The land will be returned to prior condition and use.

The access roads, if not required for farming purposes or fire access, will be removed and the site reinstated to original condition and use. Access gates, if not required for farming purposes, will also be removed.

The underground cables occur below ploughing depth and contain no harmful substances. They can be recovered if economically attractive, or left in the ground. Terminal connections will be cut back to below ploughing levels.

All such refurbishment and decommissioning work will be the responsibility of AGL.

2.9 References

DILGP (2016). Queensland Wind Farm State Code and supporting Planning Guideline. State of Queensland.