8. ASSESSMENT OF LOWER PRIORITY ISSUES

8.1. Physical environment

8.1.1. Climate and air quality

EXISTING ENVIRONMENT

Climate

The proposal site is located near the boundary between the South Eastern Highland Bioregion, and the South Western Slopes Bioregion at approximately 700 metres above sea level. The weather station at Linton Hostel, Yass, at around 500 metres ASL records a highest mean daily maximum temperature of 29.3°C in January, and a lowest mean minimum 1°C in July. The mean annual rainfall is 648.5 mm, relatively evenly distributed through the year but with a slight peak in spring and a slightly reduced monthly average in summer (Bureau of Meteorology 2004). The Conroys Gap locality experiences lower rainfall than Yass (Cathy Kaveney, landholder pers. comm.).

The annual mean 3pm windspeed in Yass is 11.9 kph, peaking in December (14.8 kph) and a reduced average in June (8.6 kph). The annual mean 9am windspeed is 6.7 kph, peaking in November (9.0 kph) and a reduced average in June (4.4 kph). The mean relative humidity at 3pm ranges from 37% in December to 69% in June (Bureau of Meteorology 2004).

Climate is erratic between years (Yass Valley Council 2004). Diurnal summer conditions in the Yass district can therefore be dry and hot with high wind speeds. This has the potential to produce dusty conditions, particularly during drought when heavily grazed paddocks are prone to wind erosion.

Air quality

The absence of heavy industry or traffic concentrations ensures that pollutant loadings are relatively low in the study area. However, temperature inversions can occur in local valleys, particularly during winter, which trap gaseous and fine particle pollutants, such as wood smoke from domestic fireplaces, heaters and stoves and carbon monoxide and particulate matter from motor vehicles (Yass Valley Council 2005).

Smoke hazes caused by inversions are visible as drivers approach the Yass township in winter months (Yass Valley Council 2005).

IMPACT ASSESSMENT

Dust and atmospheric emissions

Dust and emissions would be generated during excavation works, road works and the transport of machinery. Dust/emission impacts would be temporary, largely restricted to the 6-9 month construction period and the decommissioning phase. Similarly, the area that would be impacted would be limited in extent (works areas indicated on Figures 3.7 – 3.12). The limited use of a light service vehicle during the operational phase is not expected to cause unacceptable dust impacts. The wind farm infrastructure would not generate emissions that would impact air quality during the operational phase.

Local climate

Local climate may be affected to a minor degree by the increase in turbulence caused by the wind turbines, while the wind farm is operational. Modelling and experimentation on real wind turbines has shown that the mixing effect of thermal layers has very little effect on temperature during the day (Baidya *et al.* 2004). Recordings taken below wind turbines and averaged over a 24 hour period were observed to be greater than existing ground level wind speeds by approximately 0.6 metres/second and to raise temperatures by approximately 0.7^{o}C (Baidya, *et al.* 2004).

Wind speed impacts have been suggested as being confined to a distance from each turbine equivalent to 10 times the vertical height of the turbine (SEDA 2002). For the proposed turbines (126m from the ground to blade-tip), an effect up to 1.25km from each turbine may be expected, attenuating with distance from the turbines. The anticipated change in wind speed and temperature at the ground level is not considered large enough to impact vegetation or conflict with the continued agricultural uses of the land at the site. This impact would be ongoing but minor and is not considered to require mitigation.

Greenhouse gases

The proposal would make a contribution to the reduction in greenhouse gas emissions by providing an alternative to electricity sourced from fossil fuels. This represents the chief environmental benefit of the proposal. Benefits to long-term climate change may be afforded by the development of non greenhouse gas emitting energy sources. The electricity supply capacity of the proposed wind farm and benefits in terms of reduced fossil fuel use and carbon dioxide emissions are quantified in section 4.

IMPACT AVOIDANCE AND MITIGATION

Activities and impacts	Avoidance and mitigation measures
Dust: blasting	Nearby residences will be informed prior to any blasting taking place.
	Blasting will conform to relevant safety and noise and vibration control standards.
Dust: possible use of a concrete batching plant and/or rock-crushing plant	The batching plant will not be located near residences.
	Dust levels at stockpile sites will be visually monitored. Dust suppression (eg. water sprays) will be implemented if required.
	Product stockpiles will be protected from prevailing weather conditions.
	Loads of dry materials will be covered where appropriate.
	Dust filters will be installed on silos.
	Only machinery compliant with emission standards will be used.
	Machinery and vehicles will not be left running or idling when not in use.
Dust and emissions generated by vehicle traffic.	Should dust generation be of a high level during the transport of machinery near residences, watering of sections of the route will be undertaken to reduce dust.
	The works timetable including periods of potential dust generation will be given to local residents and advertised on site signage and in the local press.
	Vehicles and motorised equipment will be maintained so that emissions are minimised.

8.1.2. Water quality and water resources

EXISTING ENVIRONMENT

The proposal site is situated in the Upper Murrumbidgee River catchment, on a ridge between the south-flowing Yass River sub-catchment and the north-flowing Talmo Creek/Jugiong Creek sub-catchment. There are no major watercourses at the subject site. McCullums Creek, Woolgarlo Creek and an unnamed watercourse on the ‘Ferndale’ property drain the southern half of the site, flowing south to Lake Burrinjuck. Stony Creek and tributary drainage lines drain the northern part of the subject site, flowing north-west to Bogolong Creek and then Jugiong Creek.

The Yass River flows into Lake Burrinjuck downstream of the proposal site. Burrinjuck Dam impounds the Murrumbidgee River and the lower sections of the Yass and Goodradigbee Rivers to provide irrigation water for the Murrumbidgee Irrigation Area. The Murrumbidgee River catchment is a major component of the Murray-Darling Basin, joining the Murray River at Balranald, with an area of 84,000 square kilometres. The Murrumbidgee catchment has a diverse range of landscapes, and significant agricultural, social and conservation values.

The Yass River system is listed as highly hydrologically stressed, with extensive catchment modification due to the construction of a large number of farm dams (Yass Valley Council 2005), sedimentation and pollutants from farmland, unsealed roads and urban stormwater, flow modification due to runoff interception with small dams and extractions and rising saline watertables due to past clearing. Approximately 75% of the Yass Valley LGA falls within unregulated subcatchments. Five of these eight unregulated subcatchments are considered to be under high hydrological stress, implying that demand for water already equals or exceed supply.

Dryland salinity and salination of waterways are major agricultural and environmental issues in the Yass Valley, particularly in areas on sedimentary geology. The Yass River regularly experiences high salinity levels, which have at times exceeded drinking water standards (Yass Valley Council 2005). Virtually all of the groundwater within the Yass Valley area has been identified as saline, with salt concentrations estimated to be between 1000 and 3000 milligrams per litre (EPA 2000 in Yass Valley Council 2005).

Developments can exacerbate soil and water salinity problems if vegetation and soils in recharge areas are extensively impacted, producing rising groundwater levels lower in the landscape. The northern part of the study area occurs on sedimentary geology and is one of the most heavily cleared areas in the district. The exposure of saline water tables has caused scalding in the local area. The proposal area is not included within the mapped current high salinity risk or forecast high risk by 2050 mapped at the broadscale by the National and Water Resources Audit for the Australian Dryland Salinity Assessment 2000.

The site access tracks would cross higher order watercourses. Drainage lines and watercourses in the district are commonly incised and actively eroding.

IMPACT ASSESSMENT

Impacts to water quality would primarily relate to the transport of equipment and vehicles within close proximity to drainage lines and the generation of mobile sediment and potentially pollutants, during construction. While the proposed turbine development would be largely confined to ridgelines, watercourses may be potentially impacted indirectly from run-off from the construction sites.

Measures would be implemented to control erosion and sedimentation during and following the works. Given the limited area affected by the proposal and the cleared and modified nature of the existing site, the proposal is not expected to substantially affect watertables or salinity in local soils or waterways. No further clearing of trees on ridges is expected to be required in the construction of the turbines and access roads.

Approximately 8.5 kilometres of new track would be created as part of the proposal. In addition, up to 6 kilometres of existing roads and tracks may require upgrading and widening. The increased area of hard surfaces would increase the amount and turbidity of runoff to a minor extent. While traversing these tracks, there is potential for the leakage of fuels or other hydrocarbons which could find their way in to drainage lines.

Subject to further assessment, a culvert on a drainage line on Paynes Road may require replacement (refer Attachment 12). During excavations for this work, there is potential for concentrated runoff, drainage line erosion and sedimentation in Stony Creek. Erosion and sediment controls measures would be required to avoid impacts to Stony Creek.

Any boggy areas on tracks would be crossed using formalised crossings designed to minimise soil and water disturbance. The use of bound fill for minor drainage line crossings would be an appropriate means to distribute the weight of heavy vehicles.

Dust, mobile sediment and vehicle emissions generated during transport, excavation and blasting works may also find their way into drainage lines. This could lead to elevated levels of sediment and turbidity in stormwater discharged and therefore reduce water quality. The associated increase in nutrients could lead to eutrophic conditions in still water areas. Eutrophication of downstream waters could also be caused by the use of fertiliser during revegetation.

There is a risk that construction materials such as alkaline concrete wash could escape from the construction sites. Chemicals are found in paints, acids for cleaning surfaces, cleaning solvents, concrete products, soil additives used for stabilisation and other purposes, concrete-curing compounds, fuels as well as other sources. When used or stored improperly, these chemicals can become mixed with stormwater and carried by sediment and runoff from construction sites.

Water required during the construction phase for road watering and concreting would be obtained from off-site. All extractions would be permitted under required licencing and assessment arrangements. This temporary use would not place stress on human or ecological requirements.

The potential impacts on water quality are considered manageable using a range of mitigation measures.

IMPACT AVOIDANCE AND MITIGATION

Activities and impacts	Avoidance and mitigation measures
Sedimentation and turbidity	All vehicles onsite will follow established tracks or routes. Work flow will be organised to minimise the number of vehicular movements across the site and thereby minimise soil compaction and the generation of mobile sediment.
	All bridges and culverts used will be assessed prior to works to ensure that they are able to bear the projected loads of the laden vehicles.
	Permanent and temporary road construction will employ best practice drainage and erosion/sedimentation control measures.
	Moderate-high use tracks will be upgraded and constructed in compliance with DNR Guidelines (DLWC 1994).
	Sediment traps will be installed wherever there is potential for sediment to collect and enter waterways.
	Excavation will only be commenced during stable, dry weather conditions, operational requirements permitting.
	Where possible, excavation will be excluded from wet drainage lines.
	On slopes check banks will be installed across the trenchline, 20-50 metres apart, following closure of the trench. These will discharge runoff to areas of stable vegetation.
	Stabilisation and rehabilitation of disturbed ground will be carried out as soon as practicable after works.
	Stockpile sites will be identified and turbid water discharged from these treated by a combination of silt fencing and temporary mulching/seeding.
	Prior to decommissioning, the state of creek and drainage line crossings will be inspected and upgraded where required to minimise the impact of vehicle crossings.
	Where required, formalised crossings using bound fill will be designed to allow vehicle access across rivers and wet drainage lines to minimise soil and water disturbance.
Pollution hazard: transformers, vehicles and machinery (fuels and other hydrocarbons), concrete batching, fertilisers, herbicides	Site storage areas will be identified, and be bunded to prevent loss of any pollutants.
	The transformer site will be securely bunded and regularly inspected and maintained.
	Hydrocarbon spill kits will be stored at the site.
	Machinery will be operated and maintained in a manner that minimises risk of hydrocarbon spill.
	All vehicles will remain on established roads, tracks and routes.

Activities and impacts	Avoidance and mitigation measures
	Maintenance or re-fuelling of machinery will be carried out in hard-stand areas (ie. existing or proposed road surface or hard-stand areas beneath turbines, not on areas that either contain native vegetation, or will be revegetated).
	Where chemicals are utilised, their application and disposal will comply with manufacturers recommendations.
	Turbines and the substation will be bunded to contain a volume greater than the total volume of pollutants in the facility.
	The concrete batching plant, if required, will not be located near residences. Concrete wash will be deposited in an excavated area, below the level of the topsoil.

8.1.3. Soil and landforms

EXISTING ENVIRONMENT

The proposal site occurs on steep, rounded ridgelines and valleys, at an elevation of around 700 metres ASL and a local relief of up to 220 metres. The underlying geology in the northern part of the site is metasediments with steeply dipping strata. The powerline and turbine sites south of Black Range Road occur over granitic geology.

Soil landscapes are areas of land that have recognisable, describable and mappable topography and soils (Tulau 1998). The proposal would impact on three soil landscapes, as indicated on Figure 8.3. The soil and topographic characteristics of these soil landscapes are discussed below, based on descriptions in the Goulburn 1:250,000 Soil Landscapes mapsheet (Soil Conservation Service 1991).

Barrenjack soil landscape (bj)

This landscape is characterised by steep hills on volcanic greywacke, slate, conglomerate, rhyolite, tuff and limestone. Local relief is 100-400 meters, slopes range from 30% to greater than 50%. The soils are shallow, stony, sandy to loamy soils on crests and side slopes with minor stony, red and yellow podzolic soils or colluvial soils on lower slopes. The land is subject to minor to moderate sheet erosion, soil creep and gullying and stream bank erosion hazard.

Conroys Creek soil landscape (cy)

This soil landscape unit features valleys between rolling hills formed on volcanic rocks and shales of Black Range. Soils are acidic and duplex with deep, bleached, massive A2 horizons on mid and lower slopes similar to yellow podzolic soils, lithosols and red and yellow earths on upper slopes with yellow solodic soils in drainage lines. Gullying of drainage lines is extensive. Sheet erosion is significant following dry periods. Top soils have poor water holding capacity and dry out rapidly.

In the proposal area, these soil landscapes show moderate to severe sheet erosion and stream gullying. Sheet erosion is most marked on steep slopes either side of McCullums Creek, to the immediate east of the northern turbine cluster (refer Figure 8.1). Streambed erosion is advanced in McCullums Creek, and Stony Creek to the west.

Figure 8.1 Sheet erosion on slopes east of the northern turbines

Burrinjuck soil landscape (bk)

This landscape occurs in the proposed powerline route through the 'Ferndale' property. It features shallow stony lithosols on crests and sideslopes, together with shallow stony yellow earths. Yellow podzolic soils and yellow solodic soils are found on an organic mat at the surface making the soils hydrophobic when dry. Rock fields are typical. The landscape has minor sheet erosion and some gullying of drainage lines, and is saline in some low lying areas.

Topography is typically undulating rises and rolling low hills with elevations 500-540m ASL. Slope is 3-15%. Local relief is 10-40 metres. Permanent erosional stream channels are closely to very widely spaced and form a non directional tributary pattern.

On the Ferndale property, granitic bedrock is exposed on a ridge face falling steeply to the west. Gully erosion is active in granitic soils in a drainage line east of the proposed southern turbine sites (Figure 8.2).

Figure 8.2 Gully erosion on granitic soils east of the southern turbines

Land quality in the Yass Valley LGA has extensively declined, primarily due to clearing for agriculture (Yass Valley Council 2005). Over 80% of Yass Valley has been cleared, which has contributed to sheet and gully erosion and dryland salinity. The combination of fragile and low fertility soil types (lithosols, red podzolics and yellow podzolics) and extensive land clearing has resulted in the formation of large gullies and extensive sedimentation in creeks (Yass Valley Council 2005).

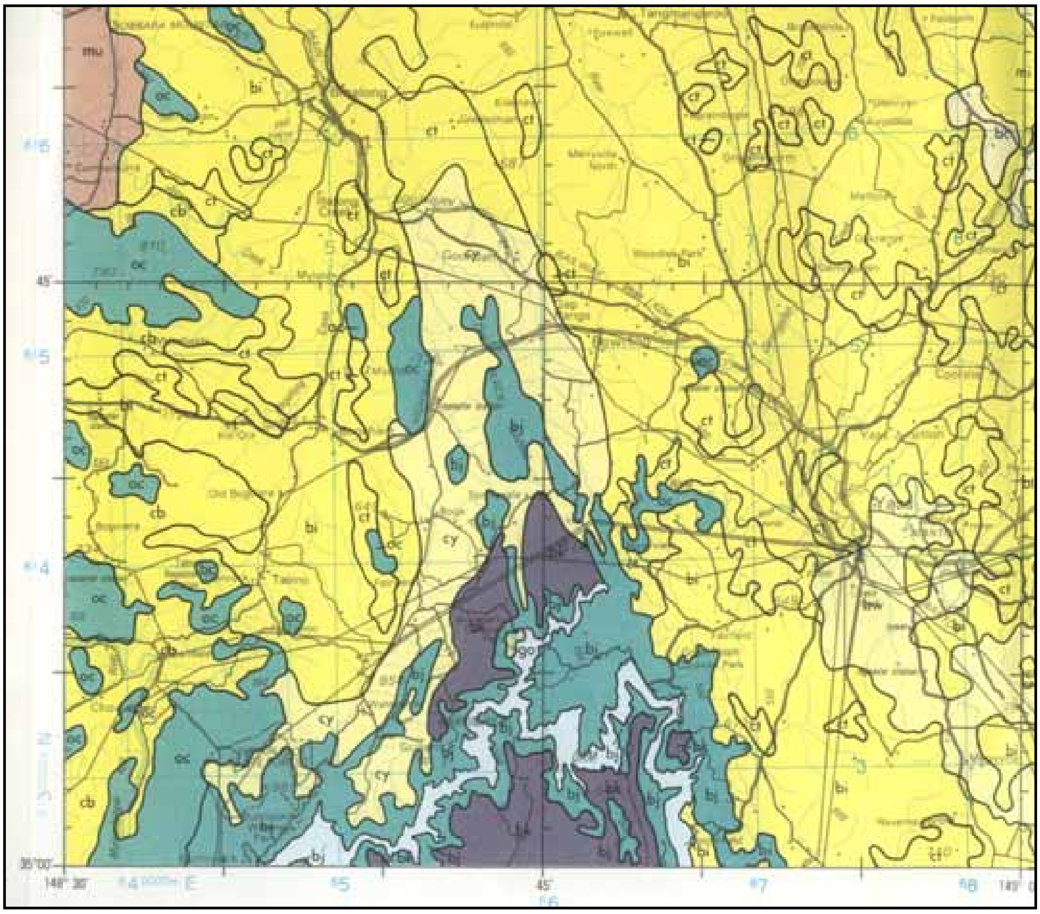

Figure 8.2 Soil landscapes in the study area

IMPACT ASSESSMENT

Soil compaction and erosion could occur during excavation works, road works and the transport of machinery. Some soil compaction would occur as a consequence of the transport of heavy equipment. Compaction can reduce infiltration capability and the biotic soil binding mechanisms provided by bacteria and micro invertebrates and leave surface layers of soil more susceptible to wind and water erosion. In lower slope positions, compaction of saturated soils may cause slumping, affecting slope stability and water quality.

Impacts would be greatest during the construction and decommissioning phases. Impacts would be temporary, occurring largely during the 6-9 month construction period. The works areas are indicated on Figures 3.7-3.12. Toilet facilities would be provided at the site for staff.

Hydrocarbons would be used at the site; the contractor would implement a Spill Control Plan as part of an Erosion and Sediment Control Plan. Spill Control Plans would identify persons responsible for implementing the plan if a spill of a dangerous or hazardous waste should occur. Any spill that occurs, regardless of size or type, would be reported to the Construction Manager. The event and clean up processes would be recorded and passed to the Yass valley Council. If the spill or hazard reaches surface waters, the EPA would be notified.

While the soils at the site are prone to erosion, they are not considered to be unstable given appropriate control and rehabilitation measures. Site-specific issues include the potential to aggravate:

- existing sheet erosion on slopes beside the northern turbine ridges;
- existing streambed erosion east and west of the northern turbines; and
- existing gully erosion east of the southern turbines.

Soil erosion and sedimentation control measures will aim to avoid the concentration of runoff, and the discharge of runoff onto thinly vegetated slopes. The works will remove the minimum amount of grassy vegetation and ensure that revegetation is undertaken effectively and quickly following works at each site. Permanent flow diversion and energy dissipation structures may be required around roads and hardstand areas in sensitive areas.

Where required, formalised vehicle creek and wet drainage line crossings constructed of bound fill would be used to minimise soil and water disturbance. Particular care would be taken to ensure than runoff is not concentrated in the eroding watercourses east (McCullums Creek) and west (Stony Creek) of the northern turbines and the eroding drainage line east of the southern turbines.

The impacts of the proposal are considered manageable with regard to soils and landforms. The identified impacts would be largely restricted to the construction and decommissioning phases of the proposal. Earthworks and road construction would comply with relevant guidelines including the NSW Guidelines for the planning, construction and maintenance of tracks (DLWC 1994), Urban Stormwater Management – Soils and Construction (Department of Housing 1998) and NSW Fisheries guidelines on creek crossings (NSW Fisheries 1999, 1999a).

IMPACT AVOIDANCE AND MITIGATION

Activities and impacts	Avoidance and mitigation measures
Hardstand establishment and stockpile sites	Landforms will be stabilised and rehabilitated as soon as practicable after works.
	Turbine and powerline placement will avoid impacts to mature trees, where possible.
Transport of heavy equipment	Tracks will be graded and drained to enhance stability. Tracks will be upgraded and constructed in compliance with DNR Guidelines (DLWC 1994).
	Routes will be confined to already disturbed areas, where possible. The existing Paynes Road will be upgraded to access the site from the Hume Highway for construction purposes.
Excavation of footings and trenches	Excavation will only be commenced during stable, dry weather conditions, operational requirements permitting.
	A minimum of vegetation will be removed during excavation and construction leaving as great a buffer between the ridgetop works area and steep sideslopes as practicable.
	Subsoil will be separated from topsoil for rehabilitation purposes. All topsoil from the excavation sites will be stockpiled and replaced to its original depth for seeding and fertilising. On steep slopes, topsoil will be stabilised using, for example, jute matting. Any excess subsoil will be removed from the site and disposed of at an appropriate fill storage site.
	On slopes check banks will be installed across the trenchline, 20-50 metres apart, following closure of the trench. These will discharge runoff to areas of stable vegetation.
	The eroding slopes east of the northern turbines, the eroding watercourses east (McCullums Creek) and west (Stony Creek) of the northern turbines and the eroding drainage line east of the southern turbines will be protected from concentrated runoff.
Vehicle and machinery operation; pollution hazard and soil compaction	Site storage areas will be identified, and be bunded to prevent loss of any pollutants.
	Hydrocarbon spill kits will be stored at the site.
	Machinery will be operated and maintained in a manner that minimises risk of hydrocarbon spill.

Activities and impacts	Avoidance and mitigation measures
	Maintenance or re-fuelling of machinery will be carried out in hard-stand areas (ie. existing or proposed road surface or hard-stand areas beneath turbines, not on areas that either contain native vegetation, or will be revegetated).
	Where chemicals are utilised, their application and disposal will comply with manufacturers recommendations.
	Work flow will be organised to minimise the number of vehicular movements across the site and thereby minimise soil compaction and the generation of mobile sediment. Where possible, vehicles will be restricted to established tracks or routes.
	Where practicable, grass surfaces will be retained on infrequently used vehicle routes to protect soils.
Concrete batching plant operation; pollution hazard	Concrete wash will be deposited in an excavated area, below the level of the topsoil.
Transformer installation and operation; pollution hazard.	The transformer site will be securely bunded to contain any leakage of coolant.
Stabilisation and rehabilitation	An Erosion and Sedimentation Control Plan will be developed prior to the works, including maps of environmentally sensitive areas, parking and laydown areas, locations of environmental protection works and emergency response. The need for any permanent erosion and sedimentation control structures along roads and around hardstand areas will also be addressed.
	Stabilisation and revegetation of excavated areas will occur progressively following works to stabilise soil, to reduce impact on adjacent water bodies and drainage lines.
	The eroding slopes east of the northern turbines, the eroding watercourses east (McCullums Creek) and west (Stony Creek) of the northern turbines and the eroding drainage line east of the southern turbines will be protected from concentrated runoff.
	Following the construction phase, track drainage will be inspected and repaired as required. Service tracks will have robust rollover drains installed (subject to vehicle access requirements), directing road runoff into vegetated areas away from watercourses.
	Disturbed areas will be seeded with native grasses, where appropriate.
	Stock will be excluded to prevent grazing and trampling in disturbed areas and areas being rehabilitated. Grazing should not occur following the rehabilitation works for 3-6 months.
	Soils will be mulched with chipped vegetation from the site (for areas located in woodland), fibre matting or sterile hay.

8.2. Construction noise and vibration

EXISTING ENVIRONMENT

Background acoustic conditions at and around the proposal site have been recorded by Heggies Australia Pty Ltd in its noise impact assessment (Attachment 7). Existing background noise includes periodic use of agricultural machinery, Paynes Road quarry operations and intermittent local and highway traffic noise.

The proposal site is located approximately 3.5 kilometres south of the Hume Highway, 4.5 kilometres east of the Burrinjuck Waters State Park access road and 15 kilometres north-east of the Burrinjuck Waters State Park.

Residences located around the proposal site are indicated on Figure 7.9. Other receptors include horse stables on neighbouring properties, horse riders and walkers using the Hume and Hovell walking track, which follows Black Range Road through the site.

IMPACT ASSESSMENT

Noise from general construction activities

Depending on weather conditions, turbine erection can occur at a rate of 2-3 per week, suggesting a two month erection period. Additional time is required beforehand (for civil construction, site preparation, preparation and pouring of footings etc) and after (for site rehabilitation). This total period could be in the order of 6-9 months, depending on weather conditions and staging of works.

The NSW Environment Protection Authority's Environmental Noise Control Manual applies criteria for noise emissions during construction projects. The EPA criteria relating to construction projects of less than 4 weeks duration have been used to assess the project. This is because, while the total construction period may exceed this period, the intensive civil works which would produce high noise emissions would shift between locations within the proposal site so that each receiver would be impacted for a relatively short period.

For projects of less than 4 weeks duration, the EPA criteria applies a construction noise limit of 20dB(A) above background noise levels.

The EPA Guideline identifies noise-sensitive locations as residential premises, schools, hospitals, places of worship, parks and wilderness areas. Apart from the transport of machinery, which can be routed to avoid sensitive locations, the works would not occur within close proximity of residential areas, schools etc.

Several residences occur within one kilometre of the site and may be within audible distance of construction works. The NSW EPA construction noise guidelines recommend noise level goals and hours for work. The hours of work for construction sites are restricted to between 7:00 am and 6:00 pm weekdays and 7:00 am and 1:00 pm on Saturdays, with no construction taking place on Sundays or Public Holidays.

The impacts of construction noise was assessed by Heggies Australia Ltd (Attachment 7), based on NSW EPA criteria for construction noise. Using a worst case scenario, modelled construction noise levels were found to be acceptable. Based on ANZECC guidelines for assessing residential disturbance caused by blasting, the potential impact of blasting was also found to be acceptable in terms of human comfort and building impact.

IMPACT AVOIDANCE AND MITIGATION

Activities and impacts	Avoidance and mitigation measures
Construction noise impacts on residential and recreational receivers	NSW EPA construction noise guidelines regarding work times and emission levels will be applied. Hours of work will be limited to 7am-6pm weekdays and 7am-1pm on Saturdays. No construction will occur on Sundays or Public Holidays.
	Machinery will use appropriate and effective exhaust mufflers and compressor silencers.
	Noise complaints will be responded to rapidly using monitoring equipment. If EPA criteria are exceeded, appropriate noise reduction strategies will be implemented, such as re-positioning of machinery, rescheduling works, installation of temporary noise barriers, improved vehicle noise control, reduced work times, 'quiet work practices' and the provision of respite periods.
	The timing, nature and need for the works will be well publicised in the local community.

8.3. Land use and management

EXISTING ENVIRONMENT

The majority of land in the Yass Valley LGA is used for agriculture, predominantly wool production. There is also an increasing demand for uses such as viticulture, horticulture and rural residential development (Yass Valley Council 2004). The relative value of the major industrial sectors in the Yass LGA is provided in Table 8.1.

Table 8-1 Value of industry sectors in Yass LGA (CRDB 2005)

Industry sector	$ million
Tourism	23.0
Retail	35.4
Manufacturing	4.6
Agriculture	39.0

This section examines the potential impacts of the proposal on agriculture and recreation/tourism in the study area and surrounding locality. Potential impacts on residential and lifestyle uses centre on noise, visual impact, telecommunications interference and other issues which are addressed in individual sections of this report. Residential property development potential is also addressed in a separate section.

The subject site is located on land zoned 1(a) Rural Agriculture in the Yass Valley Local Environmental Plan (LEP). Wind farm developments are permissable under the LEP, subject to Council approval.

Agriculture and Landcare

Agriculture in the region is dominated by wool production. Approximately five million kilograms of wool are produced annually from 331 properties (Capital Region Development Board 2005). A sideline industry has developed in fat lambs for the meat industry using Merino-Border-Leicester cross. Yass Valley LGA is diversifying its rural products; many new agricultural industries are emerging including wine, alpaca studs, olives and berries. The close proximity of Canberra to Yass Valley LGA is assisting the establishment of these new enterprises (Yass Valley Council 2005).

The study area is zoned 1(a) Rural Agriculture, which has the objective of setting aside land for agricultural purposes. The land subject to the proposal is used for grazing sheep and cattle. Four landholders would be involved in the project. Landholdings and house locations in the proposal area are shown on Figure 7.9.

There are fifteen Landcare Groups in the Yass area. Their activities focus on the major issues of dryland salinity, streambank and gully erosion, declining remnant vegetation, streambank condition and weed infestation (YANLG 2005).

Recreation and tourism

Tourism is a growing industry in the Yass district. In 1999 the Yass Visitors Information Centre was visited by over 41,000 people and the value of tourism in 1996 was over $23 million (Capital Region Development Board 2005). Yass Shire functions as an inland stopover for domestic tourists, with a range of accommodation types and standards.

Tourist activities promoted in the Yass district include historic buildings, museums, memorials, water sports such as fishing and water skiing (Lake Burrinjuck) and nature-based recreation (Burrinjuck Waters State Park, Hume and Hovell Walking Track). Carey's Caves, in the Wee Jasper Valley provides visitors access to 7 limestone caves.

The study area is used for private recreation. During the Open House consultation session held in Yass in November 2005, respondents indicated that the study area was used for recreational horse-riding.

The Hume and Hovell walking track follows Black Range Road through the study area. There are no track use counters on this section of the walking track. Walker use levels are likely to be low, in the vicinity of 10-20 per year (Warwick Hull, DoL pers. comm.). Because the route in this area is entirely on road, the track is used by horse-riding groups. This use may average around 50 riders a year, mainly in groups (Warwick Hull, DoL pers. comm.).

South of the study area, Lake Burrinjuck is used for fishing and water sports. The primary access road to Burrinjuck Waters State Park, a popular camping and boating destination, is located 3-4 kilometres west of the subject site. Black Range Road is a secondary access route to the park from Yass. The Hume Highway, located around 3.5 kilometres to the north of the project, also carries recreational and tourism traffic.

IMPACT ASSESSMENT

Agriculture

Construction and decommissioning impacts

Adverse impacts to agricultural use would be greatest during the construction and decommissioning phases of the development. During these periods, stock would need to be excluded from the works area. Rehabilitation of the site (soil stabilisation and potentially revegetation) would also require stock access to be temporarily restricted while vegetation is re-established on disturbed areas. This is considered to be a minor impact, occurring over 6-9 months during the construction and decommissioning phases. Affected land owners would be compensated for this loss by way of the lease arrangements they enter into with Taurus Energy. Consultation and liaison would be undertaken with involved landowners to restrict stock access to the construction zones during the period of construction.

The proposal has the potential to affect agriculture by introducing or spreading weeds, restricting weed or introduced fauna control activities, producing a pollution hazard from chemicals used during construction and transformer coolant, and disturbance to stock. Best practice mitigation measures would be adequate to reduce weed and pollution risks to an acceptable level. The proposal is not expected to disrupt weed and introduced fauna control programs.

Operational impacts

A minor amount of vegetation would be removed from agricultural use to accommodate the wind farm infrastructure (estimated to be around 5 hectares including hardstand areas beneath turbines, control building, substation and access tracks). The operational wind farm is not anticipated to have adverse impacts upon the agricultural use of the site and would provide a benefit as a supplementary income stream, particularly during drought periods.

The Biodiversity Assessment recommends that lambing not be undertaken on turbine ridges, to avoid attracting Wedge-tailed Eagles into the bladeswept area. For the same reason, the Assessment recommends that poisoning and fencing be used to exclude rabbits from the turbine ridges. The Assessment also suggests that sheep grazing on these sites may be preferable to cattle to avoid generating insect populations which may attract insectivorous bats and birds. These restrictions are not anticipated to significantly affect farm operations, including grazing patterns, accessibility and weed control.

Livestock

Sheep and cattle are grazed on and around the Conroys Gap subject site. Wind energy organisations promote the ability to continue to graze stock right to the base of wind turbines without ill effect (Union of Concerned Scientists 2005; AusWEA). Given the number of wind farms and duration of their operation on grazing land and the lack of data available to indicate adverse impact, it is assumed that the turbines will have minimal impact on livestock grazing at and around the site. A ‘settling in period’ is likely to occur during which livestock become accustomed to the turbines (I. Newton, Wind Farm Manager, Eraring pers. comm. Jan 2005; *AusWEA;* British Wind

Energy Association). There is no evidence to suggest that this would be drawn out or adversely impact animal welfare or agricultural productivity.

Agricultural benefits

The proposal would provide a drought resistant supplementary income stream for involved land holders. By way of the lease agreements negotiated with Taurus Energy, land managers could afford to manage the land more sustainably (lesser stocking rate, increased funds to address erosion gullies, benefiting erosion and water quality on and offsite).

There is potential for wind power to become a new rural industry, providing a significant new income stream for rural communities at a time when traditional land uses are under pressure (Warren *et al*. 2005). This point is particularly relevant to the Yass region where agricultural returns have been greatly impacted by recent drought and where anticipated climate change is projected to result in a continuation of this trend.

Pittock (2003) observed that a significant proportion of Australian exports are agricultural products sensitive to changes in climate, water availability, carbon dioxide, fertilisation, and pests and diseases. General warming will increase potential evaporation and water demand, potentially reducing the capacity of the land. While plant growth and water-use efficiency may be enhanced as a result of increased carbon dioxide levels initially, after increases in temperature of 2–4 °C and associated rainfall decreases, net effects are projected to be negative by the mid to late 21st century (Pittock 2003).

As well as direct impacts, agricultural profits could be affected by a projected increase in agricultural production in mid to high latitude Northern Hemisphere countries and the subsequent commodity price and world trade impacts (Pittock 2003). The development of land uses compatible with agricultural activities, such as wind power, have potential to provide increased economic security to rural industries. As well, they provide a substitute for carbon emission producing electricity generation that is stable (not dependent on other countries) and renewable.

Recreation and tourism

Construction and decommissioning impacts

Construction traffic would use Paynes Road to access the subject site. Black Range Road carries recreation traffic accessing Burrinjuck Waters State Park, and infrequent foot traffic using the Hume and Hovell track. Given the relatively short duration of the construction period, and is unlikely to cause significant disruption to tourist traffic or recreational uses. Traffic management and safety is addressed in section 7.3. Depending on the precise locations of horse-riding routes, some disruption may occur to horse-riding opportunities during the construction phase.

Operational impacts

Horse-riding

Horses can be adversely affected by wind storms and therefore there is concern among members of the community that the proposal may have an adverse effect on horses in close proximity to the operational wind farm.

The British Horse Society has prepared a wind farm advisory statement (British Horse Society 2005). This statement suggests that wind farms have safety implications for horses and their riders and drivers of horse drawn vehicles during the construction and operational stages. This arises due to the natural instinct of the horse, when faced with a perceived threat, to flee. Equally important, the statement notes, is the riders/drivers ability to handle the horse.

The characteristics listed by the British Horse Society as potentially eliciting a dangerous response include:

- the sudden appearance of the turbines in the horses line of sight,
- low frequency noise emitted by operational turbines,
- shadows caused by the operational turbines, and
- the unexpected start up of turbines.

The statement goes on to suggest that all of these features are diminished with distance from the turbines. A 200 metre buffer was suggested, based on turbines up to 50 metres in height. For the 126 metre high turbines proposed for Conroys Gap, this may more accurately equate to a 500 metre buffer zone. The impact of the development on rights of way or other access routes is also suggested as requiring consideration. A 200 metre minimum buffer distance from access ways is suggested by the British Horse Society.

While low frequency noise was a feature of some early wind turbines designs that had blades down-wind of the tower, modern turbine designs have reduced the level of low frequency noise to below human perception (AusWEA fact sheet number 6). The effect of ‘chopping the light’ or shadow flicker attenuates with distance and is not considered, by modellers (Danish Wind Energy Association) to be noticed beyond 500-1000m from a turbine (refer sections 7.3.4 and 7.3.6).

Participants at the Open House consultation session indicated that recreational horse-riding occurs over hills to Lake Burrinjuck to the south. The precise routes or home properties of the horses are not known. The Black Range Road section of the Hume and Hovell track also carries rider traffic, possibly around 50 riders per year, mostly in groups (Warwick Hull, DoL pers. comm.).

Based on the British Horse Society recommendations, routes within 500 metres of the turbines may no longer be available to riders. The potential turbine location closest to Black Range Road would be approximately 760 metres north of the road. This well exceeds the buffer requirement determined by the British Horse Society, and Black Range Road is likely to remain a useable riding route. The impact of this turbine may be mitigated with tree and shrub planting along the road reserve. Other mitigation options may include developing alternative trails. When a final turbine layout is developed, further consultation with affected landholders and riding clubs is required to determine routes and mitigation options.

Recreation and tourism traffic

Black Range Road carries recreation traffic accessing Burrinjuck Waters State Park. The Hume Highway, located around 3.5 kilometres to the north of the project, also carries recreational and tourism traffic. Some of the wind farm turbines would be visible from each of these routes. The visual impact of the wind farm on these and other users is addressed in section 7.3.4. The wind farm is sited in a highly modified rural landscape, and their transient appearance is unlikely to significantly affect vehicle-based recreation and tourism experiences.

Hume and Hovell walking track

Black Range Road, running east-west through the study area, forms part of the Hume and Hovell heritage walking track. Some of the wind turbines would be visible over a range of distances to walkers using this section of the track. Near the Ferndale property, the turbines may occasionally be audible. Because it is a vehicular road passing through farmland, the road is unlikely to carry high levels of walker traffic, estimated to be in the vicinity of 10-20 per year (Warwick Hull, DoL pers. comm.). Higher levels of use could be expected to occur in timbered and off-road sections of the 440 kilometre route.

In view of the low use levels and limited area of impact involved, the proposal is not expected to significantly detract from the Hume and Hovell walking track recreational experience. Walkers may in fact experience the views of the turbines positively as something different and perhaps of interest (Warwick Hull, DoL pers. comm.). If necessary, visual impacts along this route could be mitigated using tree and shrub plantings.

District and regional tourism impacts

The number and type of visitors to the area is not anticipated to be negatively impacted by the development of a wind farm at Conroys Gap. The development is not incongruous with the production-based economy of the area and the heavily modified local landscape.

Depending on demand and interest, the wind farm may be promoted by Taurus Energy as a local tourist attraction using information leaflets and viewing platforms.

IMPACT AVOIDANCE AND MITIGATION

Activities and impacts	Avoidance and mitigation measures
Impact on agriculture	Consultation and liaison will be undertaken with involved landowners regarding site fencing, weed control and stock access during the construction period and grazing during the operational phase.
Impact on recreation and tourism	When a final turbine layout is developed, affected landholders and riding clubs will be consulted regarding horse-riding impacts and mitigation options, such as tree and shrub planting and the development of alternative trails.
	Depending on demand and interest, the wind farm may be promoted by Taurus Energy as a local tourist attraction using information leaflets and viewing platforms.

8.4. General economic impact

EXISTING ENVIRONMENT

The wind farm proposal is located approximately seventeen kilometres west of Yass, a town with a population of 12,938. Residential numbers in Yass Shire have consistently risen over the 20 years between the 1981 and 2001 censuses (ACT Government 2004).

The 2001 census in the Yass Statistical Local Area recorded that 95.7% of the labour force was employed (2,650 males and 2,176 females). 14.7% was employed in the agriculture/forestry/fisheries sector, 13.7% in the retail trade industry, 9.4% in the property and business services industry, 8.2% in the health and community services sector, 7.6% in the construction industry, 6.7% in education and 4.3% in the manufacturing industry (ABS 2002).

IMPACT ASSESSMENT

Wind farms are an economically viable means to generate electricity and whilst providing several potential environmental benefits, when compared to currently available alternatives. Potential for gains exist in the provision of local employment. Approximately 50 full time jobs would be provided during the construction phase of the development and up to five during the operational phase, for maintenance and monitoring activities. Local staff and contractors would be selected where they can demonstrate the capacity to undertake the works effectively. Other economic benefits would result via the provision of services to these workers; such as accommodation, food and fuel from local service centres.

Economic benefits will vary depending on final site design, turbine suppliers, timing of works, and other details. Taurus estimates that up to $10 million could be spent within the region as a result of the wind farm and over its life, broadly split with approximately $5 million during the construction phase and $5 million during the operation phase.

The project would be privately funded by Taurus Energy. There would be no ongoing financial expenses to the community or to the Yass Valley Council. The development would be of direct economic benefit to landowners who enter into leasing arrangements with Taurus Energy. This would provide a steady stream of income to involved landowners, with flow-on benefits to local businesses. Wind farm development has not been shown to adversely impact property values in New South Wales, and would not affect the underlying productive capacity of farmland (refer section 7.3).

A feature of wind farm developments is that the distribution of benefits can be limited to a small number of landowners, while the impacts (particularly the ongoing visual impact and specific noise impacts) can have a much larger sphere of influence. The proponents intend to allocate funds in each year of operation for community projects (refer sections 4 and 7.3). These would provide additional benefits to the local community, and could include;

- weed management, landcare and conservation activities,
- sporting and community facilities,

- sponsorship of local organisations and events,
- improvements to local telecommunications services.

IMPACT AVOIDANCE AND MITIGATION

Activities and impacts	Avoidance and mitigation measures
Distribution of economic benefits	The proponent will establish a Community Fund to finance community projects (refer section 7.3.1)
	The proponent will liaise with local industry representatives to maximise the use of local contractors and manufacturing facilities in the construction of the wind farm.

8.5. Resource and waste impacts

8.5.1. Wind farm Life Cycle Analysis

ENERGY PAYBACK

Life cycle analysis (LCA) is based on careful accounting of all energy and material flows associated with a system or a process. This approach covers the whole project life cycle, from the extraction of raw materials to the disposal of materials at the end of the project's life. LCA is particularly relevant for renewable technologies, where it is often argued that the energy used to produce the technology is not 'paid back' during the lifetime of the technology (Schleisner 2000). For all the materials used in the process, LCA estimates of energy and emissions based on the total life cycle of the materials, i.e. the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner 2000).

In Schleisner's (2000) analysis of two wind farms in Denmark, the energy 'payback' time was modelled to be 0.26 years for a wind farm on land. That is, in approximately 3 months, the energy produced by the wind farm had 'paid back' the energy consumed in producing, installing and decommissioning that wind farm. It was found that 94% of the materials used for construction of a wind turbine could be recycled (Schleisner 2000). Furthermore, the value of the materials able to be sold for reuse can be used to offset the cost of decommissioning the wind farm and rehabilitating disturbed areas.

VESTAS WIND TURBINE LIFE CYCLE ANALYSIS

A life-cycle assessment has been conducted by Vestas for a Vestas V90-3.0MW wind turbine, similar to those that would be installed at Conroys Gap. Vestas divided the life-cycle into four phases: production, transportation, operation and disposal. This assessment looked only at the turbines and did not consider associated infrastructure such as transmission lines, substation and control building.

By far the greatest consumption of energy and resources occurred in the production phase. Raw materials required include iron ore of the construction of steel components and their casings as well as crude oil to make the epoxy materials used in blade construction. These resources are limited and considered non-renewable, when the rate of extraction is compared to the rate of formation.

In contrast, the transportation, operation and disposal phases were relatively minor. For the scale of the proposed Conroys Gap wind farm, which is located on a major transport corridor, the transportation resources related to the fuel consumed by vehicles transporting, installing and maintaining the turbines would be minor.

During the operational phase (based on a 20 year life-span and taking into account the maintenance required over this period) the costs begin to be offset by the operational capacity of the turbines. The turbines proposed for Conroys Gap have greater efficiency in producing energy than smaller sized turbines, due to the optimised comparative weight of the larger turbines.

Disposal encompasses the fuels required to dismantle and transport the turbines as well as the disposal of materials. Previously, 20% of the turbine blades would be deposited in landfill, the remaining 80% being reused. New blade types are now up to 100% recyclable, requiring no landfill disposal.

Using a functional unit of 1 KW hour as a basis for comparison, Vesta provide the following comparisons between phases of the 3 MW wind turbine life-cycle and CO2 emissions between other energy producing power stations (Tables 8.2 and 8.3).

Table 8-2 Energy consumed during life cycle phases of the Vestas V90-3MW

Life cycle phase	Energy consumption
Production phase	7,795 MWh
Transport phase	74.00 MWh
Operation phase	14.00 MWh
Disposal phase	-3,572 MWh
Total energy consumption	*4,311 MWh*

Table 8-3 Comparison of CO_2 emissions of different generation sources

Source	CO2 produced
Onshore Vestas V90-3MW turbine	8 grams per kWh
Gas-fired power station	467 grams per kWh
Coal-fired power station	826 grams per kWh

Hence, by comparison to major electricity generating methods employed in Australia, wind farms rate favourably based on:

- CO2 emissions produced per kilowatt hour of energy produced;
- Potential to reuse and recycle component parts; and
- Energy payback time in comparison to the life span of the project.

8.5.2. Resource use and waste management

RESOURCE USE

The majority of resource use and waste generation would occur during the construction and decommissioning phases. The construction of the proposed wind farm, including associated infrastructure, would require the use of various resources, such as concrete and other masonry products (footing, slabs, hardstand areas, building elements), materials associated with the operation of machinery, and motor vehicles (fuels and lubricants) and other construction materials (metals, glass, plastics).

Resources required during the operational phase include fuel for maintenance vehicles, lubricants for oil changes in the turbines and replacement parts if required that may consist of metal and plastic based products. All wastes would be removed by contractors and maintenance staff. No local garbage service would be required.

The abovementioned materials are not currently depleted or restricted in supply however, increasing scarcity and environmental impacts are becoming apparent from the use of fossil fuels and other non-renewable resources.

The proposal therefore, would not place significant pressure on the availability of local or regional resources.

WASTE GENERATION

Solid waste is one of the major pollutants caused by construction. Solid waste would be generated from a number of activities including limited vegetation removal and construction activities, including material from packaging, building materials, scrap metals, sanitary wastes, plastic and masonry products. Hazardous wastes would be present onsite; these include sanitary wastes, hydrocarbons and fertilisers. During decommissioning similar wastes would be generated.

A key strategy of construction and decommissioning works would be to minimise waste from the construction site, reuse or recycle waste where possible and implement protocols to minimise the risk of spills.

IMPACT AVOIDANCE AND MITIGATION

Activities and impacts	Avoidance and mitigation measures
Resource use efficiency and conservation	Excavated material will be used in road base construction and as aggregate for footings where possible, surplus material will be disposed of in appropriate locations on site (on agreement with the landowner), finished with topsoil, and revegetated.
	Surplus topsoil will be stockpiled on site during construction, and following construction will be spread on the site (particularly over hardstand areas and access roads) to assist in revegetation.
Waste minimisation and management	Waste will be reused or recycled whenever possible. Separate recyclable materials receptacles will be provided (eg. for glass, plastics and aluminium).
	Packaging materials and general construction wastes will be disposed, with Council's approval, at Council operated waste disposal centres.
	Toilet facilities will be provided for onsite workers and sullage from contractor's pump out toilet facilities will be disposed at the local sewage treatment plants or other suitable facility agreed to by Council.
	Risk of chemical spills will be minimised and protocols will be in place to ensure prompt and effective clean up of any accidental spills.
	The contractor will implement a Spill Control Plan as part of its Erosion and Sediment Control Plan. Spill Control Plans will identify persons responsible for implementing the plan if a spill of a dangerous or hazardous waste should occur. Any spill that occurs, regardless of size or type of spill, will be reported to the Construction Manager. The event and clean up processes will be recorded and passed to the Yass Valley Council. If the spill or hazard reaches surface waters the EPA will be notified.

9. CONCLUSION

The Environmental Assessment has identified and assessed the significance of environmental impacts associated with the proposal to construct and operate a wind farm at Conroys Gap. The Conroys Gap locality is a moderate-high relief rural area with a long history of extensive grazing, but with a recent trend toward large lot residential subdivision.

Key issues relating to the proposal include the presence in the wider study area of threatened flora, fauna and communities, the presence at the subject site of raptors and raptor hunting habitat, and the presence of roads, recreation areas and residences within potential noise and visual impact zones.

The impacts of the proposal on physical values (air quality, soil and water) would be readily manageable using standard best-practice methods and measures to address site-specific issues. The vegetation that would be impacted by the proposal has low conservation significance and the impacts would not be significant. All bird and microbat species recorded at the site and most likely to be affected by the proposal are widespread and not considered threatened.

Based on experiences and assessments at operating wind farms elsewhere in Australia, blade collisions by birds and bats are expected to be rare. The Assessments of Significance conclude that the proposal is not likely to have a significant impact on threatened species, populations or ecological communities listed under the TSC Act or the EPBC Act. A dedicated pre-works survey and mortality and behavioural monitoring program, coupled with adaptive management would be implemented to account for residual risks to bird and bat species.

The visual landscape is substantially modified by farming practices and contains many built elements; there are no areas where the wind farm would create unacceptable contrast. Shadow flicker will be mitigated to ensure that it does not affect two existing houses and one proposed house site in the mornings or evenings. A screening program will be implemented to minimise visual impacts to surrounding residences. Visual impacts would be acceptable and manageable using a range of mitigation measures.

Operational noise emissions have been demonstrated to generally meet the relevant criteria. The proponent will model the final turbine selection and turbine layout and demonstrate that the layout meets the SA EPA Guidelines (with respect to non-involved houses) and World Health Organisation guidelines (with respect to involved houses). The results of this assessment will be provided to the Department of Planning and disseminated to the local community prior to construction.

Studies conducted overseas and elsewhere in Australia, including a study commissioned by the proponent into the effects of the Crookwell I wind farm on land values, suggest that the proposed wind farm would not have a significant impact on local land values and development potential. The potential for interference to telecommunications is difficult to determine with certainty, but impacts are likely to be readily manageable using a range of mitigation measures. Impacts on air traffic and safety are not likely to be significant. The Conroys Gap wind farm proposal is sufficiently distant from similar proposed and existing wind farms to avoid cumulative noise, visual and biodiversity impacts.

The planning and design of the Conroys Gap proposal has been informed by past experiences of wind farms in Australia and overseas. The proposal has been progressively adapted and refined in response to the findings of the specialist assessments and consultations with the community, private organisations and government agencies. This EA provides a series of impact avoidance and mitigation measures which have bearing on the design and planning, construction and operational phases of the project.

The proposal offers clear climate change benefits in reducing the current reliance on coal for electricity generation. In Australia, a third of total greenhouse gas emissions are produced during the generation of electricity, the vast majority from coal-fired power stations. Greenhouse gas emissions from these sources are increasing rapidly in New South Wales. The wind farm would reduce greenhouse gas emissions by 90,000 to 99,000 tonnes of CO_2 per annum, or a cumulative effect of 2.70 to 2.97 million tonnes of CO_2 over the life of the project. The State's electricity demand continues to grow, and new electricity sources will be required by 2008 to meet this demand and avoid power outages and blackouts (Transgrid 2005). Wind power provides reliable and decentralised electricity production.

For the local community, the proposal offers economic benefits. The proposal would inject over $10 million into the local economy. An estimated 50 jobs would be provided during construction and 5 jobs during the operational phase of the wind farm. The wind farm would also provide an opportunity to increase local tourism. A Community Fund of $25,000 per annum would be established with the project, offering ongoing benefits to the local community and local environment.

Assuming implementation of the avoidance and mitigation measures outlined in the EA, the proposal is not considered likely to significantly affect the environment in terms of cultural heritage, social, economic or biodiversity impact. Negative impacts relating to noise, visual impact, disturbance to recreation opportunities and biodiversity risks would be localised and restricted to the 30 year lifespan of the project. These impacts are considered to be outweighed by the broader benefits of wind power generation.

Statement on ecological sustainability

An assessment of the ecological sustainability of the proposed wind farm is presented below, against nationally-agreed Ecologically Sustainable Development (ESD) criteria (refer section 5).

The precautionary principle

There are acknowledged uncertainties and risks associated with the proposal. The assessment has involved a detailed risk assessment of key impacts. Flexibility and an adaptive approach has been used in the design and siting of the proposal. A degree of flexibility would also be available in the operation of the wind farm in response to unforeseen impacts.

A monitoring program would be implemented to record the environmental performance of the wind farm. The Environmental Management Plan would incorporate an adaptive management component. Specific management responses would be triggered by quantified and measurable impacts which exceed defined tolerance thresholds.

Inter-generational equity

The proposal would be readily reversible in terms of social, physical and biodiversity impacts. The proposal incorporates guarantees of infrastructure removal at the end of the life of the wind farm. Biodiversity monitoring and ongoing environmental management prescriptions would ensure that the wind farm does not produce irreversible damage to these values, such as local extinction or permanent habitat loss.

The generation of electricity using wind, rather than coal, would also assist with the reduction of carbon emissions and mitigation of anthropogenic climate change. Reducing carbon emissions is essential to conserve the diversity, productivity and liveability of the environment for future generations. The use of renewable energy sources would contribute to intergenerational equity by reducing the losses and costs associated with global warming which must be borne by future generations.

The impacts of the proposal are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations.

Conservation of biological diversity and ecological integrity

The biodiversity values of the subject site have been a key consideration in both broadscale wind farm site selection process and finescale siting of turbines and other infrastructure. The decision to exclude the north-eastern ridge site from the proposal was based, in part, on likely impacts on threatened species habitat and an Endangered Ecological Community. The Biodiversity Assessment has concluded that the proposal as currently presented would not significantly affect biodiversity values at the site or in the region. A monitoring and adaptive management approach would be used to manage residual risks.

In reducing reliance on coal-fired power generation, the use of wind power would also reduce climate change impacts to biodiversity values.

Improved valuation, pricing and incentive mechanisms

The viability of wind generation is assisted by the Government's MRET scheme. While this represents an intervention in the energy market, the subsidy is justified because of the 'public good' nature of the outcomes, and as a corrective to existing distortions caused by the failure to include the full costs of climate change in coal-based electricity prices.

Based on the social and environmental benefits accruing from the proposal from reduced dependence on fossil fuels, and the assessed impacts on the environment, it is considered that the development would be sustainable within the context of the above ESD principles.

10. ASSESSMENT PERSONNEL

This report was prepared by **ngh**environmental. Specific sections were drawn from consultants' reports or from material provided by the proponent. Contributions to relevant sections of the report are detailed in Table 10.1 below.

Table 10-1 Authors involved in preparing the Environmental Assessment

	Section	Author
1	**Executive summary**	nghenvironmental
2	**Introduction**	nghenvironmental
3	**Description of the proposal**	
	3.1 Site of the proposal	nghenvironmental
	3.2 General description of proposed works	Taurus Energy
	3.3 Wind farm infrastructure	Taurus Energy
	3.4 Construction facilities and staging	Taurus Energy
	3.5 Associated development and future implications	nghenvironmental
	3.6 Statement of commitments	nghenvironmental
4	**Project justification**	Taurus Energy
5	**Planning context**	nghenvironmental
6	**Consultation**	nghenvironmental
7	**Assessment of key issues**	
	7.1 Scoping and prioritisation of issues	nghenvironmental
	7.2 Biological factors	
	7.3.1 Community impacts	nghenvironmental
	7.3.2 Land value impacts	Henderson and Horning, nghenvironmental
	7.3.3 Services and infrastructure	nghenvironmental
	7.3.4 Landscape character and visual values	Scenic Landscape Architecture nghenvironmental
	7.3.5 Operational noise	Heggies Australia, nghenvironmental
	7.3.6 Safety and health	nghenvironmental
	7.3.7 Telecommunications interference	Taurus Energy
	7.3.8 Bushfire impacts	nghenvironmental
	7.3.9 Traffic and transport	Bega Duo Designs, nghenvironmental
	7.3.10 Aviation impacts	Taurus Energy
	7.3.11 Archaeological and cultural heritage	NSW Archaeology, nghenvironmental
	7.4 Removal of infrastructure	nghenvironmental
	7.5 Cumulative impacts	nghenvironmental
8	**Assessment of lower priority issues**	
	8.1 Physical environment	nghenvironmental
	8.2 Construction noise	Heggies Australia, nghenvironmental
	8.3 Land use and management	nghenvironmental
	8.4 General economic impact	nghenvironmental
	8.5 Resource and waste impacts	nghenvironmental
9	**Conclusion**	nghenvironmental

Nghenvironmental staff involved in preparing the report

Personnel	Role	Qualifications	Expertise and experience
Paul McPherson **ngh**environmental	Primary author Environmental assessment Report writing and research	Bachelor of Applied Science (Natural Resources)	With **ngh**environmental since 1996 undertaking flora and fauna survey, planning assessment and environmental impact assessment. Prior to this, Commonwealth Government environmental policy, resource assessment and program delivery.
Brooke Marshall **ngh**environmental	Environmental assessment Report writing and research	Bachelor of Natural Resources (Hons)	Since joining **ngh**environmental, Brooke has prepared impact assessment reports relating to wind farms, road construction, water pipeline installation, river modification and prescribed burning activities. These reports have included threatened floral and faunal species assessments requiring research, fieldwork and GIS components.
Nick Graham-Higgs **ngh**environmental	Client liaison Editorial review	Bachelor of Applied Science	An environmental consultant specialising in environmental impact assessment and natural resource management since 1992. Much of the work undertaken has been within sensitive areas, including major infrastructure development works.

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