

Flora and Fauna Assessment – Summary of Key Outcomes

There are significant ecological values on the Development Site associated with the remnant vegetation along Leaf's Gully and the Nepean River. This area is dominated by Shale Sandstone Transitional Forest (SSTF), an Endangered Ecological Community (EEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* (TSC Act). Narrow bands of *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* ('River Flat Eucalypt Forest'), also an EEC under the TSC Act, occur along the Nepean River and its tributaries. The ecological condition of these communities is high with few weed species, a diverse understorey and canopy composition and relatively undisturbed riparian zones. This vegetation also represents high value fauna habitat, with a specialist study indicating the potential presence of *Phascolarctos cinereus* (Koala) in the area; threatened bats were also recorded within the study area.

One threatened plant species, *Pultenaea pedunculata* was recorded as a single specimen along an existing fence line to the north of the proposed power plant footprint. *Pultenaea pedunculata* is listed as an endangered species under Schedule 1 of the *TSC Act*. *Pultenaea Pedunculata* would not be directly impacted by the proposal. The location of the specimen would be fenced in order to reduce the likelihood of accidental impact during construction and operation and to improve the likelihood of regeneration for this isolated record. The assessment concluded that there would be no significant impact from the proposal on this species.

The Development Site includes areas considered to be of high vegetation value to the Campbelltown Koala population with the potential to facilitate connections to other known Koala populations. The proposed conservation strategy for the site, particularly the visual screen plantings, *Pultenaea* Recovery Area and the Conservation Area, will enhance habitat connectivity and quality for the Campbelltown Koala population.

The 'maintain or improve' test has been applied to the current proposal, taking into consideration the low biodiversity values of the proposed plant footprint, as well as the proposed impact avoidance measures, impact mitigation measures and offsets. The key impact on biodiversity values would be removal of exotic pasture grass, along with several paddock trees. The key avoidance measure has been to locate the development footprint in a largely cleared paddock. The key mitigation measures would be salvage of trees, groundcover vegetation and other habitat features, weed control and visual screen plantings. The plantings would link existing stands of native vegetation and over time, develop habitats and movement corridors for native fauna within approximately 30 hectares (ha) across the Development Site. In addition, an offset, in the form of the *Pultenaea* Recovery Area, will be delineated within the site, with the purpose of improving habitat quality and hence the chances for natural recruitment of the threatened plant *Pultenaea pedunculata*. A Plan of Management will be developed for the site, incorporating bushland management principles for high value SSTF, the *Pultenaea* Recovery Area and the visual screen plantings.

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The proposed measures for avoiding, mitigating and offsetting impacts on biodiversity are consistent with the DECC (2005) guidelines for Part 3A Assessments and meet the key criterion for 'like-for-like or better' trade-offs of biodiversity values. Adoption of the proposed mitigation measures would more than compensate for the loss of vegetation associated with the proposal and would improve biodiversity values within the study area in the long term. Hence the proposal maintains or improves biodiversity values.

In addition to the above measures, AGL is proposing to establish a Conservation Area spanning Lots 101, 102 and 103 and extending approximately 170 ha. The land would be re-titled for conservation and maintenance purposes in consultation with DECC, either through a Voluntary Conservation Agreement (VCA), a Biobanking Agreement, or some other enduring protection mechanism. A decision on which conservation mechanism is to be adopted would be made following the determination of the project and would depend on whether the Biobanking Scheme is operational and details of that Scheme.

The assessment concluded that there is no likelihood of the proposal imposing a significant effect on Threatened species, populations or ecological communities listed under the TSC Act. Similarly, there would be no adverse effects on any matters of national environmental significance listed under the EPBC Act.

13.1 Introduction

This assessment considers the flora and fauna impacts of the Leafy Gully Power Project with regard to Commonwealth and NSW State planning and environmental legislation, including the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, the *Environmental Planning and Assessment Act 1979 (EP&A Act)*, the *Threatened Species Conservation Act 1995 (TSC Act)*, *Native Vegetation Act 2003 (NV Act)*, State Environmental Planning Policy (SEPP) 44 and the *Noxious Weeds Act 1993*. The full flora and fauna assessment is presented in **Appendix K** of this Environmental Assessment.

The assessment was conducted generally in accordance with the *Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft* (DEC, 2004) and the *Guidelines for Threatened Species Assessment* (DEC/DPI July 2005).

This assessment details measures to avoid or mitigate impacts on threatened species and identifies potentially impacted paddock and fence trees.

A Koala outcomes report has also been prepared and is summarised in the chapter and the full assessment presented in **Appendix L**.

A bush fire risk assessment has been undertaken and is presented in **Chapter 19**.

13.2 Methodology

The methodology for the flora and fauna assessment included the following elements:

- review of previous studies;
- literature review;
- botanical survey; and
- fauna survey.

These methods are discussed in more detail below.

13.2.1 Literature Review

A desktop literature review was undertaken by URS to identify the representative spectrum of Threatened species, populations and ecological communities listed under the *TSC Act* and the *EPBC Act* that could be expected to occur within the study area and surrounds based on habitats present.

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13.2.2 Botanical Survey

Flora surveys were conducted on the 10 and 13 February 2006 and 24 and 25 August 2006 and were generally consistent with the *Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft* (DEC 2004). The primary objectives of the survey were to:

- map and describe the vegetation communities occurring within the study area;
- compile a flora list of those species occurring within the vegetation communities, identifying Threatened, nationally, regionally or locally significant species and communities; and
- assess the likely impacts of the proposed development and provide recommendations to minimise impacts to flora in the study area.

A total of four 100 m survey transects were undertaken within Lots 101 and 102 on 10 and 13 February 2006 to provide an inventory and map plant taxa and target vegetation communities within the study area. The locations of the four transects were based on the proposed footprint of the Leaf's Gully Power Project such that the extent of vegetation which may be disturbed as a result of the proposal was appropriately assessed.

Additional targeted surveys for *Pultenaea pedunculata* were conducted in August 2006 following receipt of more detailed records from DECC (P. Wearne, DEC email 21/8/06 – refer to **Appendix K**).

13.2.3 Fauna Survey

Due to the largely cleared nature of the proposed footprint location, the methodology employed to survey fauna included Random Meander (Cropper, 1993), opportunistic observations, diurnal bird counts, call recognition, track and scat analyses, ultrasonic bat recording and spot lighting.

Targeted fauna surveys were carried out between the 8 and 14 February 2006 and were generally consistent with the Draft DEC (2004) survey guidelines.

An additional review of the Development Site with respect to the current and potential value of the site for Koalas was undertaken by Dr Stephen Ward of Eco Logical Australia and is presented in **Appendix L**.

13.2.4 Survey Limitations

Surveys were undertaken outside the optimal survey period for some species and therefore it is possible that some species utilise the site but were not detected during the survey period. These species are likely to include cryptic species and threatened flora species such as orchids not in flower during late summer. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species (resident or transitory) were recorded during the survey period. The habitat assessment conducted for the site allows for identification of habitat resources for such species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on site in order to predict potential impacts of the proposal.

13.3 Results of Assessment

Flora

The flora literature review identified the following:

- potential for twenty-four threatened plant species listed under the *EPBC Act* and / or the *TSC Act*, which have been previously recorded within the vicinity of the property, of which fifteen are classified as being Vulnerable and nine as Endangered under these Acts; and
- identification of Shale / Sandstone Transition Forest (SSTF), an EEC listed under the *EPBC Act* and the *TSC Act*. EEC SSTF is a sub-community of the Cumberland Plains Community and occurs in transitional areas between the clay soils of the Wianamatta shale and the sandy soils of Hawkesbury sandstone within the Sydney Basin Bioregion. The floristic composition of the community includes species otherwise characteristic of, or occurring in, either sandstone or shale habitats. The structure of the community is forest or woodland.

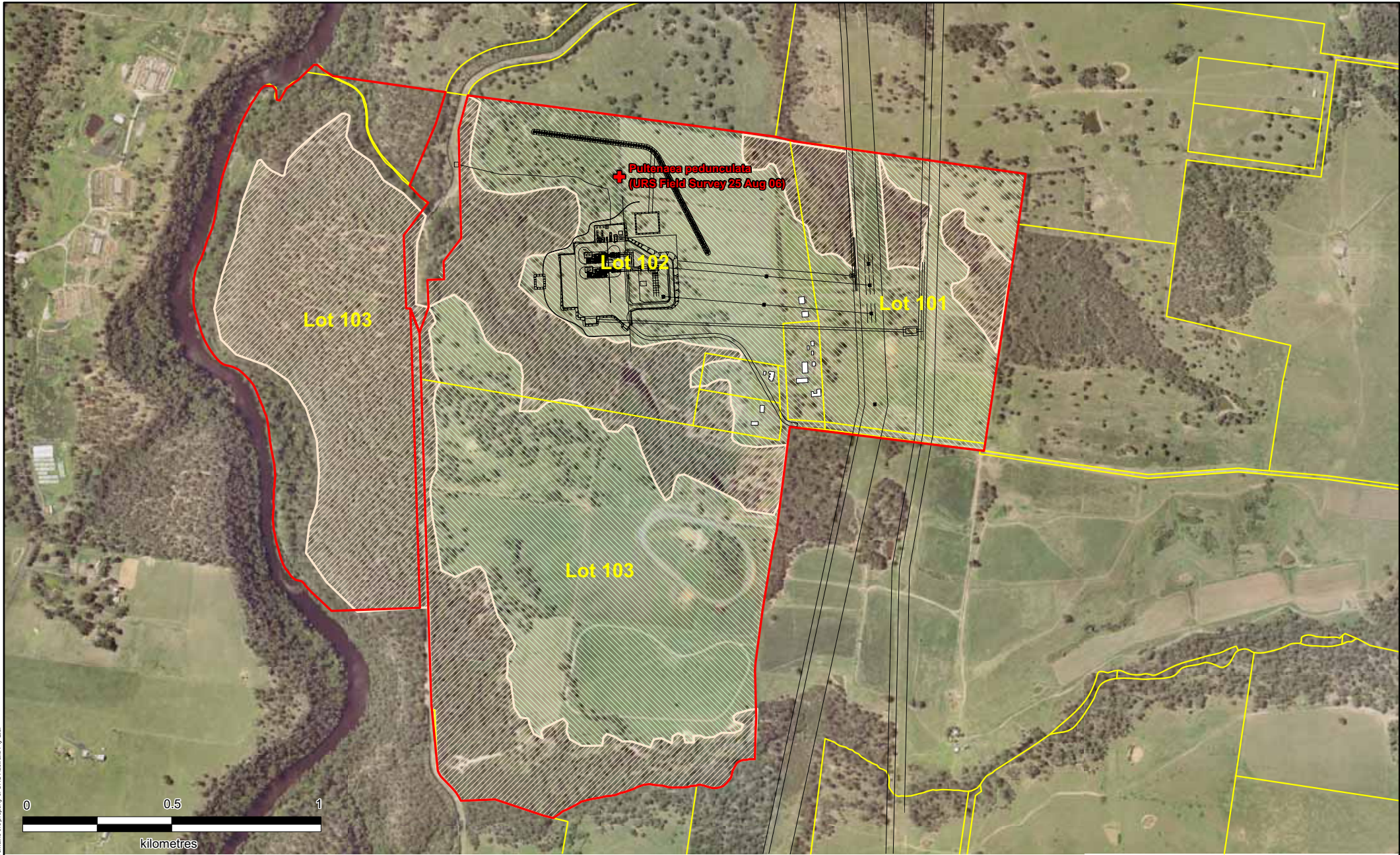
A total of 88 flora species were identified on site during surveys. Twenty of these species were exotic to the area (approximately 23%) including the noxious weeds Lantana and Blackberry. One threatened species, *Pultenaea pedunculata*, was recorded on site. *Pultenaea pedunculata* is listed as an endangered species under Schedule 1 of the *TSC Act*.

The vegetation communities identified in the field assessment were:

- *Exotic Grassland*: Open grassland dominated by exotic and pasture grasses within the central portion of Lot 102. The central and eastern portions of Lot 102 were found to be largely cleared for grazing paddocks and contain occasional paddock trees. Natural regeneration in areas of pastureland is evident in areas not traversed by vehicles and horses and is occurring predominantly along the fence lines within Lot 102. Regeneration along these fence lines is restricted to less than 2 m width. Exotic pasture grasses dominate the open paddock areas but some native species are also evident.
- *Shale Sandstone Transition Forest*: The EEC SSTF is listed as endangered under the *EPBC Act* and the *TSC Act*. The vegetation was found to be densely vegetated and of good quality. There are likely to be Threatened Species within the SSTF remnants particularly within the western portion of Lot 103. The majority of the area currently being considered for the Leaf's Gully Power Project footprint has been previously cleared for agricultural purposes and consists predominantly of open exotic grassland. Two farm dams are present within the footprint of the Leaf's Gully Power Project.

The remnant vegetation surrounding the intersection of the internal access road and Appin Road contains isolated paddock trees with a limited and disturbed understorey and numerous weed species including noxious weeds.

The vegetation communities in the study area are mapped in **Figure 13-1**.



Legend



Site Boundary



Shale Sandstone Transitional
Forest Endangered Ecological
Community



Cleared Open Grassland
Dominated by Exotic Pasture Species

Client

AGL

Project

AGL Appin Flora and
Fauna Assessment

Title

Vegetation Communities

URS

Drawn: AJW Approved: FINAL Date: 03/11/2008
Job No: 43177401 File No: 43177401-088.wor

Figure: 13-1

Datum: GDA94 Projection: MGA Zone 56

***Pultenaea pedunculata* – Matted Pea Bush**

Pultenaea pedunculata was recorded as a single specimen along an existing fence line to the north of the proposed power plant footprint. Its location in relation to the development is provided in **Figure 13-1**. Based on the results of the targeted survey, the location record provided by DECC appears either to be incorrectly located on the map provided or the species is no longer in this location. The *Pultenaea pedunculata* recorded on site was adjacent to scrubbed (ploughed) areas and appears to have avoided this disturbance by less than 0.5 m (refer to **Plate 13-1**).



Plate 13-1 Location of *Pultenaea pedunculata* adjacent to scrubbed areas within the northern portion of Lot 102

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Fauna

The fauna literature review identified the following issues:

- Potential presence of approximately 42 Threatened species as listed under the *TSC Act 1995* and / or the *EPBC Act 1999* which have been previously recorded within the locality of the Development Site. Of these species, 35 are classified as being Vulnerable and seven as Endangered under these Acts.
- The vegetated tributaries within the Development Site are considered important faunal movement corridors from the cleared agricultural areas to the Nepean River.

Protection of Koala habitat is enforced by the State Environmental Planning Policy 44 (SEPP 44). Koalas are listed as a Vulnerable species under the *TSC Act* and have been recorded to occur within approximately 5 km of the Site. A healthy habitat for Koalas occurs in the Wedderburn and Dharawal State Conservation Area, which are located on the western side of Appin Road, approximately 7 km from the Site.

The February 2006 targeted fauna surveys recorded two species of reptiles, 38 species of birds and 21 species of native mammals. The majority of these species are generally common. However, six of the native fauna species recorded, all of which are bat species, are listed as Threatened under the *TSC Act* and / or the *EPBC Act*. In addition, the following were identified:

- several *Pteropus poliocephalus* (Grey Headed Flying Fox), listed as Vulnerable under the *TSC Act* and the *EPBC Act*, were observed flying over the Site during the spotlighting surveys;
- five of the 12 microchiropteran bat species, the *Mormopterus norfolkensis* (Eastern Freetail Bat), *Chalinolobus dwyeri* (Large-eared Pied Bat), *Miniopterus schreibersii* (Large Bent-Wing Bat), *Myotis adversus* (Fishing Bat) and the *Scoteanax rueppellii* (Greater Broad-nosed Bat), recorded during the initial survey are listed as Threatened under the *TSC Act* and/or the *EPBC Act*;
- the remaining 15 native mammals are not listed under the *TSC Act* and/or the *EPBC Act*;
- no frog species listed under the *TSC Act* or *EPBC Act* were recorded;

The February 2006 surveys identified a number of paddock trees within Lot 102 and within the footprint of the proposed power station, such as the *Eucalyptus punctata* (Grey Gum), which are listed Koala Habitat Feed Trees under Schedule 2 of SEPP 44. Five of these paddock trees contained scratch marks. However, no scats (fresh or old) were observed under these trees during the February 2006 surveys. Further, the *Eucalyptus tereticornis* (Forest Red Gum) was also recorded within Lot 101 during the preliminary Flora and Fauna surveys which were undertaken by URS ecology personnel in June and July 2005. Forest Red Gum is also deemed a Koala Habitat Feed Tree under SEPP 44. However no scratch marks or scats were recorded in the vicinity of these Forest Red Gum.. A further site inspection in April 2007 found some scratches that could be from Koalas along Mallatys Creek, although no faecal pellets were located. It was noted that Koala signs (scratches, pellets, sightings) in the local area, even in areas of known activity, are known to be difficult to find.

Habitat Descriptions

The following provides habitat descriptions for each of the Lots surveyed for the Leaf's Gully Power Project.

Lot 101

The majority of Lot 101 is cleared for grazing purposes and is vegetated with exotic pasture grasses and the occasional paddock tree. A tributary to the Nepean Creek runs through the northern portion of Lot 101. This tributary is lined with both intact and naturally regenerating remnants of the SSTF EEC. This tributary provides potential habitat to a wide variety of native fauna species, especially to reptiles and amphibians.

Forest Red Gum, which is a Koala Habitat Feed Tree under SEPP 44, also occurs abundantly within and surrounding Lot 101.

Lot 102

A large portion of Lot 102 has been cleared for grazing purposes and is vegetated with exotic pasture grasses and the occasional paddock tree. However, a large remnant of the EEC SSTF is situated within the eastern portion of this Lot.

Although no threatened flora species were recorded during the February 2006 surveys, SSTF is known to provide habitat for a number of plant species recognised as being of national, state and regional conservation significance. A number of significant plant species, including *Bothriochloa macra* (Red-leg Grass), *Entolasia stricta* (Wiry Panic), *Leucopogon juniperinus* (Prickly Beard-heath), *Mentha satureioides* (Creeping Mint), *Polymeria calycina* and *Sporobolus creber* (Western Rat's Tail Grass), were recorded within remnants of SSTF at the Development Site. The Grey Gum, which is a Koala Habitat Feed Tree under SEPP 44, also occurs abundantly within and surrounding Lot 102.

The relatively dense understorey within remnants of SSTF across the property was observed to support a large range of bird species. Further, a number of large hollows, which may support large forest owls or a number of arboreal fauna species, were observed within the SSTF remnant located within the western portion of Lot 102.

The cleared areas of the property also support native grasses and given their close proximity to large stands of native vegetation these areas would provide optimal feeding habitat for native mammals such as wombats and macropods. The relatively dense and undisturbed vegetation adjacent to cleared areas would also provide good protection for mammals from potential predators in the area, such as foxes and dogs.

Lot 102 contains several farm dams, which were observed to provide habitat for a number of water birds such as the *Chenonetta jubata* (Australian Wood Duck), *Anas castanea* (Chestnut Teal) and the *Aythya australis* (Hardhead). The dams within Lot 102 are unlikely to provide optimal habitat for frog species due to the absence of macrophytes and other habitat supporting areas such as shrubs, herbs, rubble and various sized rocks. The majority of the farm dams located within Lot 102 are located within the footprint of the proposed Leaf's Gully Power Project.

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Leafs Gully watercourse, a tributary that drains to Upper Canal and the Nepean River, supports a range of habitats for reptile and amphibian species such as rocky sandstone, and unshaded areas of shallow still water with nearby shrubby areas. This watercourse is also lined by a representative assemblage of the EEC SSTF. This vegetation extends from beyond the western perimeter to the eastern perimeter of the property, and therefore acts as a movement corridor for mobile fauna across the property, hence holding significant ecological value to potentially present threatened fauna species.

All vegetated tributaries present at and within the vicinity of the site are considered important faunal movement corridors from the cleared agricultural areas to the Nepean River and may also act as important riparian corridors to link the Nepean and Georges River Catchments.

Lot 103

Lot 103 is dominated by SSTF and is not subject to any development activities related to the proposal.

Intersection of access road / Appin Road

The mature trees in this area were surveyed for hollows and Koala scratching and scats. None were recorded in this area. Common and widespread bird species were also recorded at the intersection. Carrion birds were also observed along Appin Road to Campbelltown feeding on domestic animals and possums hit by vehicles.

Habitat Assessment

Habitat features considered in assigning the quality of habitat on site were:

- native diversity in ground flora;
- structural and floristic diversity of vegetation layers, particularly presence or absence of midstorey vegetation in areas of remnant vegetation (shrubs and regenerating eucalypts) and presence of native tussock grasses;
- presence and quantity of litter layer and fallen dead timber;
- level of shelter, breeding, roosting and nesting resources available;
- presence of stem hollows and quantity of mature hollow bearing trees;
- exfoliated bark, feed trees and shrubs;
- fauna movement corridors;
- position in the landform, connectivity or value as a habitat corridor;
- presence of rocky outcrops or scattered partially buried rocks; and
- presence, size and ecological integrity of remnant communities.

In particular, an assessment was conducted of the habitat characteristics of the study area in terms of the habitat requirements of Koalas and forest dwelling bats known to occur in the plant footprint.

Likelihood of Threatened Species of Fauna

The disturbed nature of the Development Site indicates that the likelihood of threatened fauna species occurring at the proposed Leafs Gully Power Project site would be low, since many threatened fauna species prefer undisturbed habitats.

The likelihood of threatened fauna species occurring is highest in the SSTF of Lots 102 & 103, due to the quality of the habitat and the fact that it represents a faunal movement corridor from the cleared agricultural areas to the Nepean River.

13.4 Assessment of Potential Impacts

13.4.1 *Pultenaea pedunculata*

Direct Impacts

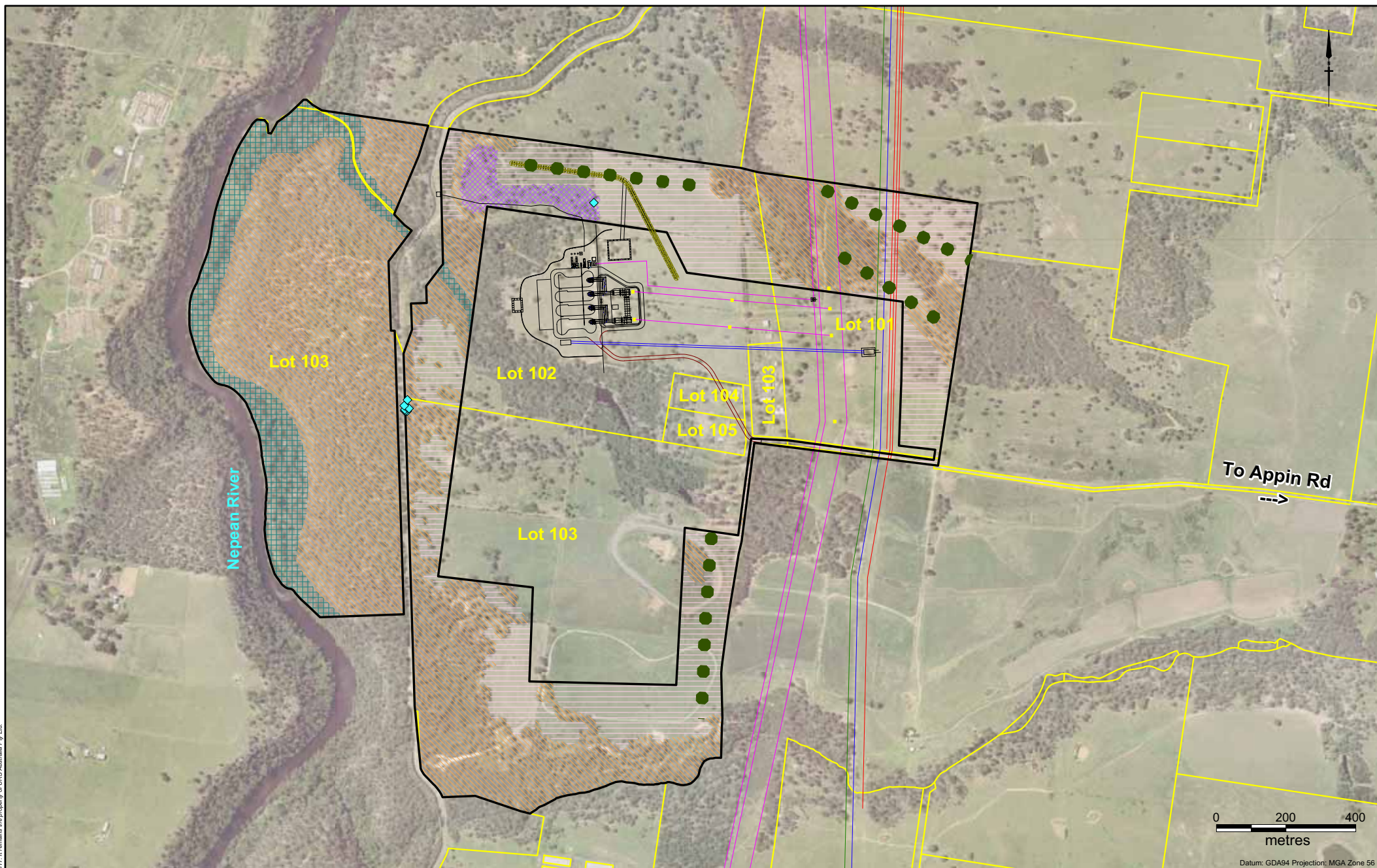
Pultenaea pedunculata would not be directly impacted by the proposal. The location of the specimen would be fenced in order to reduce the likelihood of accidental impact during construction and operation. The proposed fencing surrounding the SSTF will be extended to include the open (under-scrubbed) woodland to the north of the main power station footprint (see **Figure 13-2**).

Secondary Impacts

Precautionary management measures detailed in **Section 13.5.2** are recommended for the area indicated in **Figure 13-2**, an area of open woodland extending to the western boundary of Lot 102.

A Seven Part assessment for this species concluded that there would be no significant impact on this species.

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Legend

- | | | | | | | | |
|--|---|--|--|--|------------------------------------|--|------------|
| | Potential Conservation Area | | Pultanaea Recovery Area | | River Flat Eucalypt Forest (RFEF)* | | Grassland |
| | Shale-Sandstone Transition Forest (SSTF)* | | Previous URS records of P. Pedunculata | | Habitat Corridor Plantings | | Embankment |
- * = EEC under TSC Act

Client	AGL POWER GENERATION (NSW)			Project	AGL LEAFS GULLY POWER PROJECT EA			Title	ENDANGERED VEGETATION AND PROPOSED MANAGEMENT ACTIONS		
					Drawn: AJW Approved: JP Date: 03/11/2008				Figure: 13-2		
Job No: 43177607				File No: 43177607.008.wor				Datum: GDA94 Projection; MGA Zone 56			

13.4.2 Shale Sandstone Transition Forest (SSTF)

Direct Impacts

As part of the preliminary findings of this report it was recommended to AGL that the footprint of the power plant be repositioned in order not to impinge on the boundaries of the SSTF. A footprint design has been developed (as presented in **Figure 4-2**) to minimise the impacts on this community and is now located well beyond the SSTF community boundary. Further, the alignment of the internal access road (from the end of the existing road to the proposed plant within Lots 102, 104 and 105) has taken account of the SSTF on the southern edge of Lot 102 and would be positioned to avoid fragmentation of the remnant.

The proposed footprint would remove isolated paddock trees and the vegetation associated with fence lines, but importantly would not require clearing of SSTF. As such no direct impact to the SSTF is predicted.

Secondary Impacts

Secondary impacts on the SSTF are threats posed by the increased probability of weed invasion with disturbance adjacent to the intact EEC. It is recommended that the SSTF community adjacent to the site be fenced 2-3 m on the disturbed side of the current vegetation boundary. Weed control can then be concentrated on site and in the small remaining buffer.

Erosion and sediment control would be implemented as described in **Chapter 9 Soils, Geology and Groundwater**. This would enable the control of water and debris flows, acting as a weed vector into the intact SSTF EEC.

Plant and equipment have been set back 40 m from the SSTF vegetation boundary reducing the risk of greater fire frequency which could affect the species composition of the community. The bushfire risk is further discussed in **Chapter 19 Bush Fire Assessment**.

The Seven Part assessment conducted for this EEC concluded that there would be no significant impact on this community.

13.4.3 Bats

Five of the twelve microchiropteran bat species (Eastern Freetail Bat, Large-eared Pied Bat, Large Bent-Wing Bat, Fishing Bat and the Greater Broad-nosed Bat) recorded during the February 2006 surveys are listed as Threatened under the *TSC Act* and/or the *EPBC Act*.

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Although the Fishing Bat was recorded in the vicinity of the site, it feeds predominantly over still water including creeks, rivers, lakes and lagoons. The small dams on site would offer limited foraging opportunities in comparison to the standing and flowing water available in the Nepean River, its tributaries and the SCA Canal adjacent to site. As such, the Fishing Bat is not expected to be impacted by the proposal.

The Eastern Bent-wing Bat predominantly roosts in caves. However, it also utilises man-made structures such as drains, bridges, tunnels and mines. The study area is likely to provide foraging habitat for the Eastern Bent-wing Bat and the Large-eared Pied Bat. Diurnal roosts could also be located in natural caves or artificial structures in the surrounding area. Foraging habitat for these species may be temporarily disrupted due to the construction process. However, with the proposed habitat corridors, the long term value of the site to foraging for these species is expected to improve. As such, a Seven Part test has not been prepared for the Eastern Bent-wing Bat or Large-eared Pied Bat species.

A Seven Part assessment for the Eastern Freetail Bat and the Greater Broad-nosed Bat has been prepared and concluded that no significant impact on these species is expected as a result of the development.

13.4.4 Koalas

It is not expected that Koalas would commonly frequent the cleared areas of the property due to its high level of disturbance for agricultural uses and presence of domestic animals and other predatory animals such as foxes. Whilst two species of feed trees were identified in these paddocks (Forest Red Gum and Grey Gum) the adjacent intact remnant vegetation (SSTF) contains not only a greater number but also a greater diversity of Koala feed trees. Habitat quality in the cleared paddocks is considered to be low as Koalas are expected to utilise less disturbed areas of higher habitat value nearby. However Koalas are known to move over large distances and may use the Development Site and immediate surrounds for refuge during times of environmental stress (e.g. drought).

Some Grey Gum, which is a Koala Habitat Feed Tree under SEPP 44, that occur within and surrounding Lot 102 would be removed. Due to the scattered nature of these paddock trees, they are not expected to be frequently used by Koalas in the context of the quality of the endemic vegetation in the study area.

In addition to the flora and fauna assessment by URS, an evaluation of the current and potential future value of the site for Koalas was conducted by Eco Logical (refer to **Appendix L**). The assessment stated that the Campbelltown Koala population is estimated to consist of 90 to 200 adult Koalas, primarily occurring along the eastern fringes of Campbelltown, including the suburbs of Minto Heights, Kentlyn, Leumeah, St Helens Park, and Wedderburn.

Koala habitat on the site exists primarily within vegetation along Mallaty Creek, Leafs Creek, Nepean River Gorge, and the 'Northeast' Creek. The mapping of the study site as preferred Koala habitat (Campbelltown City Council 2005), the presence of suitable food trees, and the proximity to known Koala areas suggests that the site could be utilised by a resident population of Koalas. In addition to use by a resident population of Koalas, there is the potential for the study site to facilitate the movement of Koalas.

There are two main river systems in proximity to the Development Site: the Georges River and the Nepean River. These two river systems come into relatively close proximity in the region of the study site. Connectivity of the Campbelltown Koala population to other known populations to the south, and to the west in the Blue Mountains is considered to be crucial to the long term survival of the population, due to the relatively small size of the Campbelltown population (~90-200 Koalas) and ongoing pressure from urban areas. The study site is thus considered to be situated such that it could enhance connectivity for the Koala in this respect.

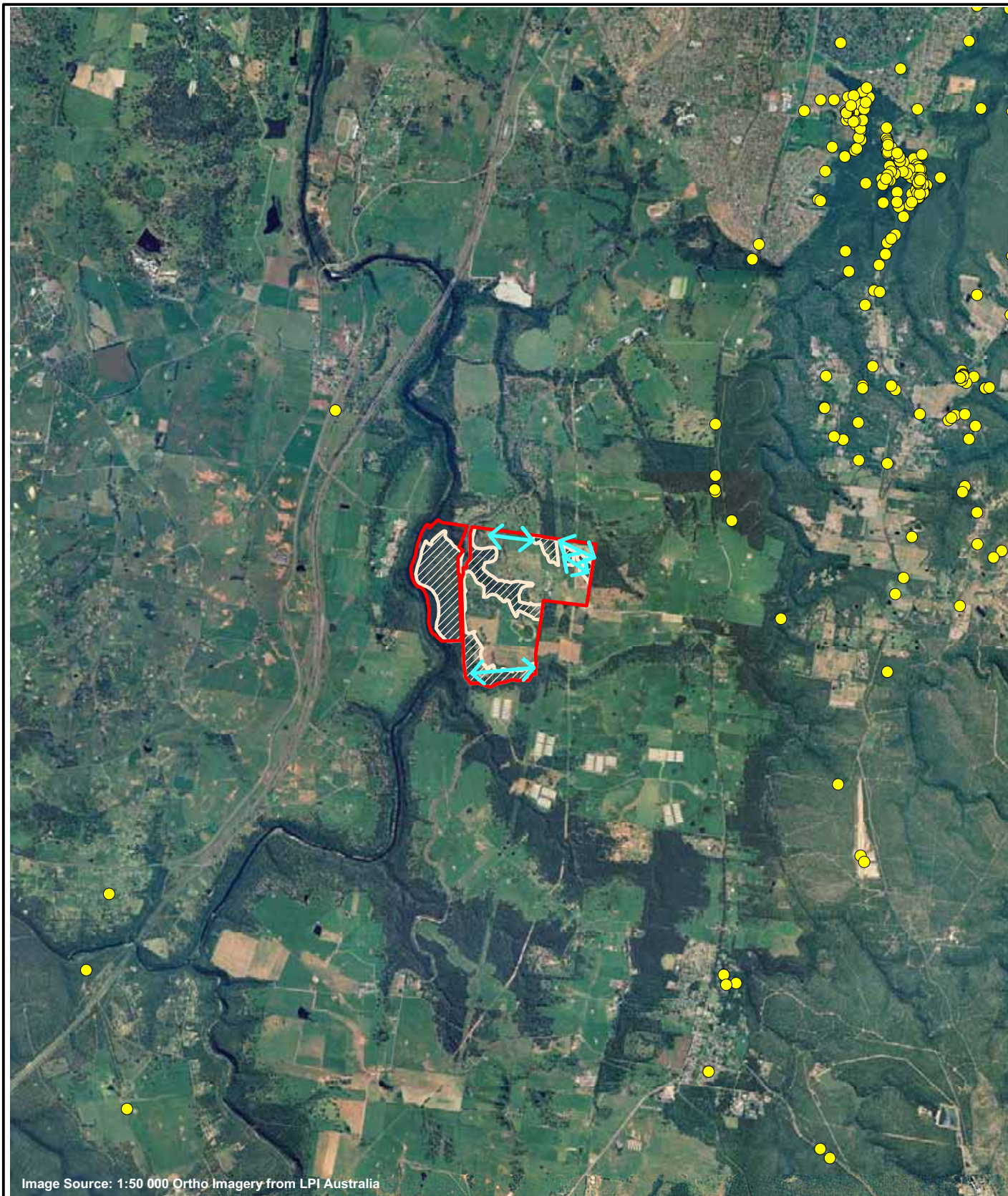
Overall, the Koala assessment considered that the proposed Leafs Gully Power Project was considered to be beneficial to Koalas. Recommendations on potential enhancement of benefits to Koalas included:

- include Forest Red Gum in the proposed list of species for planting in landscape and revegetation corridors;
- consider modifications to the proposed planting areas to create a linkage of consistent width;
 - if possible, seek to increase the area of vegetation along Mallaty Creek to the south of the site to provide the best current connectivity to the Georges River;
 - modifying the area to be planted in the north of the site to provide a linkage with a more consistent width. This could be achieved without increasing the total area of planting
- seek to integrate plantings with any other ecological linkages proposed in the area; and
- seek to minimise loss of mature trees adjacent to Appin Road, and / or consider replacement plantings.

In order to improve habitat linkages and reduce predator exposure periods for Koalas that may utilise the remnant vegetation stands on the Development Site, suggested habitat corridors have been illustrated in **Figure 13-2**. These habitat corridors should be as wide as possible to reduce potential weed and predator invasions. Such habitat corridors should mimic the native species found on site combined with potential Koala feed trees (SEPP 44). As a result of the proposed plantings, potential Koala habitat on site would be increased and the exposure to predators decreased in the longer term.

Figure 13-3 illustrates the Koala sightings in the region with respect to the conservation area and habitat corridors.

As core Koala habitat was not identified on site, a Koala Management Plan is not required under SEPP 44. However, plantings will be undertaken following advice from the University of Western Sydney's Koala Project and the Campbelltown Koala Management Plan (when released). A Seven Part assessment for Koala is contained in **Appendix L** and concludes that the proposal would not have a significant impact on this species.



Legend



Site Boundary



High Habitat Potential



New Plantings
(Habitat Corridors)



Koala Sighting Records (Source: Koala Review
Report prepared by Eco Logical Australia)

Client

**AGL POWER
GENERATION (NSW)**

Project

**AGL LEAFS GULLY
POWER PROJECT EA**

Title

**LOCATION OF KOALA
SIGHTINGS IN RELATION TO
LEAFS GULLY STUDY AREA**

URS

Drawn: AJW

Approved: FINAL

Date: 15-05-06

Job No: **43177401**

File No: 43177401-089.wor

Figure: 13-3

13.4.5 Associated Activities

Internal Access Road

The internal access road has been aligned to avoid SSTF and is located in areas of agricultural pasture, cleared of native vegetation.

Upgrade of Intersection of the Access Road and Appin Road

As discussed in **Chapter 11 Traffic and Transport**, an upgrade of the intersection of the access road and Appin Road is required by way of road widening within the current road reserve along Appin Road. The extent of the proposed widening is approximately 400 m long and predominantly on the western edge of the current road alignment (refer to **Figure 11-3**). It is understood that the road widening designs may utilise the existing road formation and therefore only require a widening in the order of 1.5 m for the road shoulders.

If the design of the road can utilise the existing road formation, it is understood that the number of trees that may be removed would be reduced. As detailed designs are not yet available, it is recommended that when the area is surveyed for road design, individual trees within the road corridor are also plotted to better define the extent of necessary tree removal. This impact assessment has therefore adopted a worse case scenario.

The proposed carriageway widening and local road widening (refer to **Figure 11-3**) will require the removal of 44 trees under a worst case scenario. **Table 13-1** below lists the number per tree species to be removed and the presence of hollows.

Table 13-1 Indicative trees to be impacted on Appin Road

Species	No. to be removed	Trunk Hollow	Branch Hollows
<i>Angophora floribunda</i> (Rough-barked Apple)	8	✓	✓
<i>Corymbia</i> sp	3		✓
<i>E. crebra</i> (Narrow-leaved Ironbark)	7		✓
<i>E. eugeniodes</i> (Thin Leaved Stringybark)	5		
<i>E. pilularis</i> (Blackbutt)	6		✓
<i>E. punctata</i> (Grey Gum)	15	✓	✓
<i>E. fibrosa</i> (Broad-leaved Ironbark)	-		
Total	44		

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As would be expected with the level of disturbance within the road corridor the majority (61 %) of the trees impacted by the road widening are mature trees with either branch or trunk hollows with Grey Gum being most impacted particularly in the north west section of road corridor.

No Koala scratches were recorded during the survey of this area. This does not discount that Koalas traversing the area may use or feed within the road corridor. The remnant to the southwest of the intersection and road corridor is a more likely habitat corridor as it links to with native vegetation corridors to the far east of the site. The removal of the trees within road corridor by the proposed road widening (>3 m) area is unlikely to increase the risk of Koala / vehicle collisions or increase predator exposure for Koalas traversing across Appin Road.

The *Ninox connivens* (Barking Owl), *Tyto novaehollandiae* (Masked Owl) and *Tyto tenebricosa* (Sooty Owl) are all known to occur in the area. The hollows along the road corridor were inspected for white wash and pellets; none were recorded. It would be unusual for these night predators to prefer this habitat due to the interference of traffic (headlights) with foraging, low likelihood of abundance of prey such as *Pseudocheirus peregrinus* (Common Ringtail Possum) and *Trichosurus vulpecula* (Common Brushtail Possum), and the large home ranges of these species.

It is likely that bat species could potentially utilise the hollows within the road corridor during foraging or for breeding including those threatened bats recorded on site. However it is unlikely that these trees would significantly impact on the habitat resources available to bats in the area. The trees' ecological significance of the trees as suitable habitat is also degraded given their proximity to Appin Road and alternative and more productive remnant habitats in the same vegetation / habitat type available south of the intersection on adjacent land. Further the impact of the removal of these trees would to a lesser extent be mitigated by the mass plantings proposed on site.

Water Pipeline from Upper Canal

A proposed underground water pipeline is to be installed connecting the power plant to the Sydney Catchment Authority (SCA) Upper Canal. The installation would be designed so as to not require removal of any trees. Depending upon the re-generation within the under-scrubbed area to be managed for *Pultenaea pedunculata* regeneration (See **Figure 13-2**) the position of the pipeline may need to be relocated to align with the Visual Screening Mound further to the east and north of the *Pultenaea pedunculata* habitat.

It is understood that there are options in developing a detailed design for this pipeline including its location, above or below ground alternatives and diameter.

Transmission and gas pipeline routes

The transmission lines and gas pipelines are in cleared areas of the site. In Lot 101 where the easement passes through a patch of remnant vegetation, a clear line of sight under the transmission lines is possible and it is expected that minimal or no clearing of native vegetation is considered to be necessary.

Visual Screening / Earth mound

The construction area and proposed visual screening / earth mound on the northern boundary of the site are proposed in areas cleared of native vegetation, however similar mitigation measures for erosion, sedimentation and weed control would need to be implemented for these associated works.

Artificial Lighting

Night-time security or operational lighting can potentially discourage habitat use where diffuse light penetrates into adjoining SSTF. Nocturnal foraging regimes could be disrupted and may be an advantage to predators such as cats, dogs and foxes as they are not strictly nocturnal foragers.

Koalas would likely be discouraged from using the existing surrounding vegetation where night security lighting is used. Nocturnal species' (such as gliders and possums) eyesight is hindered by bright lights, and where they are affected by this, they become more susceptible to predation.

Large floodlights would generally not be used, although it is likely that some lights may be required for emergency lighting to allow unscheduled maintenance.

Security lighting would be designed to minimise light spill outside the property boundary.

13.5 Biodiversity Maintenance and Improvement

This section identifies measures that have been employed in order to avoid, mitigate and offset impacts on biodiversity values associated with the Project. This discussion has been structured according to the principles stated in the DEC (2005) guidelines for Part 3A biodiversity assessments.

13.5.1 Impact Avoidance

Impacts on biodiversity have been avoided where possible, through the following means:

- locating the facility as much as possible within cleared areas, to avoid intact native vegetation; construction at the Site will require the removal of a small number of isolated paddock trees and the vegetation associated with fence lines, but importantly would not require clearing of intact SSTF; and
- the proposed access road will utilise the existing road alignment from Appin Road, taking into account the SSTF on the southern edge of Lot 102 and positioned to avoid fragmentation of the vegetation remnant.

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13.5.2 Impact Mitigation

Environmental Management Plan

A Construction Environmental Management Plan (CEMP) would be developed for the Site and would include measures for the minimisation or avoidance of impacts on native flora and fauna. An overview of the impact mitigation and environmental management measures recommended for flora and fauna is provided below. The CEMP would contain further details regarding these measures, including performance indicators, timing and responsibilities.

Pultenaea Recovery Area

The *Pultenaea* Recovery Area, as displayed in **Figure 13-2**, would be managed in accordance with the items listed below in order to allow the future survival and natural germination of *Pultenaea pedunculata* seed in the soil:

- Cessation and exclusion of grazing.
- Control of invasive exotic grasses, particularly *Pennisetum clandestinum* (Kikuyu); and *Paspalum dilatatum* (Paspalum). Thinning of the native shrub *Kunzea ambigua* (Tick Bush) may be required at a later stage to prevent shading of *Pultenaea pedunculata* seedlings (if present).
- Monitoring of all areas of retained vegetation for *Pultenaea pedunculata* seedlings.
- Prior to the installation of the water pipeline to the Upper Canal, further targeted surveys for *Pultenaea pedunculata* and, if necessary, placement of the pipeline adjacent to the visual screening mound is recommended to avoid potential habitat disturbance.
- Conduct a low intensity burn within the area (excluding the location of the *Pultenaea pedunculata* record) to facilitate germination from the seed bank.

The above management measures are aimed at improving the likelihood of regeneration of *Pultenaea pedunculata*. The previous under-scrubbing, clearing, grazing and vehicle use in the area may limit the success of these regeneration management measures.

Tree-fauna Management

Construction at the Site will require the removal of potential habitat trees (>60 cms diameter or any trees with hollows). Due care during clearing will be exercised to reduce direct impacts on any tree dwelling fauna species which may be utilising the area, particularly bats that may be roosting in the limited remnant vegetation along the fence lines or in isolated paddock trees.

A detailed pre-clearance survey by qualified ecologists will be required during the pre-construction phase. This would involve:

- diurnal searches for birds, nests and roosts;
- active searches for reptiles, including checking of woody debris within the development footprint;
- active searches for microbats, including checking under exfoliating bark; and
- nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings of threatened species are observed within, or close to, the development footprint then construction will be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC will be consulted to determine if relocating the species is acceptable.

The CEMP will detail procedures for fauna management during construction including the following:

- habitat trees (>60 cm diameter or hollow-bearing) will be identified and clearly marked;
- trees will be monitored for fauna before and during clearing operations;
- habitat trees or trees with resident fauna will be avoided as far as is practicable; and
- where removal of habitat or roost trees is unavoidable:
 - hollow-bearing trunks and branches will be carefully sawn and placed intact in adjacent areas of native vegetation; and
 - replacement habitat, such as nest boxes, will be provided.

Groundcover Management

Groundcover vegetation, leaf litter and other organic matter (especially large woody debris) and soils provide important habitat for native fauna, including threatened species. A groundcover clearance protocol would be implemented prior to construction and would involve the following steps:

- remove large woody debris using excavator grabs or manual handling if practicable (raking);
- place intact large woody debris within adjacent areas of intact vegetation;
- scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- reuse leaf litter and topsoil in rehabilitation works.

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Site Management

The following mitigation measures will be implemented where relevant in order to minimise potential impacts on native fauna associated with the operational phase:

- set maximum speed limits during construction and operation traffic on site to reduce risk of fauna road fatalities;
- limit vehicular and personnel entry into retained vegetation (including conservation area) during construction and operation through temporary exclusion fencing during construction, locating access roads and paths to avoid native vegetation and use of signage where necessary; and
- employing down-lights and motion sensor lighting in order to reduce light spill and the associated secondary impact on nocturnal fauna species potentially utilising the adjoining vegetation.

Weed and Pest Management

A weed and pest management plan will be completed as part of the pre-construction activities for the project. Active control of feral animals, such as the Red Fox and European Rabbit, and noxious weeds, such as Blackberry and Lantana, will be required during and after construction.

To limit the spread of weeds into remnant vegetation during construction, intact areas will be fenced. This will be done prior to construction, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill will not be placed in areas of remnant vegetation but instead in adjacent grazed areas.

Soil Erosion / Runoff

Standard industry management measures for erosion and sediment control on urban developments will be implemented according to the 'Blue Book' (Landcom 2004). This would involve installation of silt fencing around the perimeter of disturbed areas, areas of exposed soil and around stockpiled soils and organic matter. Placement of hay bales along watercourses may also be required. Particular areas of concern are along the boundaries of the SSTF which form the 'break of slope' into the Nepean River tributaries. Erosion controls around native vegetation 'no-go' areas will be installed by a qualified bush regeneration or landscape contractor, as part of the overall management of the revegetation and conservation areas.

Complementary Plantings and Rehabilitation

Whilst offsets against the limited clearing are recommended, there is also an opportunity for AGL to link existing fragmented SSTF with other remnants both on and off site in a manner that complements visual screening. Plant species selected for revegetation will replicate SSTF composition and SEPP 44 feed trees with plantings mirroring to the greatest extent possible the habitat corridors identified in **Figure 13-2**.

Due to the likelihood that such an extension of the SSTF would attract Koala foraging and feeding, specific management measures will be developed with reference to the University of Western Sydney's Koala Research Project and, when released by Campbelltown City Council, the Campbelltown Koala Management Plan.

Local provenance seed, propagules, or saplings where possible will be used for plantings. Similarly, utilising best practice bush regeneration techniques is recommended for consideration, as these techniques are likely to provide the greatest benefit to a range of native flora and fauna species.

13.5.3 Biodiversity Offsets

A key principle presented in the DEC (2005) guidelines is that proposals should 'maintain or improve' biodiversity values (i.e. there is no net impact on threatened species or native vegetation). Where impacts cannot be avoided or mitigated then it is necessary to identify a suitable biodiversity 'offset' in order to maintain or improve biodiversity values.

Vegetation clearing for the proposed development, and associated loss of biodiversity values, would be minimal. The measures to avoid and minimise impacts on biodiversity values within the development footprint adequately compensate for the loss of biodiversity associated with the removal of pasture grass and paddock trees. As such, a dedicated biodiversity offset to compensate for biodiversity loss associated with the development is not required for the Project. Regardless, AGL proposes to set aside and maintain a large portion of land for conservation purposes in perpetuity, referred to as a Conservation Area. For the purposes of the 'maintain or improve test', it is assumed the proposed Conservation Area is not included in the offset requirements. However, as the creation of the Pultenaea Recovery Area would involve the permanent conservation of existing (albeit modified) native vegetation, this measure is considered to represent an 'offset', as it retains vegetation that is floristically and structurally similar to that which is to be cleared.

The application of the 'maintain or improve' test to the proposal is summarised in **Table 13-2**.

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Table 13-2 Comparison of Biodiversity Impacts and Offsets

Impacts	Mitigation	Offsets
- Minimal impacts on vegetation, corridors or fauna habitat in the locality - No clearing of high conservation value vegetation (EECs or threatened plants) - Removal of native trees along fence lines through the development footprint, including some fauna habitat - Removal of exotic grassland in the proposal footprint, including some common native flora and low grade fauna habitat - Removal of paddock trees, including some hollow-bearing habitat trees	30 ha of tree planting for visual and noise screening - Retention of fallen timber (salvage of felled trees in development footprint) - Temporary exclusion fencing during construction - Presence of large tracts of native bushland adjoining the development area - Lack of connectivity of paddock trees to surrounding vegetation - Pre-clearing surveys for (and salvage of) resident native fauna - Installation of nest boxes for displaced arboreal fauna located in the development footprint	- Creation of Pultenaea Recovery Area (fencing, weed control and promoting <i>Pultenaea pedunculata</i> regeneration) - Retention of hollow-bearing trees and regenerating trees - Ongoing management and monitoring of Pultenaea Recovery Area and visual screen plantings (e.g. stock-proof fencing, retention of fallen timber, weed control, erosion control, and feral animal control)

The biodiversity offset package is proposed as a means to ensuring that the proposal maintains or improves biodiversity in the locality. The offset would protect and conserve, in perpetuity, threatened species habitats, vegetation types and landscape features of far greater conservation value than those found within the development footprint. Moreover, the conservation area package would improve biodiversity values due to the following:

- the Pultenaea Recovery Area contains vegetation that is similar to that within the development footprint (i.e. paddock trees and pasture grass, with some regeneration), but in better condition. Hence the Area is a 'like-for-like or better' trade-off;
- the Pultenaea Recovery Area is of a similar size to the development footprint;
- the Pultenaea Recovery Area contains biodiversity values (e.g. canopy trees, tree hollows, grass cover) similar to the development footprint; and
- ongoing management actions will continue to improve the condition and biodiversity values of the Area in the long-term.

On the basis of the above assessment, the conservation area package is consistent with the DEC (2005) guidelines for offsets and meets the key criterion for 'like-for-like or better' trade-offs of biodiversity values. Adoption of the proposed mitigation measures outlined in **Section 13.5.2**, along with the proposed offset described above, would more than compensate for the loss of vegetation associated with the proposal and would improve biodiversity values within the study area in the long term. Hence the current proposal 'maintain or improves' biodiversity values.

13.6 Proposed Conservation Area

The proposed Conservation Area, which spans Lots 101, 102 and 103, is approximately 172.4 ha and is shown in **Figure 13-2**. The land would be re-titled for conservation purposes either through a Voluntary Conservation Agreement (VCA), which is an existing scheme administered by DECC, or AGL would enter the land into the NSW Biobanking Scheme, which is to be released by DECC in late 2008, or some other enduring protection mechanism. A decision on which conservation mechanism is to be adopted would be made following the determination of the project and would depend on whether the Biobanking Scheme is operational and details of that scheme. The management of the Conservation Area would be funded by proceeds of the Biobanking Trust Fund if that mechanism is chosen, or from revenue from the operation of the power plant.

The Conservation Area recognises the importance of the native biodiversity of the Development Site and encompasses the areas of highest relative biodiversity value within the site. The key features of the area include:

- 119 ha of native bushland which comprises vegetation of high conservation significance (i.e. endangered ecological communities);
- conservation of habitat for *Pultenaea pedunculata* and other threatened plants that may occur within the locality;
- protection of large tracts of vegetation that provide habitat for threatened fauna, including the local population of Koalas; and
- protection of a wildlife corridor that links riparian vegetation along the Nepean River and its tributaries, as they occur within the area.

The Conservation Area, together with the *Pultenaea* Recovery Area and the revegetation areas, form an overall conservation strategy for the site.

13.6.1 Biodiversity Values

The Conservation Area contains a range of biodiversity values, including large amounts of fallen timber, rocky outcrops, dense patches of vegetation and roosting hollows. Leaf litter and fallen logs are present within the Riparian Forest and within the intact and regrowth forms of SSTF. Leaf litter and fallen logs are absent from Exotic Grassland and the canopy form of SSTF. Significant rocky outcrops and rock cover is present within the Riparian Forest and extend up the escarpment into the SSTF. Rock outcrops and overhangs are only present within intact and regrowth SSTF.

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13.6.2 Endangered Ecological Communities

The stands of Riparian Forest along the Nepean River and its tributaries match the definition of *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* ('River Flat Eucalypt Forest'), which is an EEC listed under the TSC Act. SSTF is listed as an EEC under both the TSC Act and the EPBC Act.

Subject to consent conditions determined by the Minister for Planning, AGL would agree to permanently conserve natural vegetation located within the Conservation Area, as well as the proposed Pultenaea Recovery Area and over 30 ha of tree planting (**Figure 13-2**). Land that has already been cleared for grazing, that holds low environmental value and that has not been identified for tree planting in the landscape plan will remain as it is. These initiatives for planting and conservation will contribute to the establishment of wildlife corridors between the Georges River and Nepean River.

13.6.3 Management of Conservation Area

Management of the conservation area would include, as a minimum:

- exclusion of grazing through stock-proof fencing;
- weed removal and control;
- erosion control;
- retention of fallen timber, hollow logs, leaf litter, rocks and other habitat resources;
- maintenance and monitoring of natural surface water quality and flows;
- control of feral animals, where appropriate and practical; and
- annual monitoring and reporting on biodiversity, results of management actions undertaken and general condition of the Site.

Full details of the proposed management regime would be included in a management plan that would be prepared in consultation with DECC.

13.7 Mitigation Measures

A summary of the mitigation measures is presented in **Table 13-3**.

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Table 13-3 Summary of Flora and Fauna Mitigation Measures

Mitigation measure	Implementation		
	Planning and design	Construction	Operation
Land identified for the Conservation Area would be re-titled for conservation purposes either through a Voluntary Conservation Agreement (VCA) or AGL would enter the land into the NSW Biobanking Scheme or some other enduring protection mechanism. A decision on which conservation mechanism is to be adopted would be made following the determination of the Project and would depend on whether the Biobanking Scheme is operational and details of that scheme.	✓	✓	✓
A Management Plan would be developed for Conservation Area including Management of the conservation area would include measures as discussed in the Section 8.3 of the Biodiversity Assessment (Appendix K). Full details of the proposed management regime would be included in a management plan that would be prepared in consultation with DECC.	✓	✓	✓
The management of the Conservation Area would be funded by proceeds of the Biobanking Trust Fund if that mechanism is chosen, or from revenue from the operation of the power plant.		✓	✓
A Construction Environmental Management Plan (CEMP) would be developed for the Site and would include measures for the minimisation or avoidance of impacts on native flora and fauna in accordance with the recommendations in Section 7.2 of the Biodiversity Assessment (Appendix K) and include: - ground cover management; - tree- fauna management; - site management procedures; - weed and pest management; and - soil erosion and runoff control.	✓	✓	

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Mitigation measure	Implementation		
	Planning and design	Construction	Operation
Create and manage the Pultenaea Recovery Area by: • Ceasing grazing. • Controlling invasive exotic grasses, particularly <i>Pennisetum clandestinum</i> (Kikuyu); and <i>Paspalum dilatatum</i> (Paspalum). Thinning of the native shrub <i>Kunzea ambigua</i> (Tick Bush) may be required at a later stage to prevent shading of Pultenaea pedunculata seedlings (if present). • Monitoring of regenerating species for <i>Pultenaea pedunculata</i> seedlings. • Prior to the installation of the water pipeline to the Upper Canal, further targeted surveys for <i>Pultenaea pedunculata</i> and, if necessary, placement of the pipeline adjacent to the visual screening mound is recommended to avoid potential habitat disturbance. • Conduct a low intensity burn within the area (excluding the location of the Pultenaea pedunculata record) to facilitate germination from the seed bank.	✓		✓
Qualified ecologists shall conduct a detailed pre-clearance survey prior to development of the Site in accordance with the recommendations in the Biodiversity Assessment in (Appendix K). If nests or nestlings of Threatened species are observed within, or close to, the development footprint then construction will be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC will be consulted to determine if relocating the species is acceptable.	✓		
Complementary planting and rehabilitation shall use local provenance seed, propagules, or saplings where possible for plantings and utilise best practice bush regeneration techniques.	✓	✓	✓
Prior to the installation of the water pipeline to the Upper Canal, further targeted surveys for <i>Pultenaea pedunculata</i> will be conducted and, if necessary placement of the pipeline adjacent to the visual screening mound is recommended to avoid potential habitat disturbance.	✓		
During detailed design for Appin Road widening, a survey of the area shall include plotting individual trees within the road corridor to better quantify the extent of tree removal necessary.	✓		
The landscape plan would be further developed in consultation with Council and with reference to the University of Western Sydney's Koala Research Project and when released by Campbelltown City Council, the Campbelltown Koala Management Plan.	✓	✓	

Water Management – Summary of Key Outcomes

The water requirements, wastewater production, stormwater management and flooding potential have been assessed for both construction and operation of the Leaf's Gully Power Project.

Process water is proposed to be sourced via a water main located on the Development Site and/or from the Sydney Catchment Authority's (SCA) Upper Canal and / or recycled water from a proposed Sewage Treatment Plant at Appin if the water quality is suitable and sufficient water quantities are available. Maintenance and domestic water is proposed to be sourced from rainwater tanks and supplemented by mains water if required. Fire fighting water is proposed to be sourced from waste process water or mains water. Landscaping water is proposed to be sourced from rainwater and dam water (stormwater) if available.

Process wastewater is generated at the facility by the process of blow down from evaporative air inlet coolers which cool the gas turbine air intake. The expected maximum volume of wastewater generated is 3.8 kL/hr for E class type turbines. Blow down water would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) to minimise the risk of the saline blow down water escaping into the natural groundwater system.

Clean rainwater collected from the power plant catchment area would be directed to a sedimentation pond and associated earth bund and diversion drain. The outlet of the stormwater system would be designed to maximize the dispersion of these high flows and thereby minimise their potential to cause soil erosion downstream.

Surface water from the plant footprint such as washwater from turbine washing and cleaning of other components, rainfall runoff from bunded plant areas of the plant footprint, and accumulated water within bunds would be directed through oil and grit traps designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge to the sedimentation pond. This system would also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater.

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. Wastewater volumes have been estimated and management strategies developed to maintain zero discharge from the site except for natural surface flows.

Chapter 14

Water Management

14.1 Introduction

This chapter presents an assessment of the water requirements, wastewater production and stormwater management at the site for the Leafy Gully Power Project. Both the construction and operation aspects have been considered.

This assessment includes:

- an assessment of the water quantity and quality impacts of the proposal, with particular reference to the water needs of the project;
- the proposed source(s) of water;
- the implementation of water saving measures;
- identification of the quantity and quality of wastewater and how this wastewater is to be disposed of; and
- the management of stormwater at the site.

14.2 Existing Environment

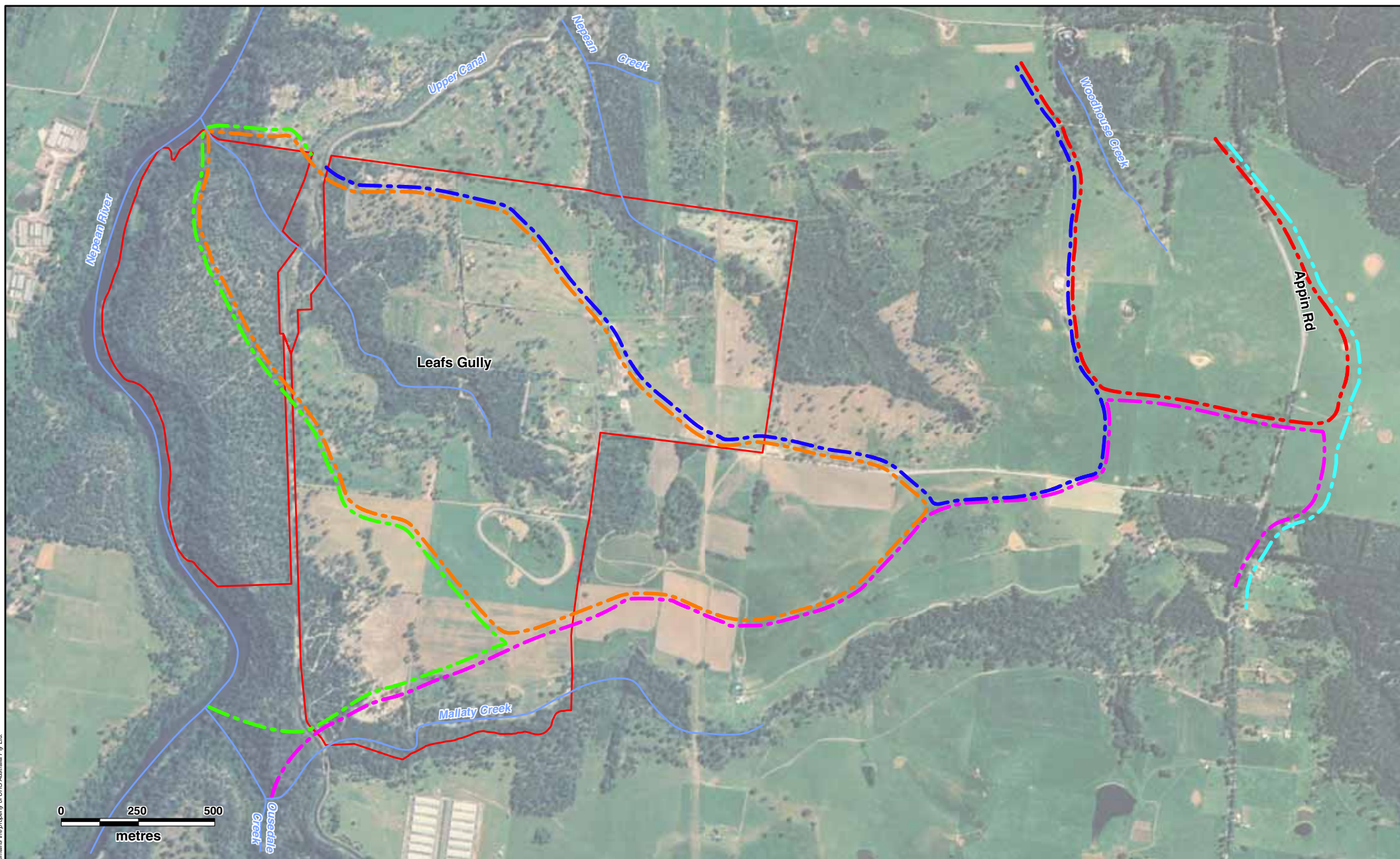
The Development Site occupies undulating land, which falls relatively gently towards the Nepean River. The site runs through Leafy Gully Farm from northwest to south east (refer **Figure 1-2**). The Nepean River forms the western most boundary of the site. The Upper Canal is located east of the Nepean River and is operated by the Sydney Catchment Authority. The Upper Canal delivers water to the Prospect Water Treatment Plant from the Nepean Dams.

The proposed Development Site currently operates as a trotting horse breeding and training enterprise. The majority of the proposed Development Site is cleared and used for horse grazing and horse yards. Main improvements include four residences used by the owner, the owner's family and an employee, farm buildings and a purpose built trotting track. The site is relatively cleared in the easternmost portion. West of the Upper Canal, to the Nepean River, the site is heavily vegetated.

The land slopes towards the west. Runoff from the site flows to the Nepean River, either directly or flowing through drainage adjacent to the Upper Canal, and/or Leafy Gully or other minor creeks.

There are approximately 10 existing dams at the Development Site, the largest at the trotting track. They are mostly located close to the top of catchments that have catchment areas of up to 12 hectares. **Figure 14-1** presents the local and regional catchments.

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Legend

- | | | | | | | | |
|--|--------------------------------------|--|-------------------------|--|---------------------------|--|---------------------------------------|
| | Property Boundary | | Leaf's Gully Catchment | | Nepean Creek Catchment | | Area Drains Directly to Georges River |
| | Area Drains Directly to Nepean River | | Mollaty Creek Catchment | | Woodhouse Creek Catchment | | |

Datum: GDA94 Projection: MGA Zone 56

Client	Project			Title	
AGL POWER GENERATION (NSW)	AGL LEAFS GULLY POWER PROJECT EA			CURRENT LOCAL AND REGIONAL CATCHMENTS	
	Drawn: AJW		Approved: FINAL	Date: 10.08.06	
	Job No: 43177401		File No: 43177401-039.wor		Figure: 14-1

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Water Management

14.3 Water Requirements

During operation of the plant, water would be required at the plant for the following uses:

- process water;
- domestic uses;
- maintenance of equipment;
- fire fighting; and
- landscaping.

The requirements for these uses are discussed in more detail below and presented in **Figures 14-2** and **14-3**.

14.3.1 Process Water Requirements

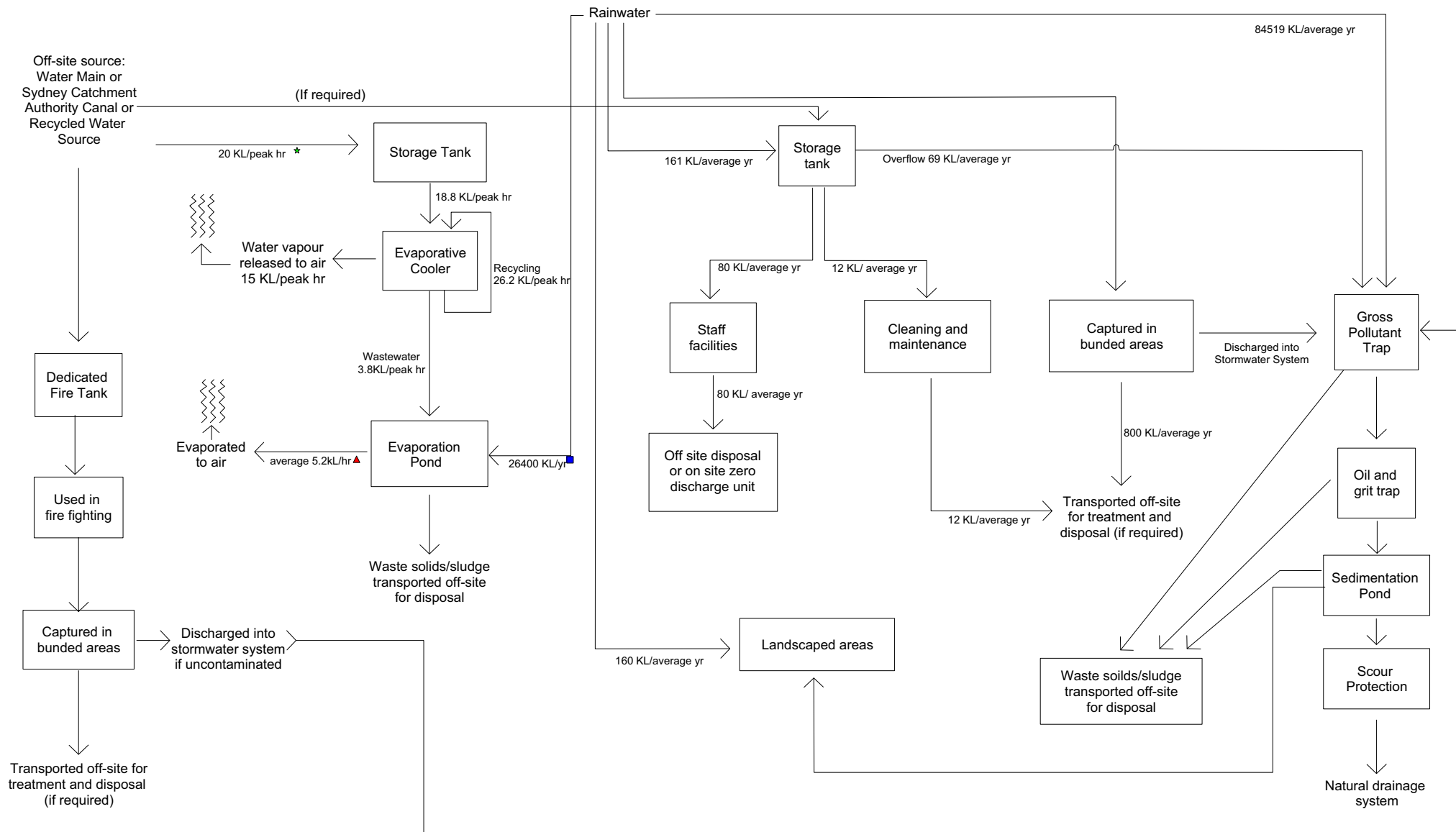
Process water is required for evaporative cooling in the operation of the proposed power plant. The maximum estimated requirements for evaporative cooling for one turbine and all turbines operating are presented in **Table 14-1** and **Figure 14-2** and are based on the likely operation of E class turbines. These are maximum quantities of water required, being at times of maximum operating capacity, and worst case ambient conditions of temperatures of 40 °C and relative humidity of 18 %. Actual water consumption would vary with ambient and operating conditions.

Table 14-1 Water Requirements for Evaporative Cooling for E class Turbines

Water Demand Source	Maximum Water Demand Requirement for Operation (kL/hr)	
	per turbine	Total
Process Evaporation	7.5	15
Blow Down	1.9	3.8
Make up from external source	9.4	18.8
Recirculated	13.1	26.2

The process water demand is based on maximising the recycling of water in the coolers and the annual average evaporation rates using historical climate data obtained near the Development Site. The evaporation rate (and thus the total water flow rate) would decrease as relative humidity in the area increases. The allowance for blow down assumes the water and air are clean / uncontaminated. This is also based on the assumption that the plant is operating during hot dry periods when water consumption would be highest. The minimum requirements of an operating plant are zero, as the evaporative cooler unit is not required to operate when the ambient temperature drops below 10° C. Under maximum operating conditions (as presented in **Table 14-1**) over 55 % of the water required by the evaporative coolers can be recycled. This minimises the need for external make-up water.

The water used for evaporative cooling would need to meet the water quality criteria presented in **Table 14-2**.

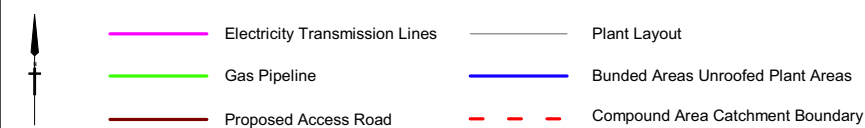
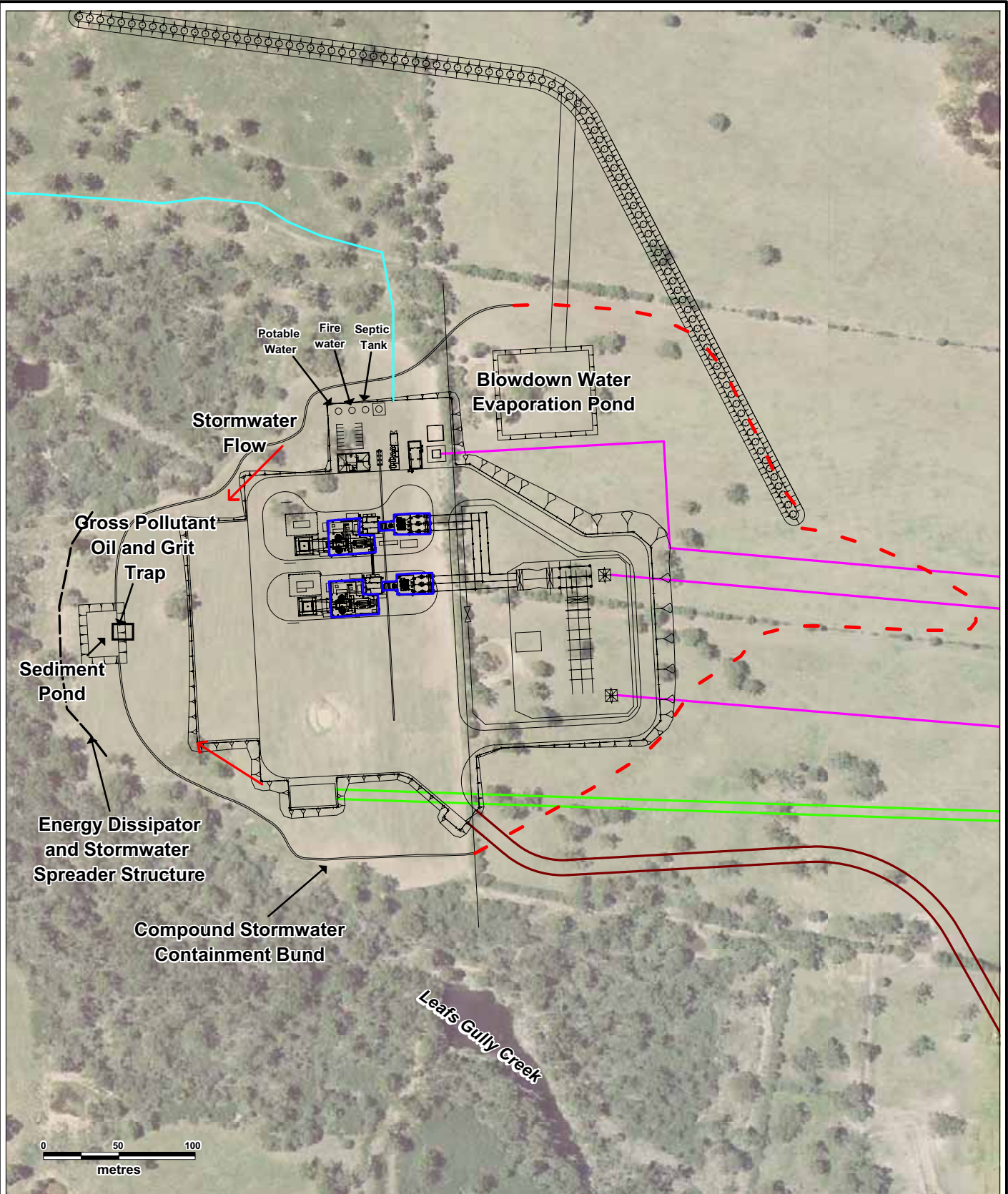


★ 2 Turbines

▲ Evaporation potential for largest evaporation pond size (average year)

■ Largest evaporation pond size (average year)

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title WATER CYCLE
	Drawn: AJW Approved: FINAL Date: 21-06-06 Job No: 43177401 File No: 43177401-018.wor	Figure: 14-2



Source: KBR, 2006

Map compiled using Mapinfo StreetPro Data. © 2004 Mapinfo Australia Pty Ltd, URS Australia and PSMA Australia Ltd. URS Australia, Mapinfo Australia or PSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title PROPOSED SURFACE WATER FLOW REGIME						
	<table> <tr> <td>Drawn: AJW</td><td>Approved: FINAL</td><td>Date: 17-07-06</td></tr> <tr> <td>Job No: 43177401</td><td colspan="2">File No: 43177401-031.wor</td></tr> </table>	Drawn: AJW	Approved: FINAL	Date: 17-07-06	Job No: 43177401	File No: 43177401-031.wor		Figure: 14-3
Drawn: AJW	Approved: FINAL	Date: 17-07-06						
Job No: 43177401	File No: 43177401-031.wor							

Water Management

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Table 14-2 Water Quality Criteria for Evaporative Cooling

Constituent	Criteria (parts per million)
Calcium Hardness (CaCO ₃)	50-150
Total Alkalinity (as CaCO ₃)	50-150
Chlorides	<50
Silica	<25
Iron	<0.2
Oil and Grease	<2.0
Total Dissolved Solids	<500
Suspended Solids	<5
pH	7.0-8.5

14.3.2 Domestic Uses

Water would be required for staff facilities, including drinking water, hand washing and toilet flushing. Water for drinking must be of potable quality. It is estimated that up to 80 kL/annum would be required. For short periods of time during operation additional staff would be based at the plant and therefore some additional domestic water may be required.

14.3.3 Maintenance of Equipment

A small volume of water would be required for maintenance and cleaning of equipment. It is estimated that up to 12 kL/annum would be required. This water would not be required to be potable. However it should not be turbid and have low levels of suspended solids.

14.3.4 Fire Fighting

Water would need to be stored at the site for fire fighting. A tank would be provided on site to store this water. The volume of the tank would meet regulatory requirements and be determined as part of the detailed design process. This water would not be required to be of potable water quality. However it would need to contain low levels of suspended solids.

14.3.5 Landscaping

To minimise the potential for soil erosion and enhance the local ecology, all disturbed areas would be planted at the end of the construction process. This would include trenches, the screening mound and the compound area. In order to minimise water usage, these areas would be planted with species that are both local to the area and whose water requirements can be supplied by rainfall alone. Some supplementary irrigation water may be required during establishment.

14.4 Possible Water Sources

A number of water sources for the various uses for the Leaf's Gully Power Project have been considered. Source options for each use are discussed below.

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14.4.1 Process Water Sources

During plant operation up to 19 kL/hr of water is required for operation to make-up for the water lost to evaporation and as blow down water. As previously noted the need for additional make-up water is minimised through maximising the recycling of process water in the coolers.

There are potentially four sources of water available for process water. These are:

- the water supply main from the Macarthur Water Treatment Plant that runs through the eastern portion of the proposed site;
- SCA Upper Supply Canal that runs through the Development Site;
- recycled water produced for re-use from a proposed Sewage Treatment Plant at Appin; and
- treated wastewater (including blow down water and water from other on-site storages)

The water main that passes through the Development Site is owned and operated by United Utilities, the owner and operator of the Macarthur Water Treatment Plant. The main carries potable water which meets the quality requirements presented in **Table 14-1** and **Table 14-4** and therefore would be suitable for use as process water. United Utilities have indicated they are willing to discuss a connection to the pipeline to serve the proposed development.

SCA has also indicated a willingness to discuss a licence for a connection to the Upper Canal. Water in the Upper Canal is untreated, however generally meets the quality requirements presented in **Table 14-1** and **Table 14-2** and is therefore suitable to supply process water. Iron levels in the water, however, sometimes exceed those recommended for evaporative cooling. If this water source is used, an evaporative cooler type would be selected so this variation is not likely to cause damage.

Alternatively, the potential for treatment to reduce iron levels could be examined during the detail design phase. While the Upper Canal is in operation it would be a reliable source of water. However, periodic maintenance of the Upper Canal would occur occasionally. Historically such maintenance periods have lasted for up to six weeks. If such maintenance periods were to occur when the plant is required to operate it would cause major disruptions to plant operation. To manage this risk a large storage tank may be required to ensure that a reliable supply is available. This would be considered in the detailed design phase.

The third potential source of water is recycled water from a proposed Sewage Treatment Plant at Appin. If the Appin Sewage Treatment Plant proposal proceeds, AGL would endeavour to use recycled water produced by Sydney Water as a primary water resource, if the water quality is suitable and sufficient water quantities are available. At this stage the quality of reuse water is not known, however it may not meet the standards required, particularly in relation to the levels of Total Dissolved Solids (salts). The most reliable method to reduce levels of Total Dissolved Solids to an acceptable level is through a membrane treatment system. Such systems are expensive to install and operate.

They also do not operate efficiently when run infrequently as this can cause problems with the membrane. As there is uncertainty about the location of the Appin Sewage Treatment Plant, the amount of water available and when it will operate, it is difficult for AGL to provide a commitment at this stage to exclusively use recycled water.

The fourth potential source of water would be to treat the blow down water and combine with other available site water (from farm dams) to achieve the make-up water requirements. Blow down water and farm dam water (in its untreated form) does not meet the quality requirements as specified in **Table 14-2**. In particular the concentration of Total Dissolved Solids (salts) would need to be substantially reduced. As noted above the most reliable method to reduce levels of Total Dissolved Solids to an acceptable level is through a membrane treatment system. Such systems are expensive to install and operate. They also do not operate efficiently when run infrequently as this can cause problems with the membrane.

Further, on-site storage water would need to be stored until it was required by the plant. In a dry year, evaporation from the dams is likely to be greater than the runoff that could be collected and the dams may not be able to supply the volume of water required when it is needed. Therefore the on-site stormwater dams may not be able to be relied upon to supply the quantity of water required.

Therefore, given the low volumes of make-up water required and the uncertainty regarding the supply of on-site water, the treatment of blow down water is not considered as a viable option for the supply of the make-up water required by the evaporative coolers.

The primary supply of process water for the evaporative coolers is from the water supply main. This water source has not yet been confirmed with the infrastructure owner. Water availability from the Upper Canal has been confirmed but will only be available to the Leaf's Gully Power Project in the event water is not available from the water main on site.

14.4.2 Domestic and Maintenance Uses

A relatively small volume of water would be required for domestic and maintenance of equipment (80 kL / annum). As there would be a number of roofs at the site including generator and transformer buildings, air compressor house, administration building and parts of the turbines themselves, some or all of these areas could be connected to rainwater tanks. Rainwater would be of suitable quality for non-potable domestic uses (showers, toilet flushing) and laundry and for the required maintenance activities. It is also likely to be able to supply the majority of the volume required and will not be affected by emissions from the plant. Where there is a shortfall, such as during low rainfall years, the rainwater system would be supplemented by the external water source supply as described in **Section 14.4.1**.

The rainwater collection system would be properly maintained in order to ensure that water entering and stored in these tanks remains of good quality. A first flush system would be installed to ensure water most likely to be contaminated by particles settled on roofs does not enter the tank.

The very small volume of potable (drinking water) water would be supplied via the water main (if a connection is made) or via tanker delivery.

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14.4.3 Fire Fighting

Fire fighting water would be stored on site. The water for the storage tank would be sourced from the external supply as described in **Section 14.4.1** or waste process water.

14.4.4 Landscaping

Water will be required for landscaping of the disturbed areas surrounding the plant on completion of the proposed construction activities. This water would be sourced from the plants stormwater collection system and from other existing stormwater dams which are currently located on the site.

14.5 Wastewater Generation and Management

Wastewater volumes have been estimated and management strategies developed that maintain zero discharge from the site except for natural surface water flows. Wastewater from the proposed facility would be generated by the following operations:

- wastewater from evaporative cooler operation (referred to as blow down water);
- domestic wastewater;
- wastewater from maintenance activities;
- fire water;
- spills; and
- stormwater collected in bunded areas.

These sources are discussed in further detail below.

14.5.1 Wastewater from Evaporative Cooler Operation

Wastewater would be generated as a by-product of evaporative cooling of the inlet air to the E class type gas turbines. This water is referred to as blow down water. Blow down water would have salt levels higher than the raw water, which may cause an adverse impact if released to the environment. As noted in **Section 14.4.1**, due to the low volume of blow down water generated by the coolers and the infrequent use of the plant, the installation of a high cost membrane treatment system (which would be required to reduce the salt levels to an acceptable level) cannot be justified at this stage. Blow down would therefore be evaporated in a pond (or ponds) at the site.

The volume of blow down water generated is dependant on the usage of the plant, the number of turbines operating, and usage of the evaporative coolers (dependant on ambient temperatures and humidity). The minimum blow down water production of an operating plant is zero, as the evaporative cooler unit is not required to operate when the ambient temperature drops below 10 °C. The maximum expected volume of blow-down water generated based on an ambient temperature of 40 °C is 1.9 kL / hr per turbine, or a total of 3.8 kL / hr.

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The requirements for evaporation pond storage are dependent on weather conditions and plant operating hours. Ambient temperature (and therefore seasons) influences the need for operation of the evaporative coolers as well as the evaporation rates of blow down water. Rainfall also influences the requirements for evaporation storage as the ponds need to accommodate not only the wastewater produced, but rain falling into them.

Operation during winter is likely to occur on cold days and as the evaporative cooler unit is not required to operate when the ambient temperature drops below 10 °C, comparatively little, if any, blow down water may be generated. Evaporation rates are generally the lowest in May to August, so blow down water generated by winter peaking is not likely to evaporate as readily as wastewater produced in summer.

Operation during summer is likely to occur on days with the highest temperatures and lowest humidity which results in the highest generation of blow down from the evaporative coolers. Evaporation rates are generally highest in October to March and, in most years, summer peaking would produce wastewater at a time that it would most readily evaporate. However, rainfall is generally highest January to March. Therefore the ponds would be sized to accommodate not only the wastewater produced, but rain falling into them.

As outlined above the required volume of the evaporation ponds is dependant on the usage of the plant and the actual climatic conditions. Occasionally large volumes may be required to store cooling blow down water and rainwater for some months until conditions allow it to evaporate. Various pond sizes have been examined by undertaking a water balance which takes into account rainfall and evaporation rates, expected blow down water generation and variations in evaporation rates due to variations in salt concentration. Given the variation in the rate at which the blow down water can be generated, the construction of the evaporation ponds would be staged so that construction of the full volume does not take place until it is predicted that the full volume is required. An initial evaporation pond would be provided (refer to **Figure 4-2** for location) and its sizing is based on an optimal depth of 0.5 m for evaporation.

It is expected that the in-situ materials or site-won fill would be structurally adequate for construction of evaporation ponds. However, the integrity of these materials as a low-permeability lining cannot be relied upon when the Development Site is subjected to mine subsidence (refer to **Chapter 9**), and consequently a synthetic liner (such as high density polyethylene) would be used to minimise the risk of the saline blow down water escaping into the natural groundwater system. The deformation capacity of these materials is much greater than any subsidence-induced straining or cracking, and no special precautions should be needed beyond normal practice for the installation of such liners. However, the liner would not be covered by a “protective” soil layer, as is sometimes the case in other applications, as it is important that the liner be able to move relative to the underlying ground to accommodate concentrated strains from subsidence.

14.5.2 Domestic Wastewater

A small amount of domestic wastewater would be generated by staff using the site. This is estimated to be less than 80 kL/annum. Wastewater generated may contain pathogens, oils and greases and small amounts of other chemicals such as detergents and soaps. Wastewater would be treated on-site to meet on-site disposal standards. The on-site disposal would utilise proprietary treatment system (examples of such systems include Advanced Wastewater Treatment System (AWTS) or Ecomax

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system) to ensure that there is zero discharge from the site. Appropriate investigations, if required, would be undertaken on the selection of the system to ensure that the manufacturer's installation requirements are met and that there is no discharge to the environment. Alternatively a storage and pump system could be used to dispose of wastewater off-site at an appropriately licensed facility.

14.5.3 Wastewater from Maintenance

It is expected that up to 12 kL/annum of wastewater could be generated from cleaning and maintenance at the plant. Liquid wastes generated through the washdown of the turbine blades is expected to contain only contaminants from the inlet air and the cleaning agents used. This waste water would be collected in washing bays in a bunded area and then disposed of off-site by a licenced contractor. Such a system would be used during construction works.

14.5.4 Fire Water

In the event of a fire, wastewater from firefighting would be collected in the bunded facility area. The water may be of poor quality and would be assessed after any event and disposed of off site at licensed facilities if necessary. The facility bund would be sized to conform with relevant guidelines.

14.5.5 Spills

It is possible that accidental spills would produce liquid wastes. This is most likely to occur in the bunded areas and the compound area. A spill management plan would be developed and implemented to minimise the likelihood of spills occurring and to minimise their impact. Spills within bunded areas would be contained within the bunds. Spills within the compound area will be contained within the compound area. Bunds would prevent potentially contaminated water from entering the stormwater system.

14.5.6 Bund Water

Areas where there is a higher likelihood of spills or leaks occurring would be bunded. These areas include unroofed areas of plant.

As far as possible, rainwater would be prevented from collecting in bunds by ensuring that bunds are no larger than they need to be and by roofing bunded areas where practicable. It is, however, still possible that storm water would fall into bunds and become contaminated. Bunds would be sized to contain not only potential spills but also the maximum of potential firewater and/or rainfall (as per relevant government guidelines). Bunds would be designed so that they do not automatically empty into the compound's stormwater system. Any water contained within the bund would be assessed to determine if it was suitable for discharge into the stormwater system or requires off-site disposal.

Roofed areas of plant and the workshop would also be bunded to ensure that any spills or fire water will not escape into the compound area. Stormwater should not enter these areas. Any liquid contained in these bunds is likely to be contaminated and will be disposed of off-site.

14.6 Stormwater Management

14.6.1 Construction Period – Potential Impacts

During the construction period, approximately 20 ha of land would be disturbed in order to construct the compound, access roads, gas and water pipelines, and electricity supply. Rainfall on these disturbed sites may cause soil erosion and runoff may contain high levels of sediments which could then enter the natural drainage system. The soils at the site are likely to have a high percentage of fines, and may or may not be dispersible. Given the relatively flat slopes for most of the areas which would be disturbed, most of the disturbed sites are likely to present minimal erosion hazard and be classified Soil Loss Class 1. The screening mound, which is likely to have relatively steeper sides (approximately 1:6 to 1:7), is likely to be classified as a higher Soil Loss Class.

There is also the potential for spills and gross pollutants to be mobilised by runoff and enter the natural drainage system if no mitigation measures are put in place.

In addition to impacts to the natural drainage system, there is also the potential that water in the Upper Canal could be affected by excessive dust if no mitigation measures are implemented.

There is little likelihood that during the construction period that there would be an increase in either the rate or volume of water entering the stormwater system.

The SCA has been consulted and has provided a list of issues for AGL to consider. A response has been provided to the SCA addressing this list of issues (refer to **Appendix C**). Further correspondence from the SCA (refer to **Appendix C**) was received and states that the SCA is satisfied that the issue of water quality in the Canal has been addressed adequately in the assessment.

14.6.2 Construction Period – Mitigation

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. At a minimum the measures outlined in the *Managing Urban Stormwater – Soils and Construction Volume 1* (NSW Department of Housing, 2004) (commonly referred to as the Blue Book guidelines) would be implemented.

Construction would be planned to minimise the time that disturbed land is exposed. Areas which are disturbed would be managed with appropriate erosion and sedimentation control devices installed and maintained in line with the Blue Book guidelines. This may include limiting slope length, the installation of sediment filters and the construction of a sedimentation basin downstream of the plant area. These devices would remain in place until the surface is restored. These devices would also capture any gross pollutants.

Disturbed sites would be quickly revegetated or covered with a non-erodable surface following construction.

The insitu material or site-won fill would be structurally adequate for construction of sedimentation ponds receiving general site runoff if these are required (as per the Blue Book guidelines). For this application, some potential decrease in water-tightness of the floor or walls as a result of mine subsidence should be acceptable (and most likely self-healing via the sediment on the pond floor), and consequently the provision of a synthetic liner is not considered necessary, unlike the case of blow down water evaporation ponds.

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Spills would be minimised through proper site management. If any spill was to occur, it is likely to be of a small volume and contaminate only a small area. All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines. They would be stored in a designated covered area. Containment bunds would be constructed with provision for collection of any spilt material. Waste collection areas would be designated. Appropriate bunding would be installed and appropriated containers would be provided. Waste disposal and collection would be properly undertaken. All vehicle and equipment maintenance would be undertaken offsite. Any vehicle washing on-site would be restricted to specific bunded areas.

Staff facilities would be provided and installed and maintained so that pollutants, including wash water, are not conveyed from the site in stormwater.

During the construction period water may be required for dust suppression. This would be sourced from the existing dams on the site or imported if required.

14.6.3 Operation Period – Potential Impacts

The flow path of stormwater controls and treatment systems is presented in **Figure 14-2** and **Figure 14-3**.

Runoff from impervious areas including the buildings and the plant would be both greater and faster than runoff from the existing areas. This runoff is considered relatively minor considering the relatively small areas of impervious surfaces involved. Rain falling into evaporation ponds would not be allowed to run off the site (rather it would be stored until evaporated). This would reduce the volume of runoff leaving the site. However, this is likely to offset any increase in runoff due to the new impervious surfaces.

Runoff from the compound area could potentially be contaminated with gross pollutions, oils and greases and sediment. It may also be released in one location causing a concentration of flows over and above what would normally occur. This could then cause localised soil erosion. Without mitigation, runoff from this area would flow into Leaf's Gully and then to the Nepean River.

The proposed earth mound on the northern side of the site would be constructed close to a natural rise and has been designed to prevent the concentration of surface water flows. However, water running off the relatively steep sides of the mound may flow faster than would naturally occur. This could then cause localised soil erosion.

There would be no direct drainage from operational areas of the site to Upper Canal lands. Natural drainage of the plant area is to Leaf's Gully which flows under the Canal (refer **Figure 14-4**). The area of the Leaf's Gully property which drains to Upper Canal Lands would be left as cleared grazing land or revegetated with species indigenous to the area and therefore there would be no change in the quantity of stormwater draining through Upper Canal lands.

Liquid spills could potentially occur in the compound area or during transportation to the site.

14.6.4 Operation Period – Mitigation

Surface water from the site that may potentially be contaminated could include:

- rainfall runoff from operational areas of the site; and
- accumulated water within bunds.

In addition, where flows are concentrated, soil erosion may occur.

Water from the power plant footprint would be directed through oil and grit traps and sedimentation pond designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge. This system would also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater. The outlet of the stormwater system from the bunded plant area would be designed to maximize the dispersion of these high flows and thereby minimize their potential to cause soil erosion downstream. This outlet would operate automatically but could be manually closed. In the unlikely event of a spill outside of bunded areas but within the compound, the outlet could be closed and this volume captured. Potentially contaminated water would then be disposed of off-site by a licensed contractor.

Other areas of the Development Site would be left undisturbed and runoff characteristics would not be altered.

Landscaping around the base of the screening mound would slow runoff before it runs over the adjoining grassed surface. This would minimise the potential for soil erosion. **Chapter 10 Landscape and Visual** provides further discussion on the landscaping treatment at the Development Site.

Correspondence from the Sydney Catchment Authority (SCA) (refer to **Appendix C**) was received and states the SCA is satisfied that the issue of water quality in the Upper Canal was adequately addressed by the previous assessment.

SCA also states that the proponent would need to obtain separate approval from the SCA for the necessary works and extraction of the water (which may include detailed environmental and risk assessment). This is noted and the necessary approvals would be sought should this water supply option be progressed.

14.7 Potential Impacts on Upper Canal

14.7.1 Construction period – Potential Impacts

As noted in **Section 14.6.1** there is a potential that water in the Upper Canal could be affected by excessive dust if mitigation measures are not implemented.

14.7.2 Construction period – Mitigation

Mitigation measures described in **Section 14.6.2** would minimise potential impact on the Upper Canal.

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14.7.3 Operation period – Potential Impacts

The Upper Canal is used for the transport of water to the catchment reservoir, and does not accept surface runoff from the area, thus the only potential pathway of pollutants would be atmospheric deposition of particulates onto the water in the canal or rain falling into the canal.

However, natural gas combustion in gas turbines is extremely clean burning, with a minimal quantity of particulates contained in the exhaust. These particles are also extremely fine, thus are transported in a manner similar to that of gases, such that deposition is minimal. These factors, coupled with the small surface area of exposed flowing water in the canal compared with its volumetric flow, and the fact that the buoyant nature of the plume means that typically the stack emissions would not reach ground level close to the source, renders any operating impact of the proposed plant on the canal to be negligible.

In addition, the assessment has assumed the plant to be operating continuously, whilst in reality operation is capped to 15 % of the year, with actual operation likely to be even less. Despite this conservativeness, the maximum long term impacts for pollutants of interest were shown to be a fraction of pre-existing background levels, and below DECC guidelines.

14.7.4 Operation Period – Mitigation measures

As described in **Section 14.7.3** operating impact of the proposed plant on Upper Canal is likely to be negligible, therefore no additional mitigation measures are proposed.

14.8 Flooding

14.8.1 Potential Impacts

The proposed site is near the Nepean River as well as the lesser streams of Leaf's Gully, which is in close proximity to the site. No flood studies have been undertaken for the Nepean River in this area. The closest location for available data is Menangle Railway Bridge. The confluence of Leaf's Gully with the Nepean River is some 4.5 km from the Menangle bridge. The flood levels at this location, based on advice from Campbelltown City Council (refer to **Appendix C**) are:

- 20 year Average Recurrence Interval – 76.40m AHD; and
- 100 year Average Recurrence Interval – 77.8 m AHD.

As a nominal platform level of 144.0 m AHD has been adopted for the Project, this is above the potential flood heights and flooding is unlikely to pose an immediate threat to the development.

As discussed in **Chapter 9 Soils, Geology and Groundwater**, the Development Site is subject to mine subsidence. Where creeks and river valleys are located above or adjacent to extracted longwall panels, additional vertical movements in the base of the valleys and horizontal movements in the valley sides are typically observed. This issue may also influence flooding of Leaf's Gully.

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14.8.2 Mitigation Measures

The issue of flooding from Leaf's Gully both before and after mine subsidence would be considered in the detailed design phase. This would require hydrologic and hydraulic studies to be undertaken and implementation of any mitigation measures to address local flooding from Leaf's Gully.

14.9 Summary of Mitigation Measures

Table 14-3 presents a summary of mitigation measures related to water management

Table 14-3 Summary of Mitigation Measures

Mitigation Measure	Implementation of mitigation measure		
	Design	Construction	Operation
Soil Erosion			
At a minimum the measures outlined in the <i>Managing Urban Stormwater – Vol 1 Soils and Construction</i> would be implemented. Measures may include: - limiting slope length, - installation of sediment filters and - the construction of a sedimentation basin downstream of the plant area.		✓	
Soil erosion and sedimentation devices would remain in place until the surface is restored. These devices would also capture any gross pollutants.		✓	
Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.		✓	
Spills and site management			
All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines and stored in a designated covered area.		✓	✓
Appropriately bunded areas would be included for storage of fuels, oils and chemicals.			✓
Waste collection areas would be designated.		✓	✓
Waste disposal and collection would be undertaken in an appropriate manner.			✓
All major vehicle and equipment maintenance would be undertaken offsite.		✓	✓
Any vehicle washing on-site (if not restricted by Sydney Water from time to time) would be restricted to specific bunded areas.		✓	✓
Staff facilities would be provided, installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater.		✓	✓
Water for dust suppression would be sourced from the existing dams on the site or imported if required.		✓	

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Mitigation Measure	Implementation of mitigation measure		
	Design	Construction	Operation
Surface water			
There will be no direct drainage from power plant site to Upper Canal lands.	✓	✓	✓
Further consultation with Sydney Catchment Authority for necessary approvals to be undertaken should the Upper Canal water supply source option be the preferred water source.	✓		
Water management strategies developed and implemented to maintain zero water discharge from the power plant site except for natural surface flows.	✓		✓
Water from the power plant site would be directed through oil and grit traps designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge from the Site. This system would also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater.	✓		✓
The outlet of the power plant site's stormwater system would be designed to maximize the dispersion of these high flows and spread the flow out over a wider area and thereby minimize their potential to cause soil erosion downstream.	✓		✓
Wastewater Treatment			
Blow down water would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) to minimise the risk of the saline blow down water escaping into the natural groundwater system.	✓		✓
Landscaping around the base of the screening mound would minimise the potential for soil erosion.	✓		✓
Undertake hydrologic and hydraulic studies and implement mitigation measures if required to address local flooding from Leafs Gully.	✓		
Domestic wastewater would be treated by a zero discharge proprietary treatment system or stored and disposed of offsite by a licensed contractor.	✓	✓	✓

Heritage – Summary of Key Outcomes

No Aboriginal objects or sites were located during the field survey of the Leafs Gully Power Project. . The proposed footprint includes an area of potential archaeological deposit (PAD) with areas of moderate and low-moderate archaeological potential. This potential archaeological deposit would be impacted upon by the development.

As a result, a program of archaeological subsurface testing across a representative sample of potential archaeological deposits would be undertaken during the planning and design stage with the aim of determining the nature and significance of any Aboriginal objects present. If necessary, appropriate management strategies would be formulated to mitigate development impacts and conserve heritage values.

The potential heritage impact on Meadow Vale and Mount Gilead historic sites and the Upper Canal was also assessed against the State (or local) heritage significance criteria set by the NSW Heritage Office. This assessment found that the proposed development would have little or no effect on the historic sites' significance.

A small section of the Sydney Water Supply Upper Canal System may be impacted by the proposed Leafs Gully Power Station development if a water pipeline is constructed to connect with the Upper Canal. The expected impact of the connection, if this option for water supply is developed further would be minor in nature.

Chapter 15

Heritage

15.1 Introduction

As part of this Environmental Assessment, an assessment of the cultural heritage was conducted by Navin Officer Heritage Consultants (Navin Officer). This chapter provides a summary of the report which is presented in full in **Appendix M**. The assessment addressed the local and regional archaeology and Aboriginal and European cultural heritage. The assessment has been prepared in accordance with the draft *Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC 2005).

Further assessment of the European Heritage potentially impacted by the development was also undertaken. This chapter provides a summary of the report which is presented in full in **Appendix N**.

15.2 Methodology

The cultural heritage assessment encompassed the following:

- *Literature and database review* to determine if known Aboriginal and historical sites were located within the area under investigation, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context;
- *Fieldwork* involved inspection of all areas of ground surface visibility within the study area; and
- *Recording parameters* identifying material evidence of Aboriginal occupation as revealed by surface artefacts and areas of archaeological potential unassociated with surface artefacts.

Based on this methodology the following was provided:

- predictive statements for Aboriginal and European heritage places in the study area;
- results of the desktop analyses and field surveys of the subject site;
- statutory obligations relevant to cultural heritage of the site; and
- recommendations based on the results of the investigation and the impact of the proposed development on the known and potential archaeological resource.

The field survey of the Leaf's Gully study area was conducted in May 2006.

Two Aboriginal stakeholder groups have an interest in the Leaf's Gully study area. These groups are:

- the Tharawal Local Aboriginal Land Council (TLALC); and
- the Cubbitch Barta Native Title Claimant Group (CBNTCG).

A representative from each group participated in the field survey.

A desktop review was also undertaken of historical heritage places in the vicinity of the proposed Leaf's Gully Power Project, and the potential impact on the heritage significance and visual elements of those places. Those places include 'Meadowvale' and 'Mount Gilead' homesteads, and features associated with the Sydney Water Supply Upper Canal system. The assessment analysed the impact of the proposed development using the NSW Heritage Council heritage assessment criteria. These NSW Heritage Office Criteria are described in more detail in **Appendix N** but are summarised below:

- Criterion (a)** an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (b)** an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (c)** an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);
- Criterion (d)** an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;
- Criterion (e)** an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (f)** an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (g)** an item is important in demonstrating the principal characteristics of a class of NSW's
- cultural or natural places; or
 - cultural or natural environments.
 - (or a class of the local area's cultural or natural places; or cultural or natural environments.)

15.3 Consultation

Consultation included the following:

- Consultation with the Department of Environment and Climate Change (DECC) to obtain information concerning previously recorded Aboriginal archaeological sites and completed archaeological studies.
- Consultation with representatives from the following Aboriginal stakeholder groups:
 - the Tharawal Local Aboriginal Land Council (TLALC); and
 - the Cubbitch Barta Native Title Claimant Group (CBNTCG).

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- These groups were also provided with a copy of the draft of the assessment (2006) for comment on the cultural significance of the locality and any archaeological objects or areas recorded in the survey. Copies of correspondence from these groups are provided in **Appendix M**.

Consultation would continue during detailed design with both the Tharawal Local Aboriginal Land Council and Cubbitch Barta Native Title Claimant Group.

As discussed in **Chapter 6**, the consultation process was carried out in accordance with the *Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation* (DEC, July 2005).

The views and ideas of stakeholders were sought on cultural heritage through:

- An advertisement inviting groups and individuals to register their interest in the Aboriginal cultural heritage assessment and management program placed in the Campbelltown Advertiser on 13 October 2008 with registrations closing on 3 November 2008.
- Letters requesting registration of interested parties for a project in the Appin region sent to the following entities:
 - Tharawal Local Aboriginal Land Council;
 - Register of Aboriginal Owners, Native Title Services;
 - Campbelltown City Council; and
 - DECC.

As of 4 November 2008 two responses were received. Responses were received from:

- the Tharawal Local Aboriginal Land Council (TLALC); and
- the Northern Illawarra Aboriginal collective inc. (NIAC).

15.4 Environmental Context

15.4.1 Landscape

There are two geological and structural divisions within the Sydney Basin which are relevant to the Leafs Gully study area: the Cumberland Plain and the Woronora Ramp.

Where the Cumberland Plain and the Woronora Ramp come together, there is a transitional zone where the landscape includes features of both divisions. The Leafs Gully study area falls within this zone.

From an archaeological perspective, the transition between these two landforms is most meaningful when the dominant variable of bedrock geology is combined with topographic variables. Critical factors that define the transitional zone are the change:

- between sandstone and shale in creek beds;
- in valley morphology between narrow, moderate and steeply graded valleys, situated between distinct break-of-slopes and dominated by sandstone; and shale based, wide and open valleys, with moderate low gradient slopes, with no break-of-slope, and
- in ridgeline topography between relatively flat remnant plateau land surfaces located between distinct break-of-slopes; and broad gently graded or rounded crests with relatively distinct watersheds.

15.4.2 Land Use Practices

A number of factors relating to landuse practises were identified to have impacted the archaeological record.

Landscape disturbance

Landscape disturbance, primarily as a result of its use for agricultural purposes would have impacted the archaeological record. The area is substantially cleared of original vegetation and is now predominantly under pasture grass. Most of the property has been ploughed. The clearance of vegetation has a variable impact on archaeological sites, depending on the clearing methodology and type of site. Disturbance would have occurred to the subsoil where rootstock and stumps were removed. It is unlikely, however, that the direct effects of vegetation clearance would destroy most subsurface deposits. Impacts would have been limited to the dispersal and disturbance of artefactual material.

Indirect Impacts

- The indirect impacts of clearing would have been locally more severe, such as increased land surface run-off and sedimentation. Bank erosion would have destroyed riparian sites and increased sedimentation rates would have buried and concealed valley floor sites.
- The impacts of agriculture and the establishment of agricultural pastures are potentially substantial. Surface site features such as stone arrangements and ground relief will not survive repeated tilling. However, depending on soil and sediment type, some archaeological deposits retain vertical integrity and may have stratigraphy that relates to older and younger features of occupation. In these cases, ploughing will destroy the stratigraphic integrity of the deposit within the plough zone.
- The indirect impacts of ploughing and cultivation include the sedimentation of sites located downslope and downstream and downstream erosion. This can act to create a variably thick layer of historic sediment deposition and is frequently encountered on basal slopes and valley floors that overlies the original pre-European land surface and has the effect of concealing archaeological sites and preventing their detection during surface survey.

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15.5 Aboriginal Context

15.5.1 Leaf's Gully Study Area

Most tribal boundary reconstructions place the Leaf's Gully study area within the Dharawal (Tharawal) tribal area.

A search of the Australian Heritage Information Management System (AHIMS) database revealed no registered sites within the study area. Nine sites, artefact scatters and art sites, were listed within a two kilometre radius of the study area in the original assessment. One of these sites, an artefact scatter, 52-2-2265, is located on Leaf's Gully, this site was located in 2002 by Navin Officer for the proposed West Cliff Colliery PED Antenna Route. Four new sites in the area have been entered on AHIMS since the original assessment including the PAD identified in this report (52-2-3289), a scarred tree (52-2-3579) and two grinding groove sites (52-2-3580 and 52-2-3581).

15.5.2 Site Location Parameters and Predictive Statements

In 2002 Navin Officer completed an Aboriginal heritage study of the Campbelltown Local Government Area. (LGA). At the time of this study there were 120 Aboriginal sites recorded in the Campbelltown LGA. Based on this information site prediction models were developed for the Woronora Ramp, the Cumberland Plain and the transitional zone.

The site prediction model and a further archaeological assessment of the proposed "Wilton Park" residential development was undertaken by Navin Officer in 2002 which refined the site prediction model for the area.

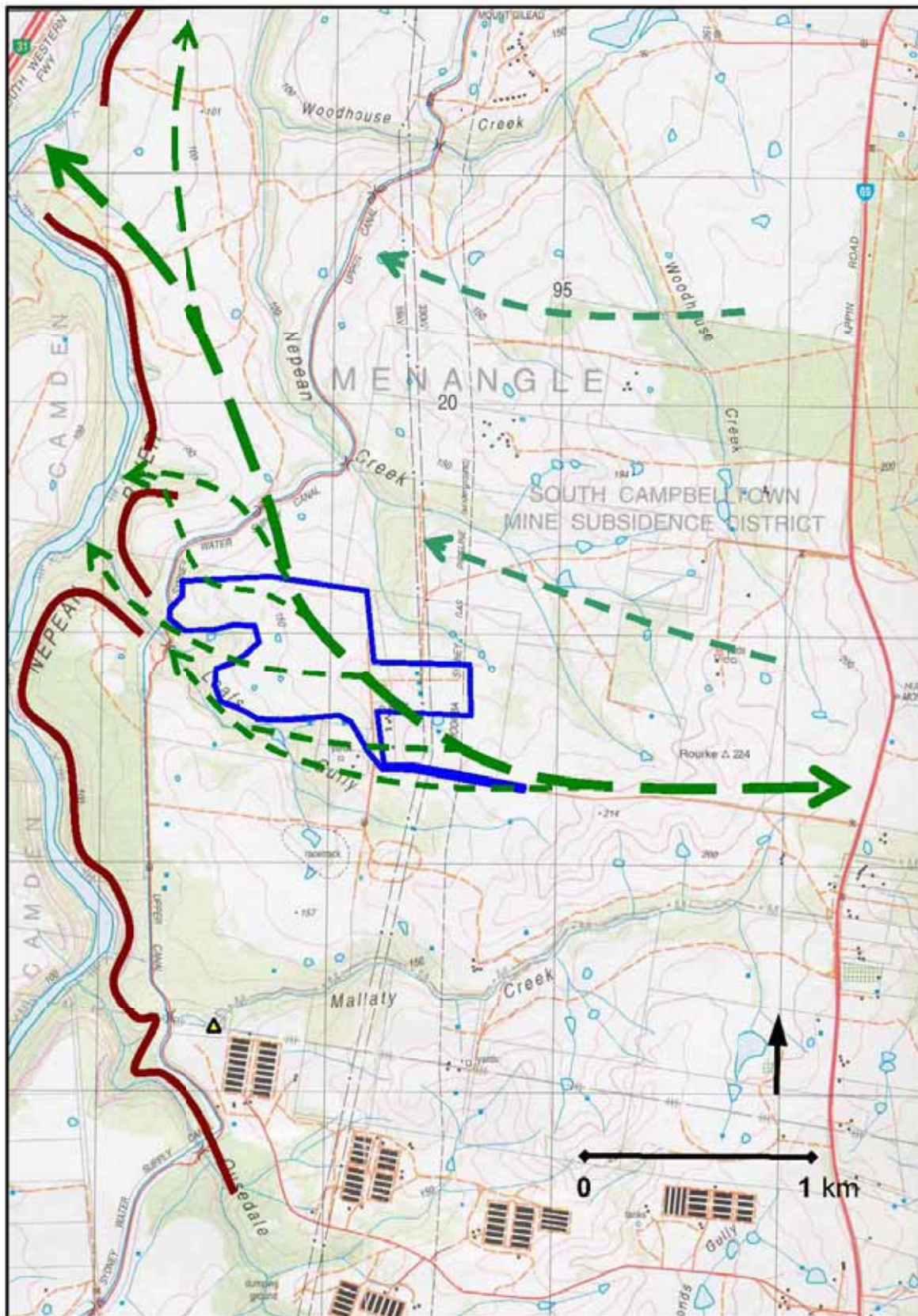
Within the study area, it can be hypothesised that spurline crests and tributary gullies were utilised in combination for through and cross-country access (Refer to **Figure 15-1**). The lower gradients of the crests and upper slopes, together with their more open vegetation structures probably aided pedestrian travel. In contrast, the continuous sandstone escarpments along lower tributary valleys and adjoining Nepean River Gorge would have constrained access. In order to access the Nepean River, the gullies of side tributaries would need to have been traversed. In a few cases, spurlines also afforded negotiable and moderate grades to the river. One such spurline is situated 2 km north of the study area where a side spur provides access to the east bank of the river. This spur branches from the main watershed spurline which passes through the study area (Refer to **Figure 15-1**).

A review of the study area topography in the light of these contrasting models reveals that aspects of both models are likely to be relevant – a finding which is consistent with the transitional nature of the region's geomorphology.

Based on the predictive models for the Cumberland Plain and Woronora Ramps, and the results of other archaeological surveys within the transitional zone topographies of the Appin region, the following predictions can be drafted regarding archaeological potential within the Leaf's Gully study area:

- Sites are likely to occur on well drained, relatively level ground adjacent to the Leaf's Gully break-of-slope, and for an undetermined distance upslope;
- In low gradient upper catchment contexts (upstream of gullies associated with a distinct break-of-slope) artefact occurrences are likely to be relatively low and situated in close proximity (within 100 m) of drainage lines;
- Sites may occur on well drained, relatively level ground on the crests of both major and minor spurlines. Such sites may be more or less continuous with the break-of-slope zone and display a direct relationship between artefact density and proximity to a water source;
- Sites may occur on the low gradient, upper spurline slopes associated with crests, especially when continuous with the break-of-slope, or a substantial crestline;
- The number and density of artefacts at any site may be, in part, related to the distance to a water source, and the degree of permanence of that source. Sites with a higher incidence of artefacts per area are likely to be situated in relative proximity to substantial water sources (such as second order or greater drainage lines);
- The archaeological sensitivity of spurline crests and adjacent slopes is likely to diminish with distance from substantial water sources. It is hypothesised that sites with greater than background densities of artefacts are most likely to occur on crests that are within 500 m of second order or greater drainage lines

The Aboriginal context of tribal boundaries, traditional groupings and local aboriginal history is discussed in more detail in **Appendix M**. Consultation with the Aboriginal community on cultural values is ongoing. As part of this consultation process, the heritage assessment will be forwarded to the relevant Aboriginal groups for comment on the recommendations and any cultural issues relating to the developments.



LEGEND

- — — Hypothesised Aboriginal Access Routes
- — — Constraining Escarpments
- — — Heritage Study Area

Source: Navin Officer Heritage Consultants Gas Turbine Power Station Leaf's Gully, NSW, Cultural Heritage Assessment, July 2006 using base map: Appin 9029-1S 1:25 000 topo 3rd Ed, LIC 2000

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title STUDY AREA RELATIVE TO HYPOTHESED ABORIGINAL ACCESS ROUTES AND CONSTRAINING ESCARPMENTS
URS	Drawn: AJW Approved: FINAL Date: 07.07.06 Job No: 43177401 File No: 43177401-026.wor	Figure: 15-1

15.6 Historic Overview

15.6.1 Leaf's Gully Study Area

The 1870 to 1904 parish maps show that George Crossley owned the land which comprises the Leaf's Gully study area. It appears from the parish maps the land at Leaf's Gully (Airds) was owned and/or purchased by the executors of Crossley's will and was still under the name of Crossley in the 1904 map.

Today the property currently operates as a trotting horse breeding and training enterprise. The majority of the land is cleared and used for grazing and horse yards. Main improvements include three substantial residences used by the owner and the owner's family, and farm buildings.

Three dwellings including associated sheds have been constructed relatively recently within the study area. All of these dwellings will be affected by the project. None of these structures have any heritage significance.

15.6.2 European Heritage Listings

Heritage Listed Sites within the Leaf's Gully Study Area

One place within the general vicinity (approximately 300 m west) of the Leaf's Gully study area is recorded as a heritage place – the Sydney Water Supply Upper Canal System. It is listed on the:

- NSW State Heritage Register;
- Campbelltown Local Environmental Plan – District 8 (Central Hills Lands) – Schedule 1 – as an item of environmental heritage, and described as 'generally following western boundary of local government area of the City of Campbelltown and south, in so far as it traverses land under this plan';
- Sydney Catchment Authority's Heritage and Conservation Register; and
- Register of the National Trust of Australia (NSW).

No other places or sites within the study area are listed on heritage lists or registers which were searched as part of this assessment.

The Sydney Water Supply Upper Canal System does not appear on the NSW Heritage Inventory for the Campbelltown LGA, however, it does appear on that Inventory for the Liverpool LGA.

Table 15-1 summarises other heritage items in proximity to the site.

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Table 15-1 Schedule of Possible Impacts to European Heritage Sites

Item Name/ No.	Description	Location	Heritage Significance
'Meadow Vale'	Historic House	1.25 km west of Appin Road	Local
'Mount Gilead'	Historic homestead group	1.5 km west of Appin Road	Local
MGH1	Sandstone weir	Woodhouse Creek	State
MGH2	Timber bridge	Woodhouse Creek	None
MGH3	Sandstone quarry	Woodhouse Creek	None
MGH4	Construction camp site	Nepean Creek	State
MGH5	Hearth and chimney	Nepean Creek	State
MGH6 (1 – 10)	Sandstone quarries	Nepean Creek	State
MGH7 (Mount Gilead area)	Sydney Water Supply Upper Canal	Various	State
Sydney Water Supply Upper Canal (Leafs Gully study area)	Upper Canal	Western margin of Leafs Gully study area	State

Heritage Listed Sites outside of the Leafs Gully Study Area

Three other heritage items are within close proximity to the study area 'Mount Gilead', 'Meadow Vale' and 'Beulah House'. A June 2008 letter from the Heritage Council of NSW identified 'Meadow Vale' and 'Beulah House' as being in the vicinity of the proposal's site and may be affected by construction works.

Subsequent to the initial assessment undertaken in 2006 it was considered that the project may impact the heritage significance of 'Mount Gilead' and 'Meadow Vale', therefore a separate historic heritage assessment was undertaken of these places (refer to **Appendix N**). The assessment considered that there would not be any potential impact to 'Beulah House'.

The 'Mount Gilead' historic site is located approximately 2.9 km northeast of the Leafs Gully Power Project. The assessment presented in **Appendix N** considered that the proposed development will have no impact on the site's heritage significance.

'Meadow Vale' is an historic house located approximately 1.25 km west of Appin Road, on Lot 1 DP602888, and approximately 1.4 km northeast of the location of the proposed gas turbine power station at Leafs Gully. 'Meadow Vale' is under consideration for State Heritage Register listing.

The historic heritage assessment (refer to **Appendix N**) concluded that the 'Meadow Vale' site would not be directly affected by the Leafs Gully Power Project. With respect to its landscape context and in particular the distant views from the homestead, it is considered that the proposed development would have little or no effect on that aspect of the homestead's significance (refer to **Appendix N**).

Beulah House, Outbuilding, Timber Bridge and Gazebo are listed on the NSW State Heritage Register. It is located another 700 m north of 'Meadow Vale' on the Appin Road on Lot 78 DP752042. The historic heritage assessment (refer to **Appendix N**) concluded that the sites would not be directly affected by the Leaf's Gully Power Project. Further it concluded that its landscape setting would not be affected as there are two gullies and a large spur line between it and the Leaf's Gully Power Project. These landscape features would block any views from Beulah to the Leaf's Gully Power Project area. Therefore the Leaf's Gully Power Project would not have any direct or indirect visual impacts on the heritage significance of the site.

15.7 Assessment of Potential Impacts

15.7.1 Aboriginal Sites

No Aboriginal sites or objects were identified within the Leaf's Gully study area.

One area of potential Aboriginal archaeological deposit (LG PAD 1) was identified in the study area (refer to **Figure 15-2**):

- Leaf's Gully PAD 1 (LG PAD 1)

GDA: 293550.6218625 to 294400.621600 to 293550.6219350 to 294175.6219350

This recording is an area of predicted subsurface archaeological potential, and occurs on the low gradient, upper slopes and crests of a spurline complex which dominates the study area and descends to the west and north towards Leaf's Gully and the Nepean River respectively. The downslope boundary of the PAD is defined by the break-of-slope above the steep gradients around second order (or greater) drainage lines, and elsewhere by the approximate edge of the crest, extending up to 500 m away from second order drainage lines.

That portion of the PAD within the study area has approximate dimensions of 1000 m by 750 m (refer **Figure 15-2**). The soils in the area display an upper level of gravelly sand.

The proportion of ground surface exposures providing visibility across the surveyed section of the PAD varied from around 30 % on the lower slopes, to less than 5% on the upper slopes and crests. The level of visibility within these exposures was good to very good, ranging from 50 % on the upper slopes, to 60 % to 80 % on the lower slopes.

There has been disturbance across the site as a result of ploughing, dam construction and erosion from stock animal treadage. This disturbance is unlikely to have removed potentially occurring subsurface artefacts but could have affected the integrity of their position.

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Justification

The topography and landscape context of this PAD complies with the predictive statements outlined in **Section 15.4.2**. The PAD is made up of the following sensitive landforms:

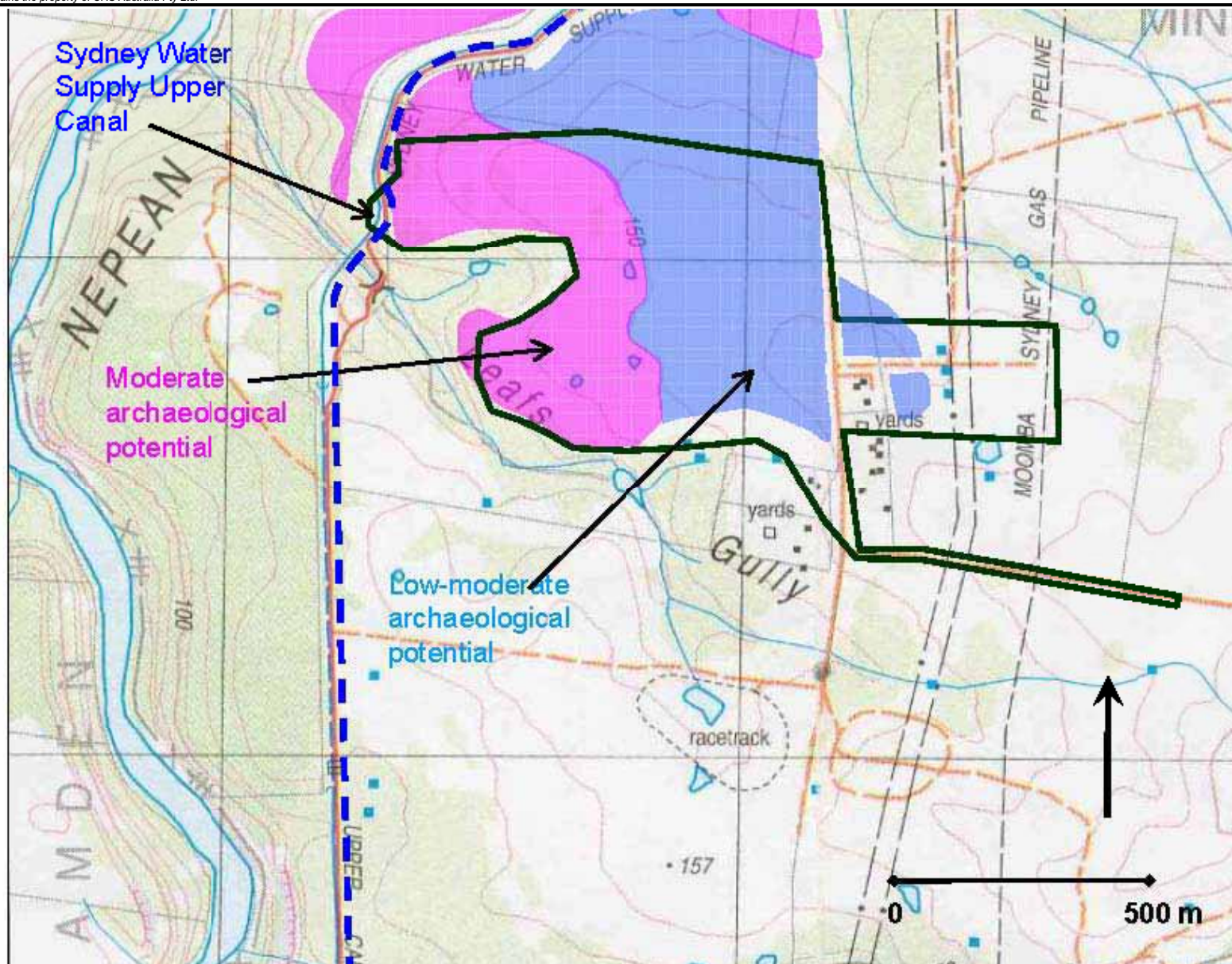
- low gradient and well drained ground immediately adjacent to and upslope from the Leaf's Gully break-of-slope;
- spurline crests extending upslope of the break-of-slope, up to 500 m away from second order (or greater) drainage lines; and
- low gradient upper slopes situated between the break-of-slope and the crests.

The sandy soil evident across the surface of the PAD provides an easy medium for stone artefacts to move down the soil profile, via bioturbation, and thus to remain undetected during surface survey. The presence of sandy soils also provides the potential for relatively deep slope wash deposits which may preserve archaeological material.

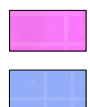
The assessed archaeological potential of the proposed power station footprint varies across the PAD from moderate on the lower slopes, to low-moderate on the higher slopes.

The boundary between these two areas has been provisionally set at approximately 300 m from a second order (or greater) drainage line, and includes some give and take to include higher potential landforms, such as crests, and to exclude lower potential areas such as higher gradient slopes. This interval is based on previous surface survey results together with a precautionary and qualitative appreciation of the study area. A more refined distance interval cannot be determined until data from excavated contexts can be obtained.

The heritage significance of the identified potential archaeological deposit (LGPAD1) within the study can only be determined following consideration of the results of a subsurface archaeological testing program. Data from a representative sample of the deposit is required in order to characterise the nature and extent of any potentially occurring archaeological material.



Legend



Moderate archaeological potential

Low-moderate archaeological potential



Sydney Water Supply Upper Canal (known as Sydney Catchment Authority Upper Canal)

Source: Navin Officer Heritage Consultants Gas Turbine Power Station Leaf's Gully, NSW, Cultural Heritage Assessment, July 2006 using base map Appin 9029-1S 1:25 000 topo 3rd Ed.

Client

AGL POWER GENERATION (NSW)

URS

Project

AGL LEAF'S GULLY POWER PROJECT EA

Drawn: AJW

Approved: FINAL

Date: 07.07.06

Job No: 43177401

File No: 43177401-026.wor

Title

LOCATION OF POTENTIAL ABORIGINAL ARCHAEOLOGICAL DEPOSIT (LGPAD 1)

Figure: 15-2

Rev: A

A4

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15.7.2 European Sites

One European historic site was located within the study area. This is a small portion of the *Sydney Water Supply Upper Canal System* (known as the Sydney Catchment Authority Upper Canal), situated at the far western end of the study area.

Heritage Significance and Visual Elements

An analysis of impact of the proposed development was conducted using the NSW Heritage Council heritage assessment criteria listed in **Section 15.2**. **Table 15-2** summarises that assessment.

Table 15-2 Summary of Heritage Significance and Impact Assessment

NSW Heritage Office Criteria	(a) Historical	(b) Personal Association	(c) Aesthetic	(d) Community Association	(e) Research	(f) Rarity	(g) Characteristics
'Meadow Vale'							
Significance	Local	Local	None	<i>na</i>	Local	<i>na</i>	Local
Impact	None	None	None	<i>na</i>	None	<i>na</i>	None
'Mount Gilead'							
Significance	Local	Local	None	<i>na</i>	Local	<i>na</i>	Local
Impact	None	None	None	<i>na</i>	None	<i>na</i>	None
Sydney Water Supply Upper Canal System							
Significance	State	<i>na</i>	State	<i>na</i>	State	State	<i>na</i>
Impact	Potential	<i>na</i>	Potential	<i>na</i>	Potential	Potential	<i>na</i>

Meadow Vale Historic Site

As the 'Meadow Vale' historic site is located approximately 1.4 km northeast of the location of the proposed gas turbine power station at Leaf's Gully, the proposed development will have no impact on the site's historical (criterion a), personal associative (criterion b), research (criterion e) or rarity (criterion g) heritage significance.

With respect to its landscape context, and in particular the distant views from the homestead, it is considered that the site has little aesthetic heritage significance (criterion c), due to those views being screened by a line of tree plantings on its south and west and compromised by more modern constructions in the landscape, such as electricity towers and transmission lines, the Hume Highway/South Western Freeway, the Main Southern Railway and communication towers. It is also considered that the proposed development will have little or no effect on that aspect of the homestead's significance.

Mount Gilead Historic Site

As the 'Mount Gilead' historic site is located approximately 2.9 km northeast of the location of the Leaf's Gully Power Project footprint, the proposed development will have no impact on the site's historical (criterion a), personal associative (criterion b), research (criterion e) or rarity (criterion g) heritage significance.

With respect to its landscape context, and in particular the distant views from the homestead, it is considered that the site has little aesthetic heritage significance (criterion c), due to those views being blocked by landform and boundary tree plantings and compromised by more modern constructions in the landscape, such as electricity towers and transmission lines, the Hume Highway/South Western Freeway, the Main Southern Railway and communication towers. It is also considered that the proposed development will have no effect on that aspect of the homestead's significance.

Upper Canal

The portion of the Upper Canal identified within the Leaf's Gully proposed project area consists approximately of a 50 m interval which incorporates a bend to the north encompassing approximately 130 degrees.

A small section of the Sydney Water Supply Upper Canal is the only historic site with potential to be impacted by the proposed development. The development proposal includes an option for the construction of a pump station and a pipeline connecting the Leaf's Gully Power Project to the canal. If constructed, this pipeline connection would be expected to involve only minor impact to the canal fabric and would be in accordance with the requirements of the Sydney Catchment Authority.

The listing includes its infrastructure elements, such as flumes, stone piers, concrete bridges, and aqueducts. **Chapter 12 Noise and Vibration** addresses the potential impacts of vibration during construction and operation on the Upper Canal and finds that no further investigation is warranted due to the low potential of impact.

15.8 Mitigation Measures

15.8.1 Aboriginal Heritage

The proposed construction of the Leaf's Gully Power Project would necessitate the substantial disturbance or removal of the current ground surface and associated upper soil profile within the footprint of the project. This level of impact could destroy, damage or move any archaeological material potentially present within the effected sediments.

This investigation has found that the proposed footprint of the development occurs in areas with predicted subsurface archaeological potential. In order to determine if Aboriginal objects would be impacted by such works, and to evaluate their significance, a program of archaeological subsurface testing would need to be conducted across a representative sample of the deposits effected.

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It should be noted that a majority of the study area has been previously disturbed by agricultural activities including clearance of native vegetation, ploughing, and the construction of power and gas easements. Such activities are likely to have reduced the significance of any potentially remaining Aboriginal objects. Despite this, there remains a statutory requirement to determine if Aboriginal objects are likely to be impacted and to ensure that appropriate strategies for impact mitigation are conducted. The likely means of managing any detected archaeological deposits subject to impact would depend on their level of assessed significance.

An appropriate level of archaeological subsurface testing is to be conducted across LGPAD1 to determine the nature and significance of any archaeological material. Based on the results of this program, a management strategy may be required to mitigate any anticipated development impacts on heritage values. The draft *Guidelines for Aboriginal Cultural Heritage and Community Consultation* (DEC, 2005) would be followed for this testing.

The subsurface testing program would aim to:

- determine if subsurface artefacts are present within the development area;
- characterise the nature of any archaeological deposits encountered (within the limitations of the sampling and processing methodology);
- identify the need for any further archaeological work, such as salvage excavation; and
- provide informed mitigative measures and management recommendations for any sites located within the proposed development area.

The indicative program and scope of subsurface testing is provided in **Appendix M**.

The indicative program and scope of subsurface testing proposes to excavate archaeological test pits using a mechanical auger. The mechanical auger holes would be placed over six transects within the development boundaries. Three auger transects would be placed on each of the two spurlines. The interval between each transect will be approximately 100-150 m and each test hole would be approximately 50 m apart. It is estimated that approximately 90-100 auger holes would be excavated within the development area. The mechanical auguring would be used to test both areas of moderate and low-moderate potential archaeological deposit within the development area and provide a broad indication of the location of cultural material and the nature of the deposits.

Where there is a concentration of cultural material recovered from a mechanical auger hole, additional auger holes may also be conducted. The additional auger holes will be used to identify more accurately the extent and nature of the cultural deposit. The holes will be excavated at a closer interval, possibly 25 m. The additional auger holes may also be placed perpendicular to the main transects to identify if the deposit extends down slope. For this purpose an additional 25-50 auger holes may be required.

If a significant cultural deposit is located a backhoe may be used. Backhoe pits would be conducted in particular locations only and used to open up a wider area to further investigate the extent of the cultural deposit. Approximately five to ten backhoe pits may be used.

More detail on the methodology for the auger pits and backhoe test pits is provided in **Appendix M**.

A CEMP for the project would detail the management strategies to be followed in the event that an Aboriginal object is uncovered during the construction of the project. In the event that an Aboriginal object is uncovered during the construction of the project the following procedures are to be undertaken:

- 1) All works will cease in the immediate vicinity of the object.
- 2) A qualified archaeologist would assess the significance of the object.
- 3) If artefacts are discovered their location would be recorded using a hand held GPS and mapped, the artefacts would be collected, bagged and given a sequential location number.

If midden material is discovered its location would be recorded using a hand held GPS and mapped, a sample of the material is collected, bagged and given a sequential location number.

- 4) The collected material would be examined in detail by a suitably qualified lithic specialist and the midden material examined and recorded. A report is to be written detailing the findings of this examination.
- 5) Following completion of the analysis of the assemblage, all the lithic items would be lodged with the Australian Museum, or would be subject to a Care and Control Permit issued by the DECC.

More detail on the management framework for the discovery of new sites or human skeletal remains during construction is provided in **Appendix M** and would be incorporated into a CEMP for the project.

15.8.2 European Heritage

'Meadow Vale' homestead

As it is considered that the Leafs Gully Power Project would have little or no impact on 'Meadow Vale', no mitigative measures are required.

'Mount Gilead' homestead

As it is considered that the Leafs Gully Power Project would have no impact on 'Mount Gilead', no mitigative measures are required.

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Sydney Water Supply Upper Canal System

The development proposal includes an option for the construction of a pump station and a pipeline connecting the Leaf's Gully Power Project to the Upper Canal. If constructed, it is anticipated that the pipeline would have only a minor impact to the canal fabric and would be in accordance with the requirements of the Sydney Catchment Authority. If the option to construct a pipeline connection with the canal proceeds, then:

- The design of the connection would minimise direct and indirect impacts to the fabric and context of the canal;
- All works and impacts on the Upper Canal would be consistent with the provisions of the existing Conservation Management Plan for the Upper Canal (Higginbotham and Associates 2002); and
- Any heritage impact mitigation actions as required by Conservation Management Plan (such as the conduct archival recording) would be included in a Statement of Commitments as part of any Part 3A project approval.

Management strategies to be followed in the event that a substantial intact non-aboriginal archaeological relic is unexpectedly discovered would be detailed in a CEMP for the project and include the following:

- 1) All work would cease in the immediate vicinity of the object.
- 2) A qualified archaeologist would assess the significance of the relic.
- 3) The location of any relic would be recorded in accordance with best practices guidelines (as identified by the NSW Heritage Office).
- 4) Based on (2) and (3) above, a report would be written by a heritage specialist detailing the outcomes of the assessment of the new discovery, including recommendations as to re-commencement of work in the affected area.

More detail on the management framework for the discovery of new sites or human skeletal remains during construction is provided in **Appendix M** and would be incorporated into a CEMP for the project.

15.9 Mitigation Measures

Table 15-3 summarises the mitigation measures relating to the heritage assessment.

Table 15-3 Summary of Heritage Mitigation Measures

Mitigation measure	Implementation		
	Planning and design	Construction	Operation
Aboriginal heritage			
Undertake a program of archaeological subsurface testing across a representative sample of the LGPAD1 deposits with the aim of determining the nature and significance of any Aboriginal objects present as detailed in the indicative program and scope of subsurface testing provided in Appendix M . The draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation would be followed.	✓		
If necessary, appropriate management strategies should be formulated to mitigate any development impacts to identified heritage values.	✓		
No development related ground disturbance to discover Aboriginal objects is to occur until this program has been completed.	✓	✓	
The CEMP would be developed and implemented addressing heritage issues. The CEMP would detail the management strategies to be followed in the event that an Aboriginal object or non Aboriginal archaeological relic is uncovered during construction as detailed in the indicative program and scope of subsurface testing provided in Appendix M . In the first instance, all works must cease in the affected area.		✓	
European Heritage			
A pipeline connection with the Upper Canal would: – minimise direct and indirect impacts to the fabric and context of the canal; – be consistent with the provisions of the existing Conservation Management Plan for the Upper Canal (Higginbotham and Associates 2002). – Comply with any heritage impact mitigation actions as required by Conservation Management Plan (such as conducting archival recording)	✓		
	✓	✓	
	✓	✓	
The CEMP would be developed and implemented addressing heritage issues. The CEMP would detail the management strategies to be followed in the event that a substantial intact non-Aboriginal archaeological relic is uncovered during construction as detailed in the indicative program and scope of subsurface testing provided in Appendix M . In the first instance, all works must cease in the affected area.		✓	

Land Use and Property Impacts

Chapter 16

Land Use and Planning – Summary of Key Outcomes

The proposed Development Site is 4.5 km north west of the township of Appin. Land use immediately surrounding the Development Site is predominantly rural enterprises on medium size holdings and smaller rural home sites.

The proposal would result in changes to the land use of the Development Site itself as it is currently used primarily for grazing. The Development Site is located in an area that is zoned Non-Urban and development for the purposes of 'generating works' is permissible with development consent under *Interim Development Order No. 15 City of Campbelltown* (IDO 15).

Mitigation measures detailed in this Environmental Assessment relate to the control of the development's impact on noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters. These mitigation measures would be implemented to ensure that the proposed project is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses.

The potential for interaction of the proposal with new urban development in the region was considered in the context of the NSW Government's plan for the development, the Sydney Metropolitan Strategy and the Metropolitan Development Plan (MDP). It is noted that the Metropolitan Strategy focuses on the South West Growth Centre and the Development Site is not within the boundaries of this growth centre. However, Mount Gilead has been identified in the MDP as potentially providing 1,340 dwellings in the long term. The MDP defines Mount Gilead as an area of approximately 2 km² located approximately 2 km from the Development Site. No other areas closer to the Development Site have been identified in the MDP. It is noted that the Metropolitan Strategy states that lands outside growth centres which are not on the MDP are not targeted for development over the next 25 years. A strategic review undertaken in 2007 which addressed housing demand and land supply in the Macarthur South area determined that Macarthur South was not required to address regional and metropolitan housing needs.

Chapter 16

Land Use and Property Impacts

16.1 Introduction

This chapter describes the land use patterns present in the areas surrounding the proposed Leaf's Gully Power Project and assesses the potential impacts of the construction and operation of the proposal on adjoining land uses. One of the main focuses of this section of the Environmental Assessment is to discuss the land use implications of the proposed Project.

16.2 Existing Land Use – Development Site

The Leaf's Gully Power Project is located in the Campbelltown Local Government Area (LGA). The proposed development site is 14 km south of Campbelltown CBD and 4.5 km northwest of the township of Appin.

The proposed development is to be located within a 280 hectare property (referred to as Leaf's Gully Farm) south of Campbelltown in an area known as Gilead. According to current designs, the power plant is likely to use less than 10 % of the total site acquired by AGL.

The outline of Leaf's Gully Farm and the proposed plant site is presented in **Figure 1-2**.

Leaf's Gully Farm currently operates as a breeding and training facility for horses. **Figure 4-1** shows the existing structures and land uses on the Development Site.

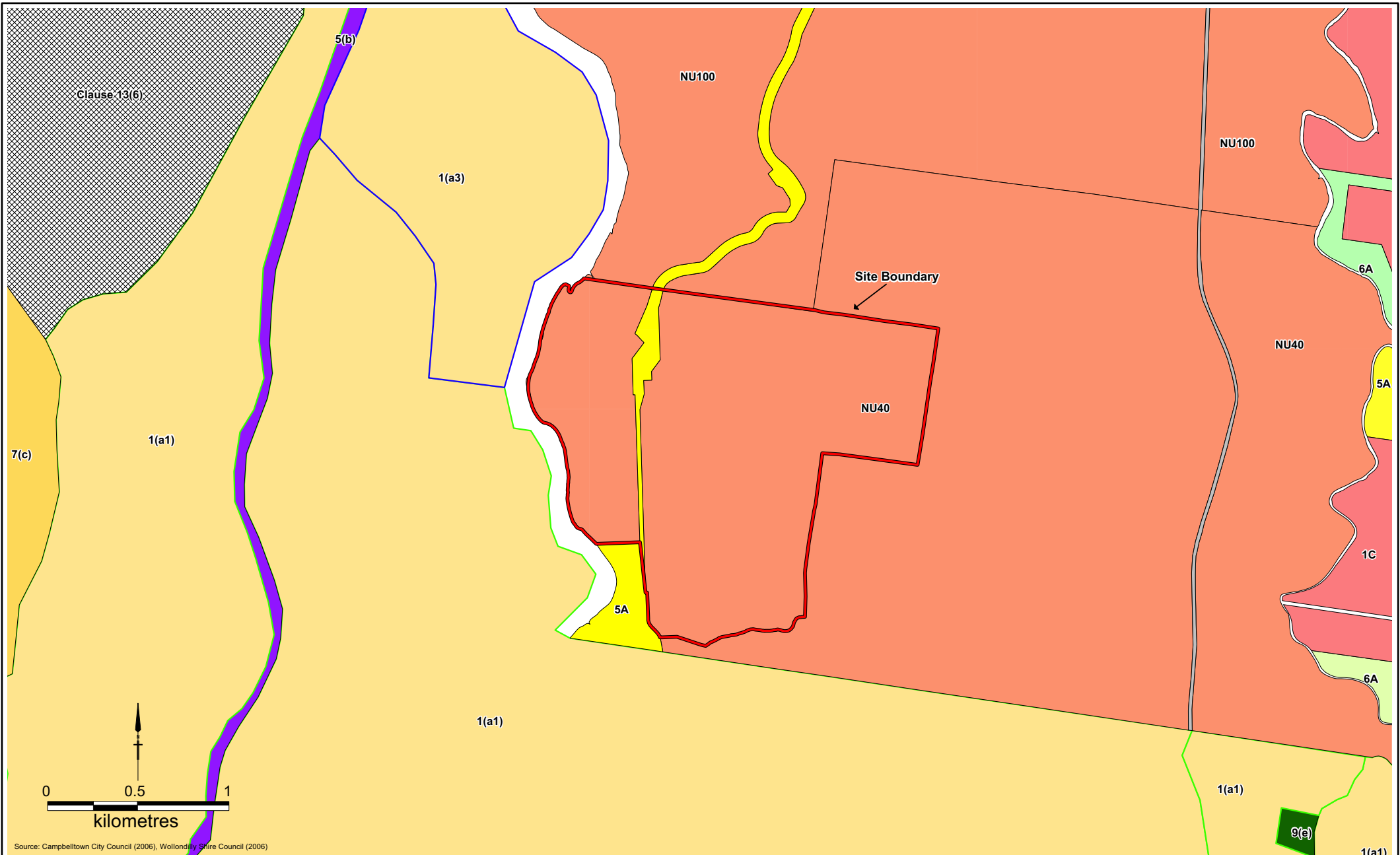
The Development Site is zoned Zone No. 1 Non-Urban Zone under IDO 15. The majority of the land immediately adjacent to the Development Site is zoned Non-Urban or Rural. **Figure 16 -1** identifies the zoning of the Development Site and the surrounding areas.

16.3 Existing Land Use – Surrounding Areas

The Development Site is 4.5 km north-west of the township of Appin. Developments immediately surrounding the Development Site are predominantly rural enterprises on medium size holdings and smaller rural home sites of between 2 and 10 hectares. The existing six residences which are closest to the Development Site are identified in **Figure 12-1**. Inghams Appin Broiler Complex adjoins the southern boundary of the Development Site and the Nepean River forms the western boundary of the Development Site.

The Mount Gilead group of properties is a group of stone buildings, windmill and dam built in the 1820s and also at later periods. These are located on Lot 1 in DP 807555 (Appin Road, Campbelltown) which is approximately 3 km north east of the Development Site. Campbelltown City Council has noted that this group of properties has historical, architectural, archaeological, aesthetic and group significance. The Mount Gilead group is listed in IDO 15, classified by the National Trust (NSW), and listed under the *NSW Heritage Act 1977*. Notwithstanding this, the group is not listed on the State Heritage Register. The heritage aspects of these properties are discussed further in **Chapter 15 Heritage**.

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Legend

	1(c) Rural "C" (Small holdings)		NU100 Non Urban (100 hectares minimum subdivision requirements)		5(b) Special Uses 'B' - Railways
	5(a) Special Uses "A"		NU40 Non Urban (40 hectares minimum subdivision requirements)		7(c) Environmental Protection 'B' (Soil Conservation)
	6(a) Open Space (Existing Recreation)		1(a1) Rural 'A1' (40 ha minimum)		9(e) Regional Open Space 'E' (Reservation)
	Road		1(a3) Rural 'A3' (100 ha minimum)		Land Referred to in Clause 13(6)

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title ZONING SURROUNDING PROPOSED SITE	
	Drawn: AJW		Approved: FINAL	Date: 22.06.06	
	Job No: 43177401		File No: 43177401-019.wor		
Figure: 16-1					

Chapter 16

Land Use and Property Impacts

'Meadowvale' is an early Hume house with colonial characteristics. It is located on Lot 1 in DP 602888 which is approximately 1.5 km north east of the Development Site. Council notes that it is listed under IDO 15 and is classified by the National Trust (NSW). This property is discussed further in **Chapter 15 Heritage**.

The current residential development within the region of the project extends as far as the suburbs of Rosemeadow (approximately 7 km north of the Development Site), St Helens Park (approximately 7 km north-east of the Development Site) and Airds (approximately 10 km north-east of the Development Site) and on the west of the proposed project site, Menangle Park (approximately 5 km from the Development Site).

16.4 Land Use Issues Arising From Consultation

Extensive consultation with adjacent landowners as well as with the general community was conducted leading up to and during preparation of this Environmental Assessment. Some adjacent landowners indicated they had invested in the area on the basis of potential for future subdivision for housing in the long term. Conversely, some landowners indicated their preference for the area to retain its rural character. The general attitude of the community was that most lived in the area for its semi-rural lifestyle.

16.5 Potential Existing Land Use Conflicts

16.5.1 Construction Phase Impacts and Mitigation Measures

The main potential for impacts of construction activities on surrounding land uses include:

- air quality;
- traffic flow effects;
- noise impacts; and
- flora and fauna.

The potential impacts of the construction phase of the proposed development on surrounding land uses are discussed in relevant chapters of the EA, including **Chapter 7 Air Quality**, **Chapter 9 Soils, Geology and Groundwater**, **Chapter 11 Traffic and Transport**, **Chapter 12 Noise and Vibration** and **Chapter 13 Flora and Fauna**. The potential effects of the proposed construction activities on surrounding land uses are briefly summarised below.

Land Use and Property Impacts

Chapter 16

Air Quality

A range of dust suppression measures and erosion and sedimentation controls would be implemented during the construction phase of the proposed power station. These controls would be incorporated in a construction soil and water management plan to be developed as part of the Construction Environmental Management Plan (CEMP).

Soils and Geology

A soil and water management plan would include procedures and controls to ensure that water runoff from construction activities is minimised, contained and disposed of appropriately (if required), and to prevent chemical spillages from construction equipment from entering water channels.

Traffic and Transport

A separate right turn lane priority intersection is proposed to be constructed at the Appin Road / access road intersection. This type of intersection minimises impact on Appin Road traffic flow and provides a safe area for queuing of right-turning vehicles. The intersection would be constructed in the early stages of the development such that the intersection would be operational for the construction traffic. This would minimise the impact from construction traffic on local traffic. There would be a short period of disruption to traffic flow while this intersection is constructed, however a Traffic Management Plan would be developed and implemented to minimise this impact.

It is proposed to extend the right turn opportunity to include a separate lane access for a property driveway on the eastern side of Appin Road located opposite the access road for the Development Site. This measure would have a positive impact for land use on this property and for other road users and is described in more detail in **Chapter 11** *Traffic and Transport*.

Noise

The construction of the proposed development is not expected to have significant noise impacts upon local residents. During the construction phase some localised and temporary noise impacts may occur. A preliminary assessment of noise during the construction phase shows no exceedances at the existing residential receivers. Implementation of noise mitigation measures to be included in a CEMP would minimise construction noise impacts.

Flora and Fauna

A Weed and Pest Management Plan, developed as part of the CEMP for the Site, would minimise the impacts of the development on flora and fauna during construction. The plan would include active control of feral animals (primarily foxes and rabbits), and Blackberry and Lantana. Detailed landscape plans would be developed as part of the CEMP with reference to the University of Western Sydney's Koala Research Project and (when released by Campbelltown City Council), the Campbelltown Koala Management Plan. Implementation of these mitigation measures would ensure that the proposed Project would not have any impact on surrounding land use from a flora and fauna perspective.

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Land Use and Property Impacts

16.5.2 Operation Phase Impacts and Mitigation Measures

The main potential for environmental impacts associated with the operation of the proposed power station on surrounding land uses include:

- air quality;
- noise impacts;
- visual impacts;
- traffic flow effects;
- water management;
- hazard; and
- bushfire hazard.

The potential impacts of the operational phase of the proposed power station on surrounding land uses are briefly summarised below but are discussed in greater detail in relevant chapters of the Environmental Assessment, including **Chapter 7 Air Quality**, **Chapter 10 Landscape and Visual**, **Chapter 11 Traffic and Transport**, **Chapter 12 Noise and Vibration**, **Chapter 13 Flora and fauna**, **Chapter 14 Water Management** and **Chapter 18 Preliminary Hazard Analysis** and **Chapter 19 Bush Fire Assessment**.

The proposal would result in considerable changes to the land use of the site itself as the site is currently used primarily for grazing. However, the proposed site is zoned for Non-Urban uses and development for the purposes of 'generating works' is permissible with development consent in the Non-Urban Zone under IDO 15.

The proposed project has a lifespan of 30 operating years. Operation of the project is not likely to have a significant impact on surrounding land uses due to the operating hours (up to 15 % of the year) of the power station and the large buffer between the proposed plant and surrounding residences.

Air Quality

The regional air quality assessment did not show any substantial adverse impacts on photochemical smog formation that may be produced as a result of operation of a power plant. The results of the worst case dispersion modelling for local air quality showed that ground level concentrations of NO₂, PM₁₀, CO and SO₂ were below the NSW DECC criteria; and VOC, including PAH were found to be below the NSW DECC criteria. In conclusion, the assessment considered that the impacts on local air quality from this development will be minor and adverse impacts are unlikely for surrounding land uses.

Land Use and Property Impacts

Chapter 16

Water, Soils and Geology

Mitigation measures would be employed to minimise the erosion of soils during construction such that discharge from the sedimentation pond would be through an appropriately designed dissipating structure to minimise soil erosion potential in Leaf's Gully. Appropriately bunded areas would be established for storage of fuels, oils and chemicals and areas within the operational plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater. Implementation of these measures would minimise adverse impacts on surrounding land uses.

Wastewater volumes have been estimated and management strategies developed to maintain zero discharge from the site except for natural surface flows and ensure minimal impact on surrounding land uses.

Landscape and Visual

The Landscape and Visual Assessment concluded that the proposed project would have a low visual impact on people in areas surrounding the site due to a range of measures including:

- screening from existing trees and natural landforms;
- restricting the views to the stacks to upper portions of the stack structures;
- using materials and colours to minimise the visual contrast;
- visual screening from the earth mound and associated tree planting to the north and north east of the site and supplementary planting which would also provide beneficial visual screening to potential views from the west and east of the site;
- lighting design which would avoid direct line of sight from residences that are located to the east and west of the site; and
- no visible emissions would be discharged from the turbine stacks.

The implementation of the above measures would minimise the impact of the proposed Project on surrounding land uses.

Traffic and Transport

The traffic and transport assessment found that the arterial road network can satisfactorily and safely accept the additional traffic generated by the proposed development during the operational and maintenance phases provided a separate right turn priority lane is construed at the Appin Road / access road intersection. This type of intersection minimises impact on Appin Road traffic flow and provides a safe area for queuing of right-turning vehicles. It is proposed that the right turn opportunity be extended to include a separate lane access for a property driveway on the eastern side of Appin Road located opposite the access road for the site.

Chapter 16

Land Use and Property Impacts

Noise

No exceedances of operational noise have been predicted for the existing six residences. Mitigation measures are proposed that are not considered excessive and are considered to be relatively easily achieved. Further information with respect to design would be provided during the detail design assessment once the final selection of the turbine is complete.

Flora and fauna

A Weed and Pest Management Plan developed as part of the OEMP for the site would minimise the impacts of the development on flora and fauna during operation. The plan would include active control of feral animals (primarily foxes and rabbits), and Blackberry and Lantana. Detailed landscape plans would be developed as part of the OEMP with reference to the University of Western Sydney's Koala Research Project and (when released by Council) the Campbelltown Koala Management Plan. Implementation of these mitigation measures would ensure that the proposed project would not have any impact on surrounding land use from a flora and fauna perspective. Replanting on-site would also create corridors for linkages to the Campbelltown Koala population. These plantings could be integrated with other ecological linkages proposed in the area.

In addition, AGL are proposing to establish a Conservation Area within the Development Site of approximately 170 ha. The land would be re-titled for conservation purposes in consultation with DECC, either through a Voluntary Conservation Agreement (VCA), a Biobanking Agreement, or some other enduring protection mechanism. A decision on which conservation mechanism is to be adopted would be made following the determination of the project and would depend on whether the Biobanking Scheme is operational and details of that Scheme.

Hazard

The hazard assessment concluded that the risk associated with the gas supply pipelines is well below all current criteria for new development and is contained well within site boundaries. The risk of injury at the nearest residential area is well below the criterion for new installations. The risk of propagation of an incident at the power station does not encroach into any other industrial areas. The risk of fatality does not extend to any residential area and is well within the criteria for business / industrial areas. It is therefore considered that the proposed plant does not have a significant impact on societal risk. Despite the conservatism built into the risk assessment, the results show that the risk associated with this development is very low. The proposed project complies with the most stringent risk criteria stipulated by the DoP, are adhered to and therefore the project does not pose issues for the surrounding landholders.

Bush Fire Hazard

An Asset Protection Zone has been incorporated into the parameters for siting the proposed facility. A Bush fire Management Plan would be prepared and implemented for the Development Site. Implementation of these measures would minimise the potential risk of bush fire impact on surrounding land uses.

Land Use and Property Impacts

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The key elements to bush fire protection on the Development Site would be set out in a Bush fire Management Plan for the site and would comprise:

- Asset Protection Zones (APZs) which involves maintenance and clearing of fire breaks;
- installation of reticulated mains water (or tank water) with hydrants around the perimeter of the facility (for fire fighting purposes);
- allowance for access for fire fighting vehicles;
- allowance for a 'defendable space';
- design and management of proposed landscaping to avoid creation of a new bush fire hazard; and
- installation of fire protection systems.

16.6 Potential Future Development

16.6.1 Current Land Use Zoning

The current zoning of the Development Site and surrounding land uses is shown in **Figure 16-1**. The site identified for the proposed project is currently zoned as Non-Urban. Development for the purposes of 'generating works', such as the Leaf's Gully Power Project, is permissible in the Non-Urban Zone. The majority of the areas surrounding the Development Site are currently zoned as Non-Urban and Rural. The current zoning of these surrounding areas permits activities such as agriculture, rural housing and open space.

16.6.2 Interim Development Order No. 15

Council has a Local Environmental Plan (LEP2002) that covers the urban area of the city and a number of Interim Development Orders (IDOs) that cover the remaining area¹. There are also numerous other LEP's within Council's local government area that specifically apply to issues such as exempt and complying development. Eventually, Council has indicated that it will undergo a process to consolidate its LEP and IDOs into one planning instrument.

The Development Site is subject to the provisions of IDO15 – City of Campbelltown. The Site is zoned Zone No.1 – Non-Urban under IDO 15.

IDO 15 adopts part of the *Environmental Planning and Assessment Model Provisions 1970* (Model Provisions). The Leaf's Gully Power Project comes within the definition of 'generating works' contained in the Model Provisions. Development for the purposes of 'generating works' is permissible with development consent in the Non-Urban Zone under IDO 15 and therefore the Leaf's Gully Power Project is permissible in the Non-Urban Zone under IDO 15.

¹ Department of Local Government, *The Local Government Reform Program - Promoting Better Practice Review Report – Campbelltown City Council*, September 2004.

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Land Use and Property Impacts

16.6.3 Summary of Development Planning in the Region

The section provides a summary of the development planning in the region and addresses the following strategies, strategic reviews, and policies in the context of implications for the Project:

- Macarthur South Regional Environmental Plan 1991;
- Cities for the 21st Century 1995;
- Sydney's Metropolitan Strategy 2005;
- Metropolitan Development Program; and
- Macarthur South Strategic Review.

Macarthur South Regional Environmental Plan 1991

Regional environmental plans (REPs) cover issues such as urban growth, commercial centres, extractive industries, recreational needs, rural lands, and heritage and conservation. REPs are made under the *Environmental Planning and Assessment Act 1979* and provide the framework for detailed local planning by councils. All REPs are exhibited in draft form for public comment before a final plan is gazetted and becomes legal.

The DoP website discusses the Macarthur Rural Lands Draft REP and states that it will not proceed as its principles are being adopted in local plans².

The Macarthur South Regional Environmental Study (RES) examined the suitability of the existing environment for urban development. The RES concluded that there appear to be significant environmental constraints on the scale and form of the development which could be acceptable for Macarthur South. These environmental constraints relate to effluent disposal, air quality issues and methane gas drainage.

The Macarthur South RES was exhibited 14.10.91 to 20.12.91³. The DoP website states that the Macarthur South RES was “Deferred” and notes in the context of the abstract that the Macarthur South RES: *“Examines the suitability of the existing environment for urban development and suggests a possible strategy for future development of the Macarthur South area. The study concludes that major urban development should not proceed until issues of water quality in the Hawkesbury–Nepean River, air quality in western and south-western Sydney and coal mining conflicts with urban development have been satisfactorily resolved.”*

A more recent strategic review conducted in 2007 for the Department of Planning noted that “A recent internal DoP review of Macarthur South (DoP 2007) notes that since the release of the Macarthur South RES there have been changes to the information it was based on, and changes to the Government's approach to urban development and infrastructure provision.”⁴ This study is discussed in more detail below.

² <http://www.planning.nsw.gov.au/planningsystem/rep2.asp>

³ <http://www.planning.nsw.gov.au/planningsystem/rep2.asp>

⁴ APP Corporation Pty Ltd, Macarthur South Strategic Review for Department of Planning, September 2007, page 12

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Cities for the 21st Century 1995

The NSW Government released the *Cities for the 21st Century* in 1995. The Strategy intended to represent a whole of government approach to integrated urban management for the following 20 years.

One of the key principles was “*more compact cities – taking up less land, getting more out of new and existing land and infrastructure...*”. The discussion on providing more housing opportunities states that the 1998 Metropolitan Strategy identified a number of areas which would need to be developed, of which Macarthur South was one. However, the discussion continues that

“The compact city and recognition of new information now available particularly on environmental factors indicates that only opportunities in Warnervale, South Creek Valley, Bringelly and Rouse Hill will now need to be evaluated, at least until towards the latter years of this Strategy....Macarthur South will need to be managed as a long term urban potential area. This will involve some measure of control of land fragmentation, but will permit investing in existing activities and, in the case of Macarthur South timely management of underlying gas and coal resources.”

Sydney's Metropolitan Strategy 2005

The NSW Government released their plan for the development of Sydney over the next 25 years from 2005 in the *City of Cities: A Plan for Sydney's Future*, (NSW Government 2005).

The Metropolitan Strategy states that its intent is to guide the process of planning for where people will live and work in Sydney to 2031 and that it sets strategic directions for Government decisions on the timing and location of investment in transport and other infrastructure. The Metropolitan Strategy is intended to guide major decisions and plans by State and Local government and inform private sector investment. The Metropolitan Strategy is designed to allow decisions on new areas for housing and jobs, roads and public transport, local schools and hospitals.

The introduction to the Metropolitan Strategy document states that a major overhaul of the NSW planning system was announced in 2004⁵. The reforms aimed, amongst other things to focus on strategic planning for growth areas.

One of the eight key elements of the Metropolitan Strategy is to “*contain the footprint of Sydney*”⁶ with an environmental target to “*Ensure 60–70% of future growth occurs within existing urban footprint.*”⁷

The strategy states in relation to the key element of ‘containing the footprint of Sydney’ that

*“Valued rural and resource lands extending to the Nepean–Hawkesbury and foothills of the Southern Highlands will be recognised and protected. New land will not be released for urban development unless it meets the Government's sustainability criteria. Sydney's green areas will continue to provide habitat for native animals, food and other raw materials for Sydney and recreational opportunities for residents and visitors. Western Sydney's diverse plants and habitat will be protected.”*⁸

⁵ NSW Department of Planning, *Metropolitan Strategy*, 2005, Introduction, page 12.

⁶ NSW Department of Planning, *Metropolitan Strategy*, 2005, Introduction, page 8.

⁷ NSW Department of Planning, *Metropolitan Strategy*, 2005, Environment and Resource Lands, page 209.

⁸ NSW Department of Planning, *Metropolitan Strategy*, 2005, Introduction, page 8.

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This key element of the Metropolitan Strategy highlights that an area will not be released in the future (post 2031) unless the area goes through the process of demonstrating it can meet the Government's sustainability criteria.

It should be acknowledged that the Metropolitan Strategy further states that

*"Rural and resource lands are those places beyond the city's urban areas. They are working lands which support diverse rural industries such as agriculture, extractive industry and mining and hold values that contribute to Sydney's quality of life. They are not land 'in waiting' for urban development."*⁹

In June 2005 the NSW Government released detailed plans for new growth centres in the north west and south west of Sydney. The NSW Government has also developed a State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (SEPP) and related documents for the Growth Centres. The SEPP is a technical document that sets out the statutory plans and processes that apply in the Growth Centres.

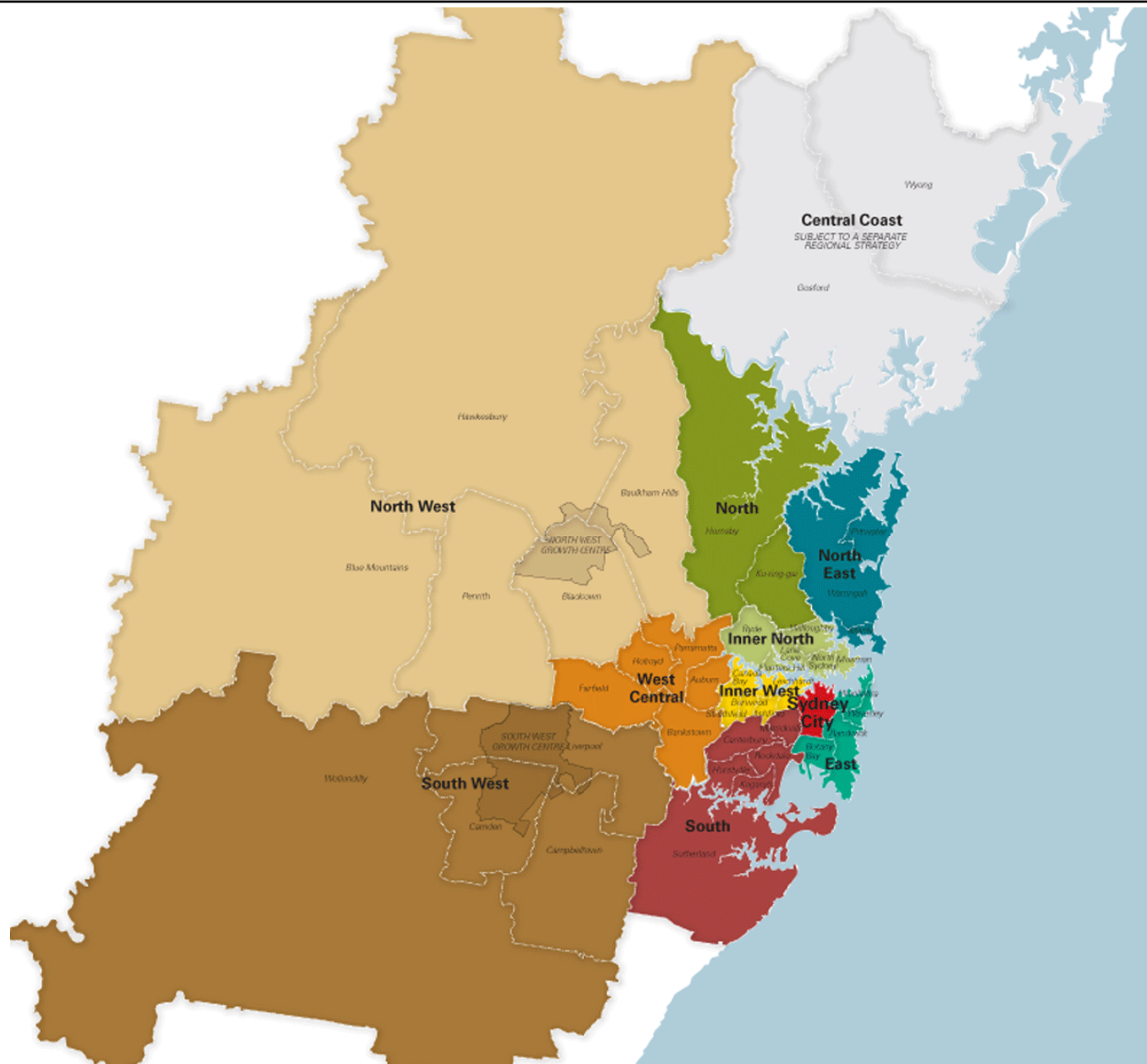
The Metropolitan Strategy states that subregional plans are developed as an intermediate step in translating the Metropolitan Strategy. The subregional plans provide the spatial basis for preparing and assessing local plans as well as specific projects.

The section of the Metropolitan Strategy that specifically deals with the proposed project site area is the South West Sub Region (refer to **Figure 16-2, 16-3 and 16-4**). The South West Sub Region, in the Metropolitan Strategy, has a target of:

- 40,000 new dwellings in existing areas;
- 100,000 dwellings in the South West Growth centre;
- 15,000 dwellings in other green fields; and
- 80,000 new jobs.

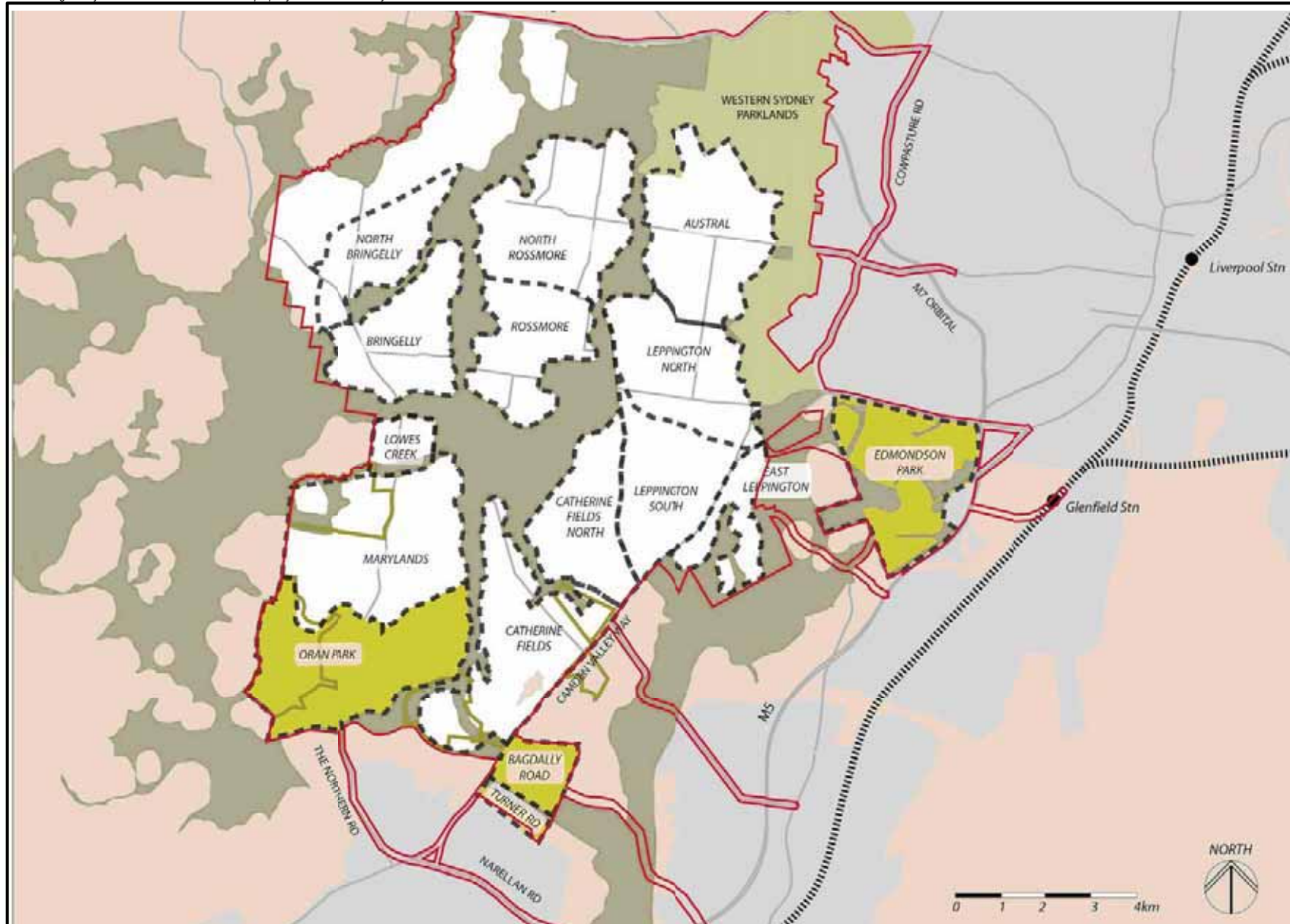
The South West Subregional Strategy was completed in November 2007 and placed on public exhibition between 14 December 2007 and 28 March 2008. The South West Subregional Strategy identifies the majority of land release in the South West Growth Centre and identifies Liverpool as a regional city, Campbelltown – Macarthur as a major centre and Appin as a small village. Mount Gilead is identified as a land release area. This is the closest proposed development area to the proposed Leaf's Gully Power Project and is located approximately 2 km away. No other potential release areas are identified surrounding or within the vicinity of the Development Site.

⁹ NSW Department of Planning, *Metropolitan Strategy*, 2005, Environment and Resource Lands, page 206.



Source: Department of Planning 2005

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title METROPOLITAN STRATEGY GROUPINGS OF SUBREGIONS
	Drawn: BH Approved: FINAL Date: 06.06.06 Job No: 43177401 File No: 43177401.072.wor	Figure: 16-2



LEGEND

- SW Growth Area
- Western Sydney Parklands
- Landscape & Rural Lifestyle Area
- SW Growth Precincts

RURAL HOMESTEAD DRAFT HERITAGE CURTILAGES UNDER INVESTIGATION

There are a number of significant rural homesteads in the South West Sector. The NSW Heritage Office and DIPNR have identified draft heritage curtilages to ensure the heritage and cultural significance is protected.

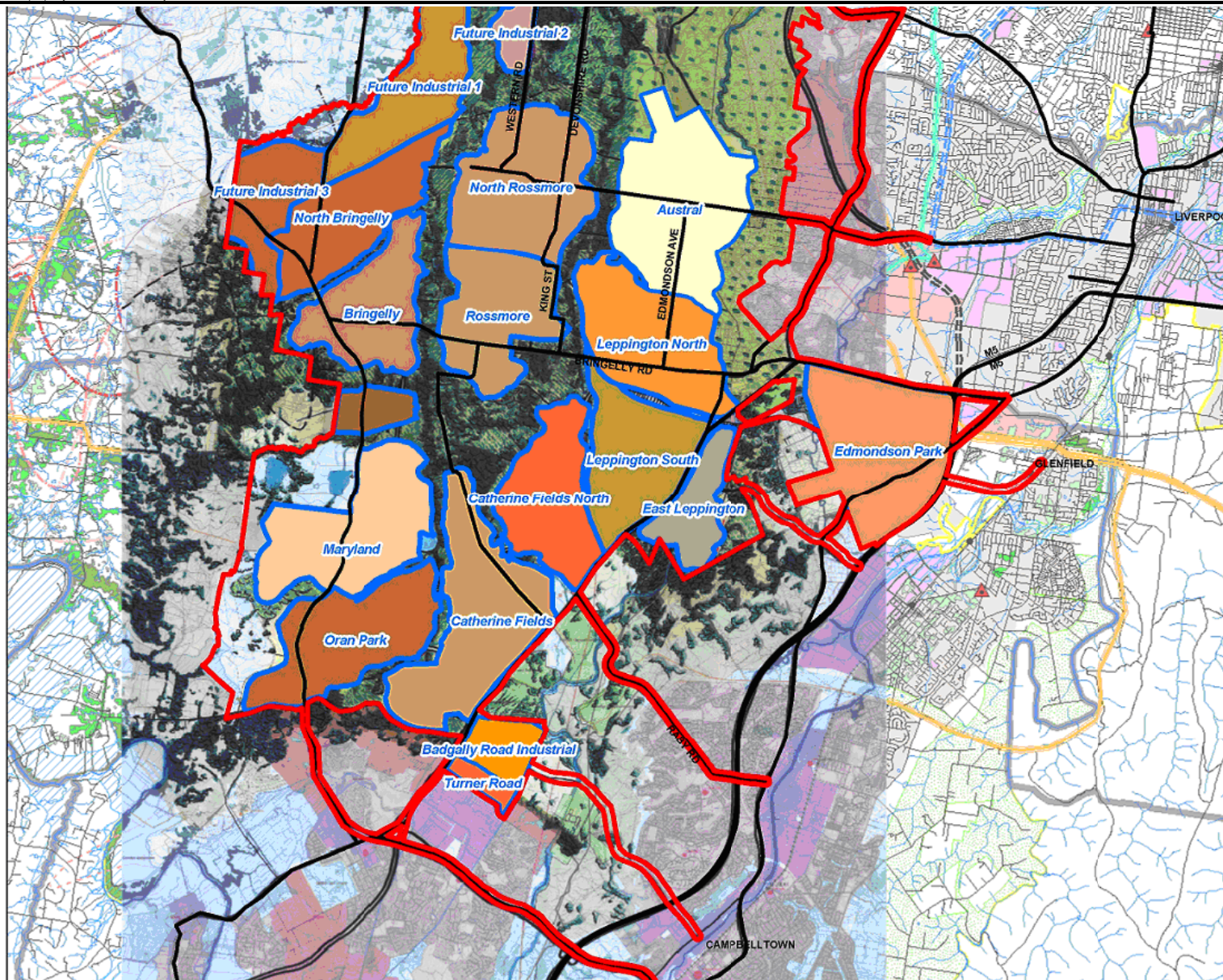
The purpose of the curtilages is to ensure any development within this area is sympathetic with the significance of the rural property.

The draft heritage curtilages will eventually be listed on the State Heritage Register.

FIRST PRECINCTS FOR RELEASE

These Precincts have been identified by the NSW Government as immediate release areas.

Source: NSW Department of Planning		Client AGL POWER GENERATION (NSW) URS	Project AGL LEAFS GULLY POWER PROJECT EA	Title SOUTH WEST METRO STRATEGY DEVELOPMENT AREA	
			Drawn: AJW Approved: FINAL Date: 07.07.06 Job No: 43177401 File No: 43177401-025.wor	Figure: 16-3	Rev: A A4



Legend

- SW Growth Centre Boundary
- Future Precinct
- Existing Urban Areas

Client

**AGL POWER
GENERATION (NSW)**

URS

Project

**AGL LEAFS GULLY
POWER PROJECT EA**

Drawn: AJW

Approved: FINAL

Date: 07.07.06

Job No: 43177401

File No: 43177401-025.wor

Title

**SOUTH WEST SECTOR
PRECINCT - METRO STRATEGY**

Figure: 16-4

Rev: A

A4

Chapter 16

Land Use and Property Impacts

Metropolitan Development Program

The NSW Government has, since the early-1970s through its urban development program, maintained the supply of new home sites to accommodate Sydney's growing population. In December 2001 the Government announced the creation of the Metropolitan Development Program (MDP) to achieve better urban outcomes. Where the Metropolitan Strategy identifies the broad scale and direction of the long term expansion of the urban area, part of the MDP's function is to monitor and forecast land supply in metropolitan Sydney and Central Coast.

The MDP aims to create closer links between infrastructure planning and funding, new land being investigated and brought forward for urban release in western Sydney, new organisational structures and new land release processes. The MDP aims to assist in realising the NSW Government's long term vision for Sydney. The directions for growth are outlined in the Metropolitan Strategy, related subregional strategies and north-west and south-west growth centre plans.

The MDP is the Government's key program for managing housing supply and assisting in coordinating infrastructure provision. The program covers both infill sites in existing urban areas as well as the release of land not previously urbanised, known as greenfield areas, typically on the metropolitan fringes. By overseeing the release of new home sites, the NSW Government intends to ensure new suburbs and redeveloped sites have adequate services and amenities, such as water, electricity and open space, along with adequate funding committed for regional facilities such as public transport, roads, schools and health facilities.

MDP forecasts were prepared in 2003, 2004 and updated in 2007. Each forecast is discussed below with respect to the Leafs Gully Project.

2003

The MDP Residential Forecasts 2003/04 - 2012/13 (DoP 2003) identifies future residential areas and categorises the dwelling supply into Historical (1998/99-2002/03), Short Term (2003/04 – 2007/08) and Medium Term (2008/09-2012/13). Within proximity of the Proposed Site, the 2003 MDP identifies Mount Gilead (Area 4.20) as a potential release area identifying a potential 1,340 dwellings. It identified that the area would not be released in the medium term. It identifies the Mount Gilead release area as having potential as a greenfield release area in the long term, at least after 2013.

This is the closest proposed development area to the proposed Leafs Gully Power Project and is located approximately 2 km away. No other potential release areas are identified surrounding the site or within closer vicinity.

2004

The MDP Residential Forecasts 2004/05 - 2013/14 (DoP 2004) identifies future residential areas and categorises them into Historical (1998/99-2003/04), Short Term (2004/05 – 2008/09) and Medium Term (2009/10-2013/14). The 2004 MDP similarly identifies Mount Gilead (Area 4.20) as a potential release area in the long term and therefore updates timeframe to beyond 2013/14, extending the 2003 forecast of 2013. No other potential release areas are identified surrounding the site or within closer vicinity.

Land Use and Property Impacts

Chapter 16

2007

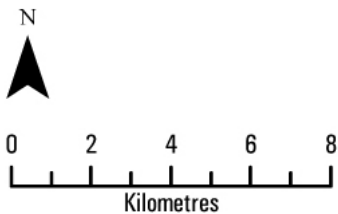
In February 2007, the DoP released the *MDP 2007 Update* to provide current information on greenfield land and dwelling supply.

As in previous MDP's, this update identified Mount Gilead (Area 4.20) as a potential for 1,340 houses and being currently "*not zoned nor serviced*" (refer to **Figure 16-5** and **16-6**). This is the closest proposed development area to the proposed Leaf's Gully Power Project. The MDP 2007 Update states that the majority of new release areas that will be added to the MDP to meet the Government's benchmark of land for 112,500 potential dwellings will be from the North West and South West Growth Centre and the Central Coast. Mount Gilead, although within the South West Subregion, falls outside the South West Growth Centre. The 2007 Update further states that "*Consideration of additional release areas will be through the Land Supply CEOs Group with approval by the Infrastructure and Planning Cabinet Committee*". The update further states "*the process from a Government decision to release an area to availability of the first new lots for sale by developers typically takes seven to ten years [i.e. 2014 to 2017 if commenced at the time of the update]*".

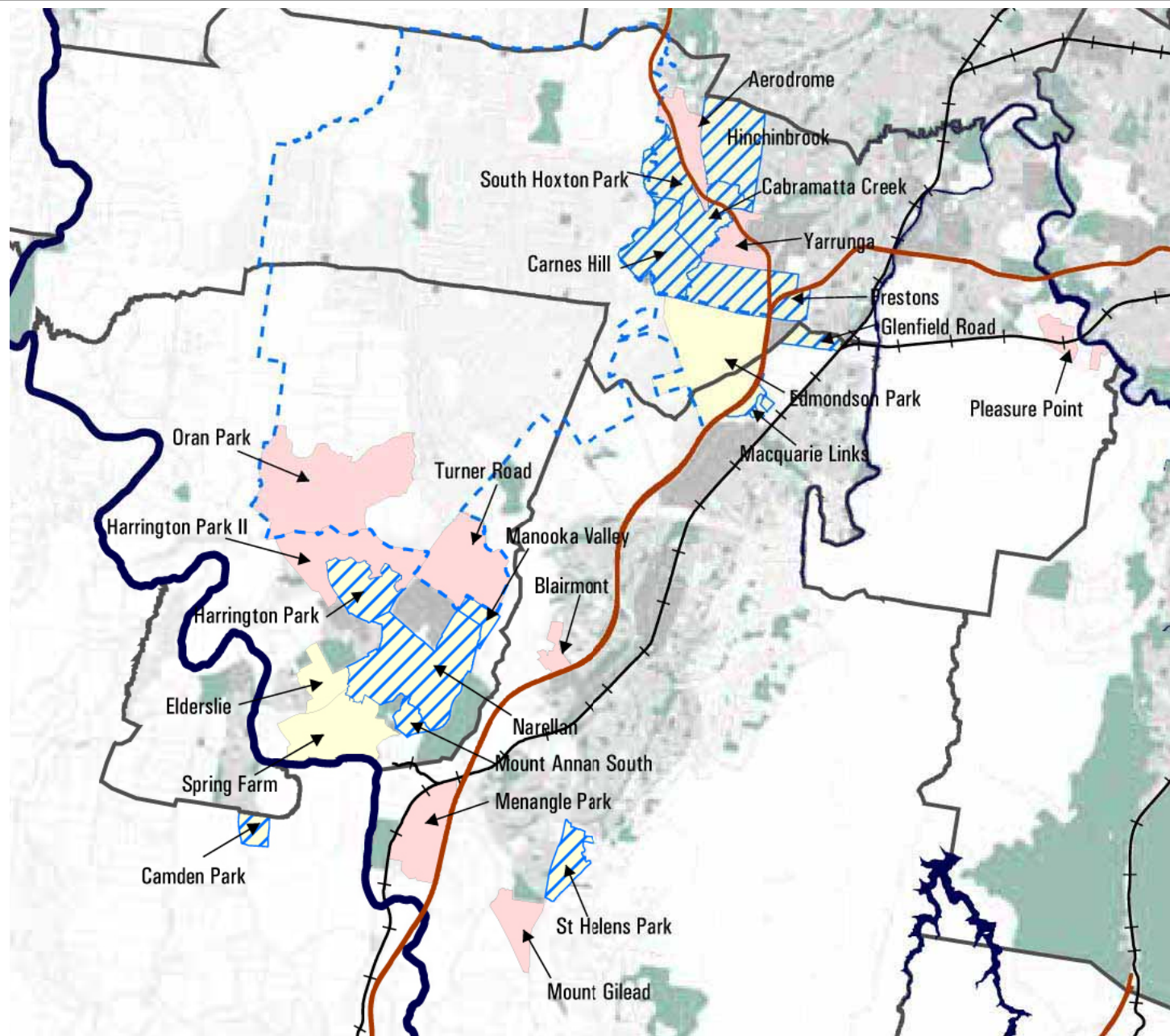
Legend

- Not Zoned nor Served
- Zoned but not Served
- Zoned and Served
- Employment Lands
- Open Space
- Rail Line
- Sewer Treatment Plant
- Freeway
- LGA Boundary
- SW Growth Centre
- NW Growth Centre

NB - Growth centre boundaries are indicative only.

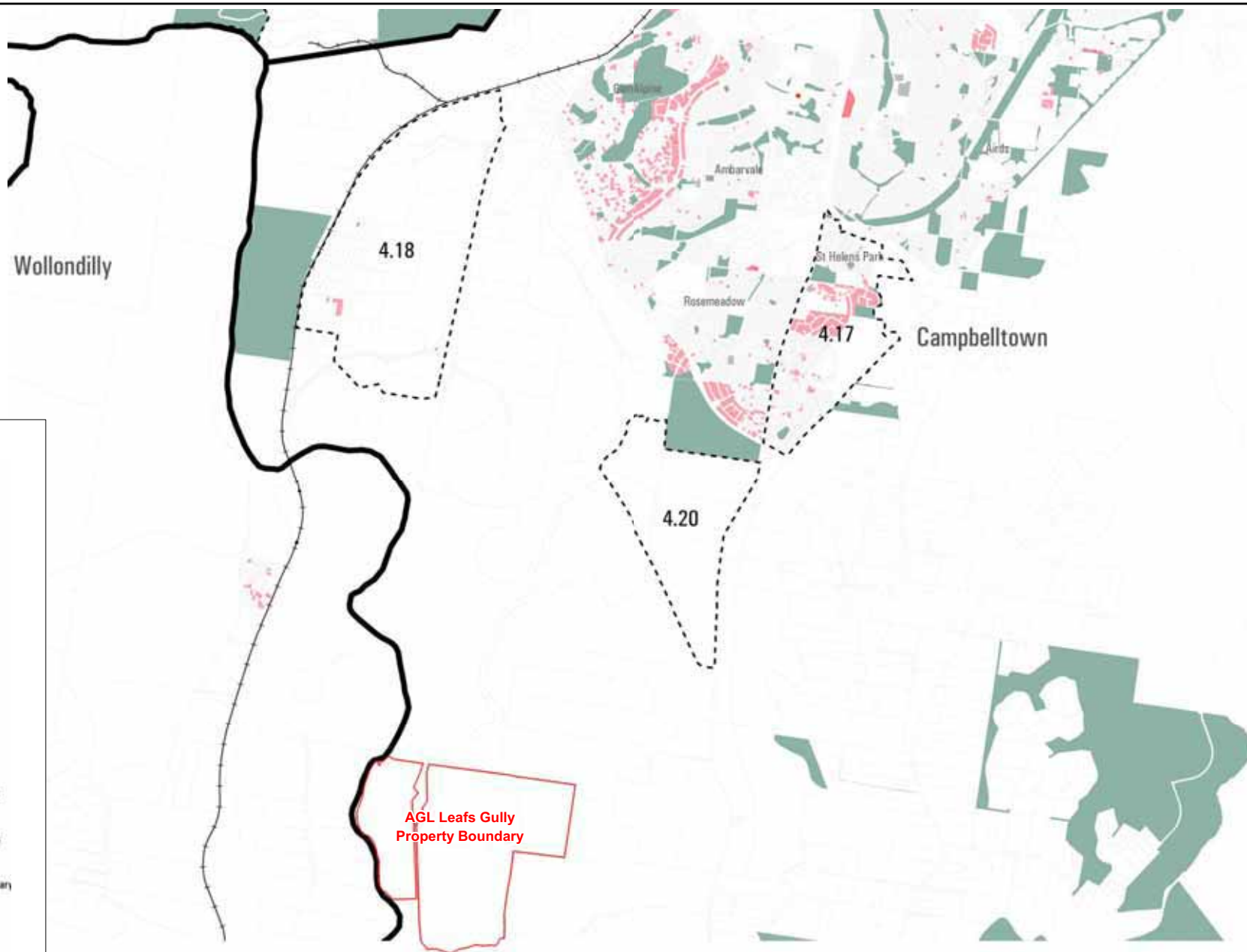
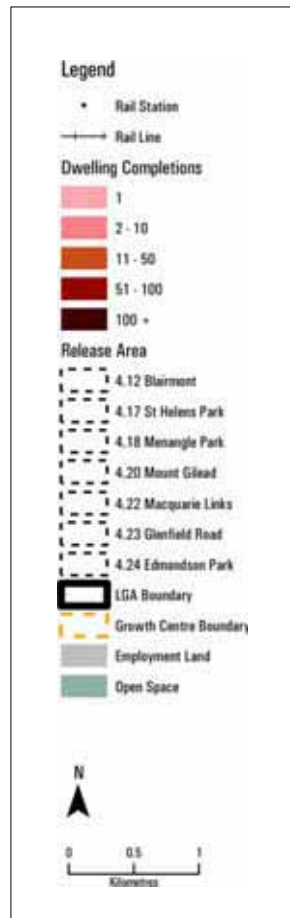


January 2007



Source Department of Planning January 2007

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title METROPOLITAN DEVELOPMENT PROGRAM 2007 UPDATE GREENFIELD RELEASE AREAS
	Drawn: BH Approved: FINAL Date: 1.05.07 Job No: 43177401 File No: 43177401.074.wor	Figure: 16-5



Source Department of Planning January 2007

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title METROPOLITAN DEVELOPMENT PROGRAM 2007 UPDATE CAMPBELLTOWN
	Drawn: BH Approved: FINAL Date: 1.05.07 Job No: 43177401 File No: 43177401.073.wor	Figure: 16-6

Chapter 16

Land Use and Property Impacts

Macarthur South Strategic Review

A strategic review of the Macarthur South area was undertaken for the Department of Planning in September 2007. The strategic review addressed housing demand and land supply in the Macarthur South area. The review determined that Macarthur South was not required to address regional and metropolitan housing needs (APP, 2007). The review stated the following:

- Demand for new housing is at historic lows in south western Sydney, and there are substantial stocks of land available for development in the short to medium term.
- There is already ample competition in the south-western Sydney market.
- Further strategic assessment of environmental issues would be required if the release of the entire area was to proceed but that key issues include managing the impacts on the Nepean River and addressing the relationship between urban development and mining resources¹⁰.

The review also stated that

“Consultation with Government agencies also confirmed that Macarthur South was not on the planning horizon of any agencies¹¹”.

The review developed four options for consideration by the Government ranging from focusing on existing MDP release areas within Macarthur South (i.e. Mount Gilead) and nearby (Menangle Park) through to addition of Macarthur South to the MDP. Option 1, being the existing MDP area of Mount Gilead and Menangle Park, was the preferred option for reasons including the following:

“The land supply and housing demand context does not warrant larger scale additional stocks of land being added to the MDP at this time...”

Government agencies report they are currently focussed on supporting the implementation of the South West Growth Centre. The planning effort required to support large scale release at Macarthur South may compromise effective resourcing for the Growth Centre.

Piecemeal release of selected portions of Macarthur South and potential pressure for further additional release poses risks for coordinated land use and infrastructure planning¹².”

The review further concluded that

“To go beyond Option 1, or possible Option 2 [expansion of Option 1 with two proposed expansions of existing rezoned developments being additional land adjacent to Bingara Gorge and the remainder of the Mount Gilead site and some adjoining DoP and private holdings to the east of Appin Road], at this time would require the entire Macarthur South area to be comprehensively planned to ensure a coherent optimal outcome which would address the broader planning and economic development objectives together with the infrastructure requirements. At this time no compelling need for such planning has been identified.”

¹⁰ APP Corporation Pty Ltd, Macarthur South Strategic Review for Department of Planning, September 2007, page 1

¹¹ APP Corporation Pty Ltd, Macarthur South Strategic Review for Department of Planning, September 2007, page 1

¹² APP Corporation Pty Ltd, Macarthur South Strategic Review for Department of Planning, September 2007, page 2

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Incremental development may demonstrate that it is 'self sufficient' but over time the risk is that the aggregation of these developments will result in inadequate social and transport infrastructure requiring remedial action is inherently more expensive and difficult than orderly and appropriately-timed infrastructure provision.¹³

Implications for the Surrounding Area of the Development Site

The closest proposed development area to the proposed Leaf's Gully Power Project is the Mount Gilead land release area which is located approximately 2 km away. The Mount Gilead area is identified in strategic planning documents as a release area in the long term (at least after 2013). No other potential release areas are identified surrounding the Development Site or within closer vicinity.

The Metropolitan Strategy identifies that any substantially new greenfield area will be required to meet sustainability criteria. It states that *"lands outside the growth centres which are not on the Metropolitan Development Program are not needed for urban development over the next 25 years. This land will be maintained in its current land use for rural activities and resource production. Land will only be identified in non-statutory planning documents for urban investigation where it is the subject of a broad Strategy prepared by the State Government – or strictly as rural town expansions in local strategies¹⁴".*

The conclusions of the strategic review conducted in 2007 (APP, 2007) further supports this with the conclusion that *"Macarthur South was not required to address regional and metropolitan housing needs¹⁵".*

It should be noted that the boundaries of the Metropolitan Strategy are not fixed and may be subject to on-going review by the Department of Planning in consultation with councils and stakeholders, in response to issues such as population and broader demographic needs. The work undertaken in this report has relied on existing planning forecasts for its analysis.

16.7 Potential Future Land Use Conflicts

16.7.1 Underground Mining

The Development Site is located above proposed underground coal mining areas (known as longwalls) at West Cliff Colliery. Land subsidence can occur in locations above longwall mining. As a result the Development Site and surrounding area has been identified in the South Campbelltown Mine Subsidence District. To date, there has been no mining beneath the site, however, there is at least one and possibly two episodes of longwall extraction expected in the future. The current mine plan shows longwall extraction in the Bulli seam continuing over the next five to ten years in the Gilead area. It is unlikely the underlying Balgownie seam will be mined until the Bulli seam is exhausted which is a long term proposition (more than 30 years, as advised by Illawarra Coal, 19 September 2008).

¹³ APP Corporation Pty Ltd, Macarthur South Strategic Review for Department of Planning, September 2007, page 2-3

¹⁴ Metropolitan Strategy, 2005, page 261

¹⁵ APP Corporation Pty Ltd, Macarthur South Strategic Review for Department of Planning, September 2007, page 1

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An analysis has been undertaken in **Chapter 9** *Soils, Geology and Groundwater* to determine the ramifications of possible mine subsidence as part of the geotechnical and foundation conditions assessment. As noted in this chapter, mine subsidence should have no significant effects on the Leaf's Gully Power Project provided adequate design and engineering measures are implemented. Further, the location of the Leaf's Gully Power Project would not conflict with any future underground mining in Westcliff Colliery. The assessment of the impact of mine subsidence included:

- site preparation;
- pavements;
- gas turbine foundations;
- general building foundations;
- gas pipeline connections;
- transmission line connections;
- evaporation ponds; and
- sediment ponds.

These infrastructure requirements are minimal and would have no significant impact on future underground mining in Westcliff Colliery.

16.7.2 Residential Development

The Development Site is zoned Non-Urban Zone and the majority of the land immediately adjacent to the Development Site is zoned Non-Urban or Rural (**Figure 16 -1** identifies the zoning of the Development Site and the surrounding areas).

The potential for future residential development on land surrounding the Development Site is restricted as sub-division restrictions of between 40 ha to 100 ha minimum allotments apply to proposed residential development on land surrounding the Development Site.

There are currently no applications lodged with Campbelltown City Council for the land surrounding the Development Site to be rezoned.

Campbelltown City Council's report entitled '*2001-2021 Population and Household Forecasts*' (Campbelltown City Council, (a)), a number of assumptions were made about forecast land and dwellings for the local government area region between 2001 and 2021. These developments are for the most part residential and include:

- Rural Residential (predominantly Menangle Park) - 4,200 dwellings;
- Campbelltown-Blair Athol - 3,700 dwellings;
- Ingleburn - 2,300 dwellings;
- Glenfield - 1,600 dwellings;
- Minto - 900 dwellings;

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- Leumeah - 570 dwellings;
- Macquarie Fields-Macquarie Links - 430 dwellings;
- St Helens Park - 380 dwellings;
- Woodbine-Blairmount - 350 dwellings;
- Airs - 250 dwellings; and
- Glen Alpine - 200 dwellings.

The Rural Residential category includes the vicinity of the Development Site. However, the residential forecast up to 2021 is dominated by proposed development at Menangle Park. Further the Metropolitan Strategy focuses on the south west Growth Centre (which the Development Site is outside) for the large street proportion of new dwellings.

However, Mount Gilead has been identified in the MDP as potentially providing 1,340 dwellings in the long term. This area is a defined area of approximately 2 km² and is approximately 2 km from the Development Site. No other areas closer to the Development Site have been identified in the MDP. Further the Metropolitan Strategy states that lands outside growth centres which are not on the MDP are not needed for development over the next 25 years. A recent strategic review concluded that *“Macarthur South [which includes Mount Gilead] was not required to address regional and metropolitan housing needs... [and that] consultation with Government agencies also confirmed that Macarthur South was not on the planning horizon of any agencies”*.

Notwithstanding that there is no existing plan for urban development in the area, should the land surrounding the Development Site be re-zoned to permit substantial residential development, the Leaf's Gully Power Project has been planned such that the environmental impacts of the power station would not affect this.

AGL has adopted a conservative approach for this Environmental Assessment and has proposed mitigating measures greater than strictly necessary. In particular, the visual assessment has incorporated a visual screening into the proposed project which would provide screening from the Leaf's Gully Power Station should the neighbouring land be developed. On this basis, it is considered that the Leaf's Gully Power Project would not have a significant impact on the potential for future residential development in the area.

16.8 Implications for Future Land Value

The implications for the surrounding areas both currently and in the future from the proposed Leaf's Gully Power Project are important issues to the local community. There are two main issues that need to be considered in this discussion:

- the effect on the current value of the surrounding lands; and
- opportunity cost of land over the next 10 to 30 years.

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The existing value of land surrounding the Development Site is based on its current use, which as shown is currently zoned as non-urban. However, it has been suggested that part of the current value of the land surrounding the proposed project is based on a belief that within the future this land will be zoned residential, and can hence be developed for housing purposes. This is referred to as a speculative premium. Given the likely timeframes for potential re-zoning and development to occur the speculative premium will be limited at present.

The likely impacts to land values in the short term are forecast to be limited on the basis of existing planning and zoning restrictions and due to:

- the unobtrusive nature of the proposed project given the size of the buffer zones afforded by the Leafs Gully property;
- the limited operational impacts (and operational times); and
- the limited supporting infrastructure requirements.

16.9 Mitigation Measures

The proposal would result in changes to the land use of the site itself as the site is currently used primarily for grazing. However, the proposed site is located in an area that is zoned for Non-Urban and development for the purposes of 'generating works' is permissible with development consent.

Mitigation measures detailed in this Environmental Assessment relate to the control of noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters, as detailed in **Chapter 7** through **Chapter 19**, would be implemented to ensure that the proposal is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses.

Socio-economics Assessment – Summary of Key Outcomes

As part of this Environmental Assessment a socio-economic impact assessment was undertaken to determine the effect of the Project.

The mitigation measures for social impact broadly relate to the mitigation measures relating to the control of noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters. These measures are detailed in **Chapter 7** through **Chapter 19**, and would be implemented to ensure that the proposed Project is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses.

The outcomes of the economic impact assessment highlight that the value added or Gross Domestic Product (GDP) effects of the construction period are \$50.9 million, while the operational GDP effects are \$29.7 million per annum. The annual GDP impact is a result of the low operating cost associated with the Project compared to forecast revenues received. This is not unusual for projects that have a high upfront capital component due to the cost of equipment. Employment effects range from 130 full-time equivalent positions (direct and indirect employment) over the construction period to 19 full-time equivalent positions per year of operations. The effect of this increase in employment on household incomes was predicted to be \$15.8 million over the construction stage and \$0.7 million per annum during the operational period.

The analysis shows positive economic and social benefits at a national level in terms of contribution to GDP, income and employment resulting from the plant construction and operation. It is believed however, that a large proportion of the benefits from the Project would eventuate in the local or state regions. Where possible, local contractors and supply companies would be utilised for the provision of labour and services during the construction phase and subsequent operation and maintenance of the plant.

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Socio Economic Assessment

17.1 Introduction

This assessment aims to analyse the direct and indirect economic impacts of the proposed Leaf's Gully Power Project located in the Campbelltown Local Government Area, NSW. Analysis has been undertaken on the construction and ongoing operation of the power plant development.

The assessment also addressed the social impact of the project in terms of the impacts on population and labour workforce.

The proposed Leaf's Gully Power Project being considered in this report is located in the Campbelltown Local Government Area (LGA) and is approximately 55 km south west of Sydney, 14 km south of Campbelltown Central Business District (CBD) and 4.5 km north west of the township of Appin. As a result of the project location, the following regions are the likely areas to be impacted by the project and will be the focus of socio-economic analysis:

- Campbelltown LGA;
- New South Wales; and
- Australia.

Economic impact analysis has been used to assess the effect of the proposal on the Australian economy level, which encompasses all local, state and national impacts. Economic impact analysis measures the total economic contribution of a project, infrastructure facility, business operation or industry on an economy. In this analysis, the total economic impact of the proposed plant development has been assessed at the construction and ongoing operations stages of development.

The need to address both the current and post-development economic environment after the Project forms the basis for the remainder of this assessment.

17.2 Existing Regional Socio-economic Conditions

The existing socio-economic environment of the proposed project areas is examined in the following section. An understanding of the current situation provides a comparative basis for project impacts as it forms the basis for a 'without' proposed development scenario, which is supplemented by a 'with' development scenario addressed in later sections of this chapter.

17.2.1 Demography

Population

Local, state and national population counts and projections for the areas surrounding the proposed Leaf's Gully Power Project are shown in **Table 17-1**. The populations for all regions are characterised by a pattern of growth continuing until 2026. The population projections for Campbelltown area indicate a compound annual growth rate (CAGR) of 0.8 % from 2001 to 2026, which is the same rate

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of growth projected for NSW over this period. These rates are 0.5 % lower than nationally projected growth, which is forecast at 1.3 % CAGR for Australia over the same 25 year period.

Table 17-1 Population (Census & Projections)

Area	2001 Actual	2006 Forecast	2011 Forecast	2016 Forecast	2021 Forecast	2026 Forecast
Campbelltown	150,150	154,310	164,050	179,240	181,710	181,880
New South Wales	6,575,220	6,868,900	7,164,700	7,450,360	7,734,930	8,012,570
Australia	18,972,350	20,352,013	21,710,086	23,118,693	24,581,902	26,068,251

Source: DIPNR NSW SLA Population Projections 2004; ABS Population Projections Australia 2004-2051

Age Structure

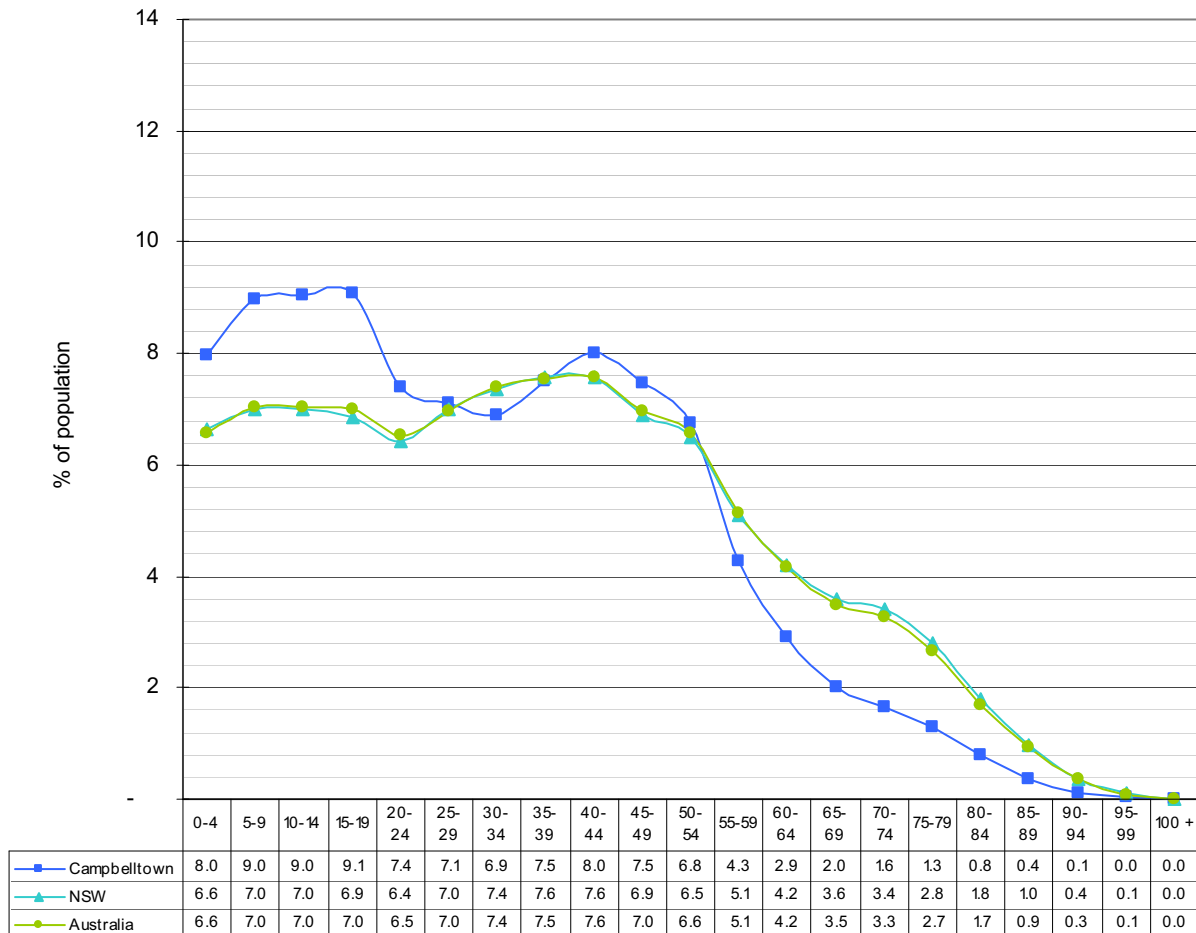
The age structure of the project region based on the 2001 ABS Census is shown in **Figure 17-1**. The largest proportion of the population is 'working age' between 15 - 64 years, ranging from 66 % to 67 % of the total populations. This indicates a positive number of working age residents, which will be analysed further in terms of the actual labour force size in **Section 17.2.2**. Campbelltown has the highest proportion of working age residents, consisting of 67.4 % of the population. NSW and Australia respectively have 65.4 % and 65.8 % of their population being of working age, which is slightly below the Campbelltown proportion though still a majority of the total population.

The figure below also highlights that Campbelltown has the youngest age profile of all regions analysed, with a low proportion of residents in the over 65 age bracket (6.2 % in 2001 compared to 13.0 % in NSW and 12.5 % in Australia), and a high proportion of residents in the under 15 age bracket (26.0 % in 2001 compared to 20.6 % in the state as well as nationally). It is of interest to note that there is a sudden drop in residents aged 20-39 in Campbelltown, which differs from the state and national age trends and may indicate a shift of the Campbelltown region's new school graduates to work and study in other parts of the state or Australia.

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Figure 17-1 Age Structure (2001 Census)



Source: ABS Basic Community Profile 2001

17.2.2 Labour Force

In addition to the age structure discussed above, further analysis of the existing labour force situation is detailed in the following section.

Labour Force Status

The Project's local region, Campbelltown, has a labour force of 67,522, which is 2.3 % of NSW's total labour force. In terms of unemployment levels, the Campbelltown region's unemployment level is 8.5 % of the labour force. This unemployment level is higher than the state and national levels of 7.2 % and 7.4 % respectively based on 2001 census data.

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Table 17-2 Labour Force Status (2001 Census)

Area	Employed	Unemployed	Total Labour Force
Campbelltown	61,813 (91.5%)	5,709 (8.5%)	67,522
NSW	2,748,396 (92.8%)	213,196 (7.2%)	2,961,592
Australia	8,298,606 (92.6%)	660,709 (7.4%)	8,959,315

Source: ABS Basic Community Profile 2001, URS Analysis

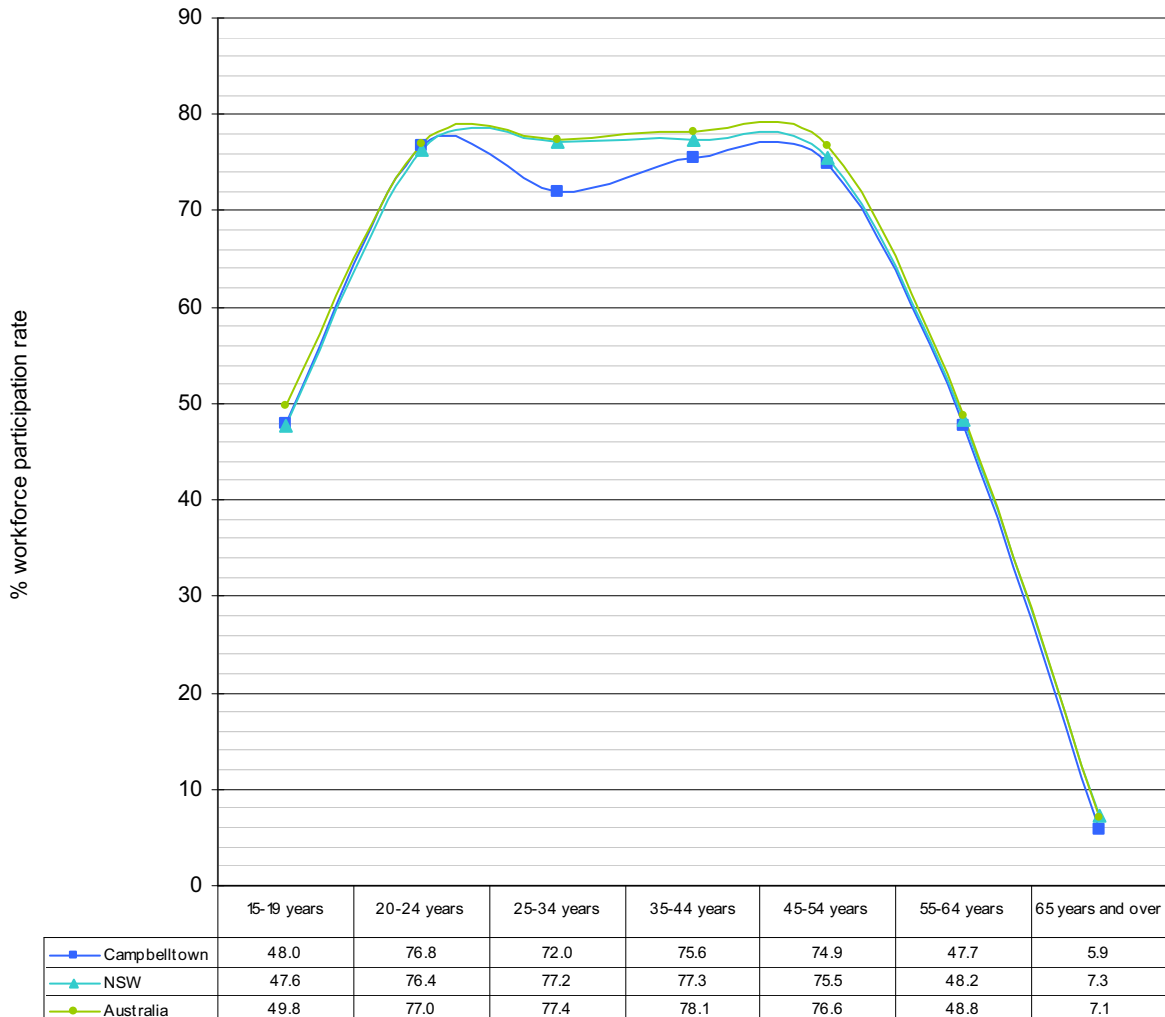
- As the labour force data in **Table 17-2** is sourced from 2001, updated statistics have been identified in order to consider more recent trends in unemployment. Based on the February 2006 *Macarthur Economic Profile*, of which Campbelltown is one of the three Local Government Areas (LGA), the unemployment rate of the Macarthur region was 5.3 % in the September quarter of 2005. This is significantly lower than the 2001 Census level of 8.5 %. In comparison to more recent NSW unemployment levels however, Campbelltown (as part of the Macarthur region) does still have a higher proportion of unemployment, as in June 2006 NSW unemployment was 5.1 %¹.
- Figure 17-2** shows the proportion of workforce participation based on the age of residents in the working population of each of the regions. This diagrammatic representation indicates that on a local, state and national basis the project areas follow a similar trend in terms of the proportion of each age group employed in the workforce. For all regions analysed, the only age groups where less than 50 % of people that age are not employed is from 55 years and over, and from 15-19 years of age. Of note is Campbelltown having a lower proportion of 24-30 year olds employed, with 72 % of this age group participating in the workforce in Campbelltown in comparison to a proportion of 77 % in NSW and Australia. This indicates a higher unemployment level in the 24-30 year age group in the project's local region, and a workforce with a higher proportion of 20-24 and 35-44 year olds.

¹ Source: ABS 2006, cited in Sunday Telegraph 8 June 2006, *Unemployment Drops*, URL: <http://www.sundaytelegraph.news.com.au/story/0,9353,19403206-1702,00.html>

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Figure 17-2 Proportion of Workforce Participation by Age (2001 Census)



Source: ABS Basic Community Profile 2001

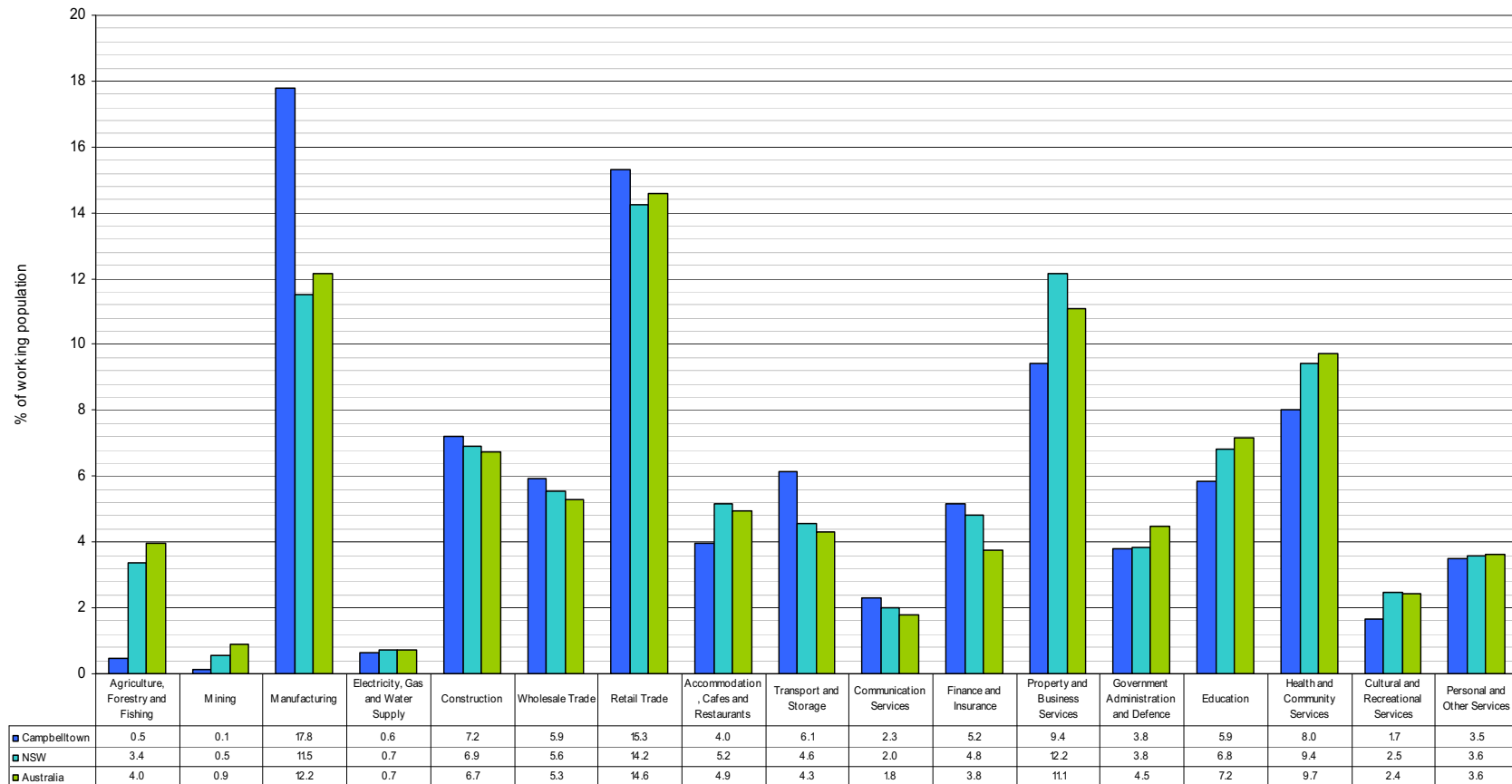
Industry Employment

The major industries in terms of the proportion of the working population employed in different industries are shown in **Figure 17-3** for Campbelltown, NSW and Australia. The two major industries in the Campbelltown region are manufacturing (with 17.8 % of employed persons working in this industry) and retail trade (with 15.3 % of employed persons). This is followed by the property and business services and health and community industries. A similar situation is found in NSW and Australia, with the three major industries also being retail trade, property and business services, and manufacturing. This indicates a focus on manufacturing not only for the proposal's local area of Campbelltown but also throughout the state.

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Figure 17-3 Industry of Employment (2001 Census)

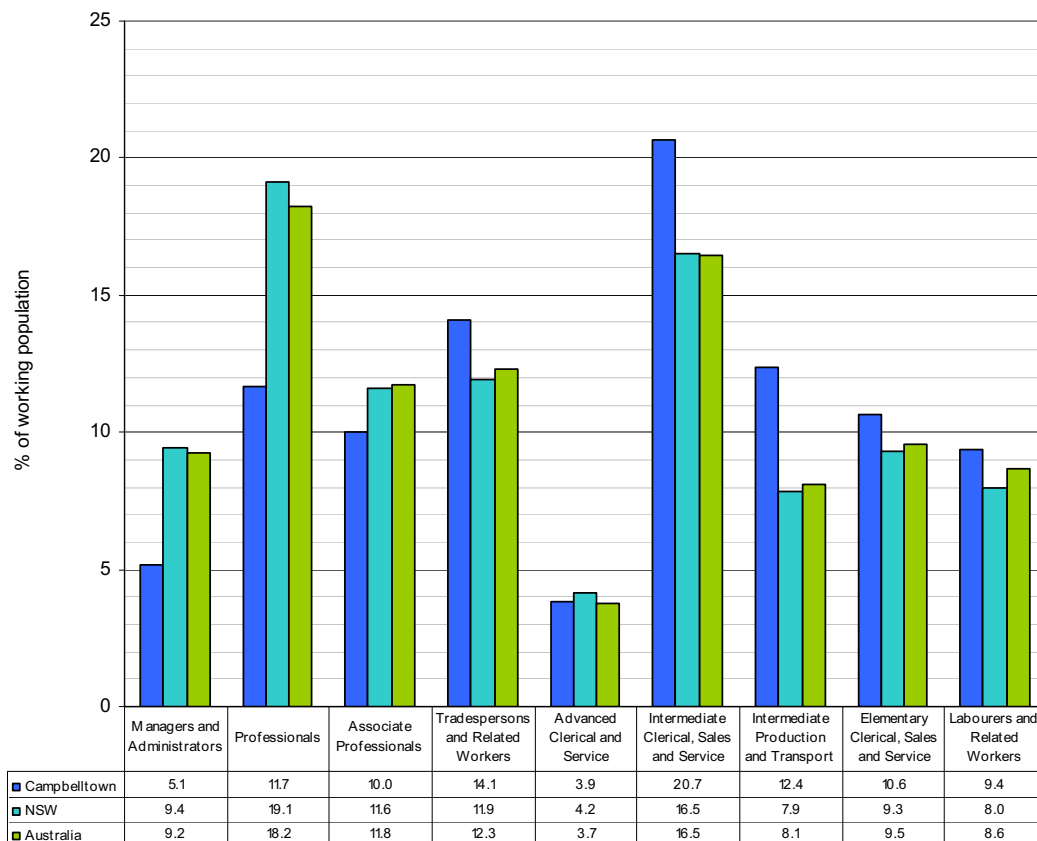


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Further examination of the current labour force in the project area is shown in **Figure 17-4**, which presents the proportion of the working population in a range of occupation categories. This figure indicates that in the project's local Campbelltown area, the two major occupation categories are Intermediate Clerical, Sales and Service Workers (20.7 % of the work force), and Tradespersons and Related Workers (14.1 % of the working population). This is a significantly higher proportion than in NSW or nationally, indicating that the local region has a comparative advantage in this area of employment. It is of note that the Campbelltown region has the highest proportion of the work force employed as tradespersons, labourers and workers. These findings indicate that there are already occupations in the Project's local area similar to those that the Project is likely to employ. Occupations that are the lowest proportion of Campbelltown workers in comparison to the proportions in the state and nationally, are managers and administrators and professionals. In comparison to the project local area, NSW has comparative advantage in Professional and Management occupations, which is likely to reflect the influence of Sydney as a capital city.

Figure 17-4 Occupation of Labour Force Participants (2001 Census)



Source: ABS Basic Community Profile 2001

17.2.3 Social Characteristics

A review of relevant media was conducted to profile the concerns and social characteristics of the broader community within the Campbelltown LGA and Wollondilly LGA. The central community issues arising from this review (Coakes, 2006, presented in **Appendix B**) were:

- concerns about traffic, roads and transport, in particular safety issues around Appin Road;
- issues related to urban development, land releases and housing markets;
- environmental issues; and
- issues associated with housing estates.

The review noted that there has been a strong push for urban development and rezoning in the City of Campbelltown in recent years which has mirrored broader Sydney Metropolitan region trends. This push has resulted in community dispute of heritage value of Campbelltown buildings, such as Glenavlon which has been described by developers as an impediment to the CBD expansion.

Community attitudes to urban development in Campbelltown are variable. Some landholders are eager for non-urban zoned land to be rezoned for urban development, whereas other residents wish to retain the rural characteristics and sense of place of Campbelltown. The community attitudes to urban development in the Wollondilly Shire were variable. Some land holders expressed concern over delays in rezoning from non-urban to residential, whereas other residents were concerned about impacts of urban development, such as decrements to air quality, health and native vegetation.

Media coverage of the Wollondilly area had a stronger focus on environmental issues than Campbelltown, including concerns about impacts to native flora and fauna, Bargo River Gorge, as well as air quality.

The City of Campbelltown is experiencing pressures associated with outward urban development of the Sydney Metropolitan Region. These pressures include problems associated with: transport, roads, infrastructure requirements, local employment and housing estates. Both Appin and the broader Wollondilly Shire have experienced growth in the amount of dwelling types in recent years.

17.3 Issues Raised in Community Consultation

In relation to socio-economic impact of the proposal it was raised in community consultation that there was a perception that industrial development in the area would potentially affect livelihoods and be detrimental to the lifestyle currently afforded by the region.

Other issues were raised in the community consultation that may also be seen as impacts on the social character of the community. However, the impact of the proposed power plant on the lifestyle afforded by the region and social character of the region is a complex issue that is influenced by the impact of different elements of the proposal. Therefore these have been addressed in the separate environmental assessments and mitigation measures identified.

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The potential impacts of the construction phase of the proposed power plant on surrounding land uses are discussed in relevant chapters of the Environmental Assessment, including **Chapter 7 Air quality**, **Chapter 9 Soils, geology and groundwater**, **Chapter 11 Traffic and Transportation**, **Chapter 12 Noise and Vibration** and **Chapter 13 Flora and Fauna**.

If approved, the construction phase of the Leafs Gully Project would be relatively short and span an 18 to 24 month period with employment opportunities, some of whom would be specialist engineering staff.

The potential impacts of the operational phase of the Project on surrounding land uses are discussed in relevant chapters of the Environmental Assessment, including **Chapter 7 Air quality**, **Chapter 8 Health Impact Assessment**, **Chapter 10 Visual Impact Assessment**, **Chapter 11 Traffic and Transportation**, **Chapter 12 Noise and Vibration**, **Chapter 13 Flora and Fauna**, **Chapter 14 Water Management**, **Chapter 18 Preliminary Hazard Analysis** and **Chapter 19 Bush Fire Assessment**.

Once operational, the Leafs Gully Power Project would employ the equivalent of five full-time staff. Population impacts in the region are likely to be minimal given the relatively short construction phase and the low numbers of full-time operational employees.

17.4 Economic Impact Analysis Methodology

Economic impact analysis is typically carried out to determine the impact of a project on economic activity, employment and trade in both the private and public sector. Such studies are useful where the impact of a project needs to be quantified.

An economic impact analysis measures the economic activity generated by a major activity on an economy. The economic impact of an activity or project is usually measured in terms of the contribution to four key economic indicators:

- output (i.e. sales);
- value added (i.e. Gross Domestic Product);
- household incomes (i.e. wages / salaries); and
- employment.
- The economic impacts of the proposed Leafs Gully Power Project have been analysed in terms of these four economic indicators from the perspective of the national economic impact of both the construction and operation phases for the development.

In determining the overall impacts of the proposed plant, a number of steps were undertaken including:

- data research and collection;
- the identification of direct economic impacts;
- synthesis of data and assumption consideration; and
- economic modelling.

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These steps are discussed briefly below.

Data Collection

The first stage of any economic impact assessment is to collect the necessary data. The data requirements include information on revenue streams, operating cost items, capital expenditure, wages and salaries, employment numbers and types, and the sources of expenditure. All project-specific information used in the economic impact assessment has been developed and supplied by AGL, and combined with ABS national data.

Economic Impact Analysis – Direct Impacts

Following data collection, the direct impacts of the project are measured and quantified. Measuring direct impacts requires gathering data on output, expenditure, economic value add, jobs and household income from the project. Importantly, data has been sought on the locality of the source of inputs for each activity generator (i.e. how much of AGL's project expenditure is sourced nationally, rather than imported from overseas).

Direct economic impacts are typically a combination of construction activity and activity that is expected to occur because of the on going operation of the development. In examining the net economic impact of the plant construction and operation, and to ensure not to overestimate the economic impact of the proposed development, the following three impacts were considered in estimating the direct economic impacts of the project:

- **displacement impacts of economic activity** – whereby economic activity is simply relocated from one area to another;
- **substitution expenditure** – simply where demand for one industry's output is switched to another, therefore providing little net stimulus to an economy; and
- **import expenditure** – whereby expenditure is undertaken on imported goods which does not produce economic stimulus to the Australian economy.

Economic Impact Analysis – Flow on/Indirect Impacts

Once the direct impacts have been identified and quantified, the next step involves the measurement of indirect or "flow-on" impacts. Indirect economic impacts are those that are not directly associated with construction and operations of the proposed plant, but are the result of flow on activities. For this project, analysis has been undertaken at a national level, utilising input-output techniques.

Input-output (IO) models are static, short-run models of an economy that utilise multipliers to determine economic impacts. Because they are static, these models assume that a development or activity will not change prices and that all resources required will be available. Input-output models would be described as relatively simple models of the economy. These IO multiplier tables are produced by Government and academic statistical organisations. For the Leaf's Gully Power Project, ABS input-output multipliers for operation and construction have been used to determine the economic impact of the proposal from a national perspective.

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17.5 Economic Impact of the Project

The Leafs Gully Power Project would have an economic impact on the Australian economy in two phases, the construction phase and the on going operational phase. As mentioned earlier, economic impact is typically measured in terms of four key indicators. These include output, value added, household income and employment. The following sections address the two phases in terms of these indicators.

17.5.1 Construction Impacts

In order to determine the direct and indirect economic impacts of constructing the Leafs Gully Power Project, two key pieces of data were gathered from AGL:

- information on the total cost of construction, including breakdowns between labour and materials; and
- information of the geographic source of key labour and material inputs (i.e. from national sources or imported from overseas).

Based on this information, a model could be developed of the economic impacts of the construction phase of the project. The construction of the Leafs Gully Power Project is estimated to take 18 to 24 months.

It has been assumed that conservatively approximately 50 people would be employed during construction (with 50 employment opportunities). The proportion of expenditure on capital inputs that are made within the national economy compared to those imported from international sources has been provided by AGL. The majority of capital equipment and design are assumed to be imported from outside of the Australian economy.

The total construction expenditure was assumed to be \$168.3 million. The results of the input-output modelling highlight the direct and indirect impacts of the development on the economy over the course of the construction period. It is important to note that the economic impact of the construction stages, only last for as long as construction is occurring, therefore the economic impacts are short term.

Total economic impacts (direct and indirect) for the construction stage include:

- output of \$259 million over the construction period;
- a contribution of \$51 million to Gross Domestic Product;
- provision of \$16 million in household income; and
- employment of 130 people per stage (includes flow on employment effects).
- A breakdown of the direct and indirect impacts of construction are set out below.

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Table 17-3 Leafs Gully Power Project Construction Economic Impact

Economic Impact Indicator	Direct Impact	Flow-on Impact	Total Impact
National Impacts			
Output (\$ m)	88.6	170.2	258.8
Value Added (\$ m)	17.7	33.2	50.9
Household Income (\$ m)	5.0	10.8	15.8
Employment (Full-time equivalents)	50.0	80.1	130.1

Source: URS Analysis, 2006

17.5.2 Operations Economic Impact Results

Using the information provided by AGL, input-output analysis was used to calculate operational flow-on effects via industry multipliers. The economic impacts are due to the ongoing functioning of the proposed Leafs Gully Power Project, and are calculated at a national level to reflect the annual outcome for each of the project stages.

For the purposes of the assessment, it has been assumed that the operations of the Leafs Gully Power Project would commence in approximately October 2009.

Operating costs incorporated in the analysis include labour, maintenance, and utilities costs such as gas and water required for operations.

During operation of the 300 MW peaking plant, AGL has forecast annual output at 200 GWh, and five full time personnel are anticipated to be required to operate the plant. A breakdown of the direct and indirect impacts for one year of operations are set out in **Table 17-4**.

The total annual economic impact when operations are fully operational include:

- output effect of \$47 million;
- contribution of \$30 million to Gross Domestic Product;
- provision of \$1 million in household income; and
- employment of 19 full time equivalents.

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Table 17-4 Leafs Gully Power Project Annual Operations Economic Impact

Economic Impact Indicator	Direct Impact	Flow-on Impact	Total Impact
National Impacts			
Output (\$ m)	20.0	27.1	47.1
Value Added (\$ m)	12.9	16.8	29.7
Household Income (\$ m)	0.3	0.3	0.7
Employment (Full-time equivalents)	5.0	14.4	19.4

Source: URS Analysis, 2006

17.6 Summary of Impacts

The outcomes of the economic impact summary are shown in **Table 17-5**. The table highlights that the value added or Gross Domestic Product (GDP) effects of the construction period are \$50.9 million, while the operational GDP effects are \$29.7 million per annum. The annual GDP impact is a result of the low operating cost associated with the project compared to forecast revenues received. This is not necessarily unusual for projects that have a high upfront capital component due to the cost of equipment. Employment effects range from 130 full time equivalent positions over the construction period to 19 full time equivalent positions per year of operations. The effect of this increase in employment on household incomes is \$15.8 million over the construction stage and \$0.7 million per annum during the operational period.

Table 17-5 Leafs Gully Power Project Annual Operations Economic Impact

Economic Impact Indicator	Construction	Operations
Output (\$ m)	258.8	47.1
Value Added (\$ m)	50.9	29.7
Household Income (\$ m)	15.8	0.7
Employment (Full-time equivalents)	130.1	19.4

Source: URS Analysis, 2006

The analysis shows positive economic and social benefits at a national level in terms of contribution to GDP, income and employment resulting from the plant construction and operation. It is believed however, that a large proportion of the benefits from the Project would eventuate in the local or state regions. Some of the local / state impacts to have come from the report include:

- labour is likely to come from the local Campbelltown region, as the construction and manufacturing industries are both strong in terms of the proportion of the workforce employed in these industries, and the local region has a comparative advantage to the rest of NSW in the number of tradespersons working in the area;

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- population is not expected to be impacted by the project as the employment numbers are not significantly high; and
- Campbelltown is characterised by a majority of working-age residents suggesting there will be no considerable change in the age and gender demographic of the region as a result of the project.

17.7 Mitigation Measures

Where practicable, local contractors and supply companies would be utilised for the provision of labour and services during the construction phase and subsequent operation and maintenance of the plant.

The mitigation measures for social impact broadly relate to the mitigation measures detailed in this Environmental Assessment relating to the control of noise levels, air and water quality, traffic and transportation, visual amenity and other environmental matters. These measures are detailed in **Chapter 7** through **Chapter 19**, and would be implemented to ensure that the Leaf's Gully Power Project is managed in an effective and efficient manner, with minimal impact on existing surrounding land uses.

Preliminary Hazard Analysis – Summary of Key Outcomes

The preliminary hazard analysis (PHA) assessment has been carried out in accordance with the Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 (*Guidelines for Hazard Analysis*) and HIPAP No. 4 (*Risk Criteria for Land Use Planning*). The main hazard associated with the proposed Project is associated with the handling of natural gas (predominantly composed of methane gas), which is a flammable gas held under pressure. Other, less significant hazards are associated with the handling of flammable and combustible liquids.

It is noted that for the purposes of conducting a conservative hazard assessment, it has been assumed that a further two turbines may be located in the site (subject to future relevant approvals), although it is noted that this Environmental Assessment is seeking approval for two turbines with an output of approximately 300 MW.

Despite the fact that many of the assumptions in the PHA are highly conservative, the results show that the risk associated with this development is very low. The most stringent risk criteria, as required by the Department of Planning, are adhered to.

The risk assessment carried out in this study assumed that the safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.

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Preliminary Hazard Analysis

18.1 Introduction

The Department of Planning's *Multi Level Risk Assessment Guidelines*, aim to provide a guide to the level of assessment necessary for an operation being studied. In accordance with these guidelines and as part of the Environmental Assessment, a quantitative Preliminary Hazard Assessment (PHA) was prepared for the proposed Leaf's Gully Power Project. The following sections summarise the results of the PHA undertaken by Planager Risk Management Consulting for the proposed power plant. The full report is presented in **Appendix O**.

The assessment has been carried out in accordance with the Department of Planning's HIPAP No 6 (*Guidelines for Hazard Analysis*) and HIPAP No 4 (*Risk Criteria for Land Use Planning*). These documents describe the methodology and the criteria to be used in PHAs, as required by the Department of Planning for major "potentially hazardous" development.

In accordance with Department of Planning's HIPAP No. 3 (*Environmental Risk Impact Assessment Guidelines*), the safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.

It is noted that for the purposes of conducting a conservative hazard assessment, it has been assumed that a further two turbines may be located in the site (subject to future relevant approvals), although it is noted that this Environmental Assessment is seeking approval for two turbines with an output of about 300 MW.

18.2 Methodology

The process for PHA follows a number of steps which provide assurances that risks imposed by a development upon surrounding land uses would be within acceptable limits and that this would continue to be the case throughout the life of the development.

The aim of the PHA is to:

- identify and analyse the hazards and risks associated with all processes involved with the handling and transporting of potentially hazardous material which form part of the new development;
- assess the findings against the risk criteria currently in use by Department of Planning; and
- identify opportunities for risk reduction, and make recommendations as appropriate.

The risk assessment has quantitatively determined the risk of fatality and injury to the public associated with the handling and processing of potentially hazardous material at the proposed development.

The report assesses the risks from the following facilities:

- the supply pipelines carrying natural gas from the AlintaGN pipeline and the EGP; and
- the gas fired power plant.

The PHA notes that there are five stages in risk assessment, each of which is described below.

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18.2.1 Stage 1 - Hazard Identification

The hazard identification includes a review of potential hazards associated with all dangerous and hazardous goods to be processed, used and handled at the power plant and associated pipelines and facilities. The hazard identification includes a comprehensive identification of possible causes of potential incidents and their consequences to public safety and the environment, as well as an outline of the proposed operational and organisational safety controls required to mitigate the likelihood of the hazardous events from occurring.

The tasks involved in the hazard identification of the proposed facility included a review of all relevant data and information to highlight specific areas of potential concern and points of discussion, including drafting up of a preliminary hazard identification word diagram. The hazard identification word diagram is then reviewed and completed in a workshop which included people with operational, engineering and risk assessment expertise. The review takes into account both random and systematic errors, and gives emphasis not only to technical requirements, but also to the management of the safety activities and the competence of people involved in them.

18.2.2 Stage 2 - Consequence and Effect Analysis

The consequences of identified hazards are assessed using established techniques for risk assessment. Well established and recognised correlations between exposure and effect on people are used to calculate impacts.

18.2.3 Stage 3 - Frequency Analysis

For incidents with significant effects, whether on people, property or the biophysical environment, the incident frequency are estimated, based on historical data. A probabilistic approach to the failure of vessels and pipes is used to develop frequency data on potentially hazardous incidents.

18.2.4 Stage 4 - Quantitative Risk Analysis

The combination of the probability of an outcome, such as injury or death, combined with the frequency of an event gives the risk from the event. In order to assess the merit of the proposal, it is necessary to calculate the risk at a number of locations so that the overall impact can be assessed. The risk for each incident is calculated according to:

$\text{Risk} = \text{Consequence} \times \text{Frequency}$

Total risk is obtained by adding together the results from the risk calculations for each incident, i.e. the total risk is the sum of the risk calculated for each scenario.

The results of the risk analysis are presented in three forms discussed below.

Individual Fatality Risk

Individual Fatality Risk, is the likelihood (or frequency) of fatality to notional individuals at locations around the site, as a result of any of the postulated fire and explosion events. The units for individual risk are probability (of fatality) per million per year. Typically, the result of individual risk calculations is shown in the form of risk contours overlaid on a map of the development area. For pipelines (as for other transport activities), the individual risk contours are best represented as risk transects, showing the risk as a function of the distance from the pipeline.

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Preliminary Hazard Analysis

Injury and irritation risk

Injury and irritation risk, i.e. the likelihood of injury to individuals at locations around the site as a result of the same scenarios used to calculate individual fatality risk.

Societal risk

Societal risk takes into account the number of people exposed to risk. Whereas individual risk is concerned with the risk of fatality to a (notional) person at a particular location (person 'most at risk', i.e. outdoors), societal risk considers the likelihood of actual fatalities among any of the people exposed to the hazard. Societal risk are presented as so called *f-N curves*, showing the frequency of events (f) resulting in N or more fatalities. To determine societal risk, it is necessary to quantify the population within each zone of risk surrounding a facility. By combining the risk results with the population data, a societal risk curve can be produced.

The risk results are then assessed against the guidelines adopted by the Department of Planning.

18.2.5 Stage 5 - Risk reduction

Where possible, risk reduction measures are identified throughout the course of the study in the form of recommendations.

18.3 Risk Criteria

18.3.1 Individual Risk Criteria

The individual fatality risk is the probability of fatality to a person or a facility at a particular point. It is usually expressed as chances per million per year (pmpy). It is assumed that the person would be at the point of interest 24 hours per day for the whole year. By convention in NSW, no mitigation is allowed, i.e. any possible evasive action that could be taken by a person exposed to a hazardous event, e.g. by walking out of a toxic cloud or a heat radiation. The assessment of fatality, incident propagation and injury risk should include all components contributing to the total risk, i.e. fire and explosion.

The Department of Planning uses a set of guidelines on acceptable levels of individual risk which are in line with the criteria used elsewhere in the world. These guidelines are published in the HIPAP No. 4 (*Risk Criteria for Land Use Safety Planning*).

18.3.2 Societal Risk Criteria

Societal risk is concerned with the potential for an incident to coincide in time and space with a human population. Societal risk takes into account the potential for an incident to cause multiple fatalities. Therefore, two components are relevant, namely:

- the number of people exposed in an incident, and
- the frequency of exposing a particular number of people.

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The societal risk criteria specify levels of societal risk which must not be exceeded by a particular activity. The same criteria are currently used for existing and new developments. Two societal risk criteria are used, defining acceptable and unacceptable levels of risk due to a particular activity. The criteria are represented on the societal risk (f-N) curve as two parallel lines. Three zones are thus defined:

- 1) Above the unacceptable / intolerable limit the societal risk is not acceptable whatever the perceived benefits of the development.
- 2) The area between the unacceptable and the acceptable limits is known as the ALARP (as low as reasonably possible) region. Risk reduction may be required for potential incidents in this area.
- 3) Below the acceptable limit, the societal risk level is negligible regardless of the perceived value of the activity.

18.4 Potential for Hazard Incidents and Mitigation Measures

18.4.1 Summary of Hazard Identification Process

The main hazard associated with the proposed development is related to a leak of flammable natural gas.

This would generally only have the potential to cause injury or damage if there was ignition, which resulted in a fire or explosion incident. The factors involved are:

- the pipelines, vessel or equipment must fail in a particular mode causing a release. There are several possible causes of failure, with the main ones being corrosion and damage by external agencies;
- the released material must come into contact with a source of ignition. In some cases this may be heat or sparks generated by mechanical damage while in others, the possible ignition source could include non-flame proof equipment, vehicles, or flames some distance from the release;
- depending on the release conditions, including the mass of flammable material involved and how rapidly it ignited, the results may be a localised fire (for example a jet fire), a flash fire or an explosion of the vapour cloud formed through the release; and
- finally, for there to be a risk, people must be present within the harmful range (consequence distance) of the fire or explosion. How close the people are will determine whether any injuries or fatalities result. Environmental damage from gas fire incidents are generally associated with a failure to control fire water used.

Natural gas is a buoyant, flammable gas which is lighter than air (relative density of 0.6). On release into the open, the non-ignited gas tends to disperse rapidly at altitude. Ignition at the point of release is possible, in which case the gas would burn as a jet (or torch) flame. On release in an enclosed area (for example within the gas turbine housing) an explosion or a flash fire is possible.

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The gas is non-toxic, posing only an asphyxiation hazard. Due to its buoyancy, any release of credible proportions from operations of this scale, in the open, would not present an asphyxiation hazard. With standard confined space entry procedures and appropriate security arrangements to prevent unauthorised access to any of the facilities the risk associated with asphyxiation from natural gas should be minimal.

Locally, the pressure of the compressed gas may be hazardous in case of an uncontrolled release. These hazards, while of importance for people working at the site, do not have implications beyond the immediate location of the release unless the released gas is ignited. Therefore, the risk associated with non-ignited compressed gas does not form part of the scope of the present risk assessment. This potential risk would however need to be closely managed through job safety analysis (JSA) and / or other risk assessment practices used by management and operators of the facility in accordance with *NSW Occupational Health and Safety Act 2000* and its associated regulations.

Other potential hazards are associated with the handling and use of diesel and other combustible liquids (i.e. the oils used for pumps, compressors, turbines etc.). Minor quantities of flammable acetone (used for cleaning) would also introduce a potential fire hazard.

A total of 13 hazards were identified for the proposed power station, as listed in **Table 18-1** below.

Table 18-1 Summary of Identified Hazards

Number	Hazardous Event Potential	Offsite Impact Potential
1	Leak of natural gas from the new gas supply pipelines	Yes
2	Leak of natural gas to atmosphere from gas pipes on-site (outside the turbine housing)	Yes
3	Venting of gas from process	No
4	Explosion within piping or inside a vessel	No
5	Leak of natural gas to inside the turbine housing	Yes
6	Release of carbon dioxide (or of other fire quenching material to be used for fire protection)	No
7	Loss of containment of flammable or combustible liquid (including diesel, oils and acetone)	No
8	Fire at transformers	No
9	Flooding	No
10	Land subsidence due to mining activity	No
11	Earthquake	No
12	Aircraft crash on Power Station site	No
13	Transport of potentially hazardous material to the site (diesel, acetone)	Yes

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Table 18-1 above shows that 13 hazards were identified during the assessment. The PHA (refer to **Appendix O**) presents a hazard identification word diagram representing the hazardous incidents and their associated mitigating features. This assessment determined that nine events had no potential for offsite effects. The remaining four hazards (natural gas leak from pipeline, natural gas leak from plant to outside housing, natural gas leak from plant inside housing, and transport of potentially hazardous material to the site) were assessed in more detail. The detailed risk assessment is presented in **Appendix O** and summarised below.

Consequence Analysis

The initial outflow rates estimated for natural gas releases are shown in **Table 18-2**.

Table 18-2 Release Rates

Release rate (k/s)	Hole Size					
	Small leak (5 mm)	Flange leak (13 mm)	Intermediate leak (25 mm)	Major leak (80 mm)	Massive leak (100 mm)	Full bore (guillotine)
Upstream of the Pressure Regulator						
Instantaneous	0.4 kg/s	2.8 kg/s	6.5	104	163 kg/s	2,600 kg/s (first few seconds)
Downstream of the Pressure Regulator						
Instantaneous	0.1 kg/s	0.8 kg/s	2	30	47 kg/s	946 kg/s (first few seconds)

The distance from the source of the fire to the specified heat radiation for jet fire scenarios is listed in **Table 18-3** below.

Table 18-3 Heat Radiation from Jet Fires

Hole size	Distance to Heat radiation (metres)		
	4.7 kW/m ²	12.5 kW/m ²	23.5 kW/m ²
Downstream of the Pressure Regulator			
Small leak (5 mm)	7	4	3
Intermediate leak (25 mm)	40	25	15
Massive leak (100 mm)	145	90	65
Full bore (guillotine)	575	350	260
Downstream of the Pressure Regulator			
Small leak (5 mm)	4	2	1.5
Intermediate leak (25 mm)	20	12	9
Massive leak (100 mm)	80	50	35
Full bore (guillotine)	350	215	155

The distance to 100 % chance of fatality from a jet fire is shown in **Table 18-4** below.

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Table 18-4 Distance to 100 % Chance of Fatality

Hole size	Distance to 100 % Fatality (metres)		
	Jet Fire	Flash Fire	Vapour Cloud Explosion
Downstream of the Pressure Regulator			
Small leak (5 mm)	5	15	15
Intermediate leak (25 mm)	15	40	40
Massive leak (100 mm)	75	75	150
Full bore (guillotine)	220	220	250
Downstream of the Pressure Regulator			
Small leak (5 mm)	2	10	10
Intermediate leak (25 mm)	10	25	25
Massive leak (100 mm)	30	60	75
Full bore (guillotine)	120	120	150

Frequency Analysis

The design of the Power Station has not been finalised and in some cases, conservative assumptions relating to the design were made, including the length of pipe, number of flanges required and operating pressures used.

The equipment failures and associated frequencies are presented in **Table 18-5**.

Table 18-5 Equipment Failures and Associated Frequencies

Type of Failure	Failure Rate (pm/y)
Pipelines Within Fixed Plant (Power Plant)	
3 mm hole	9 / m
13 mm hole	3 / m
50 mm hole	0.3 / m
3 mm gasket (13 mm hole equivalent)	5 / joint
Guillotine fracture (full bore):	
< 50 mm	0.6 / m
> 50 mm but < 100 mm	0.3 / m
> 100 mm	0.1 / m
Vessels	
6 mm hole	24
13 mm hole	6
25 mm hole	3
50 mm hole	3
Gas Supply Pipelines (>100mm Nb)	
<20 mm hole – steel pipeline	0.23 / m
<80 mm hole – steel pipeline	0.03 / m
Guillotine fracture (full bore) – steel pipeline	0.009 / m

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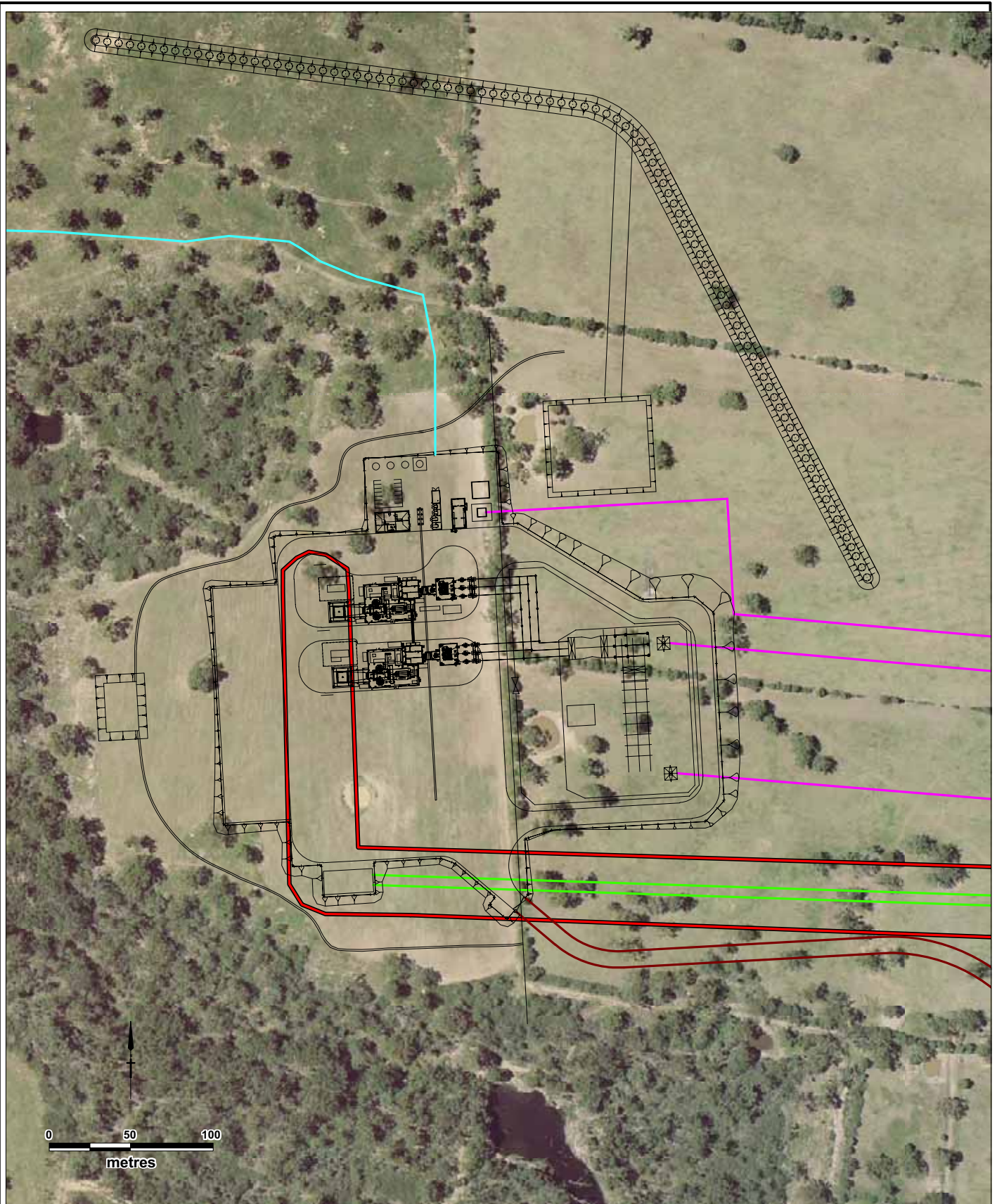
18.4.2 Risk Assessment

Natural Gas

Risk contours for the site are shown in the following figures:

- **Figure 18-1** shows the individual fatality contours for risk associated with the Leafs Gully Power Plant.
- **Figure 18-2** shows the risk transect for individual fatality at the natural gas supply pipelines.

Fatality, injury and propagation risk contours are contained well within the site boundary. In this study the risk of fatality of 1 per million per year does not extend beyond the site boundaries and is therefore well away from the residential areas. The concept of societal risk is therefore not applicable for the proposed development.



Legend



Hazard Analysis 1 Chance
per million per year



Gas Pipeline



Proposed Access Road



Electricity Transmission Lines

Source: Planager, 2006

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title INDIVIDUAL FATALITY RISK CONTOURS
	Drawn: AJW Approved: FINAL Date: 7-07-06 Job No: 43177401 File No: 43177401-024.wor	Figure: 18-1

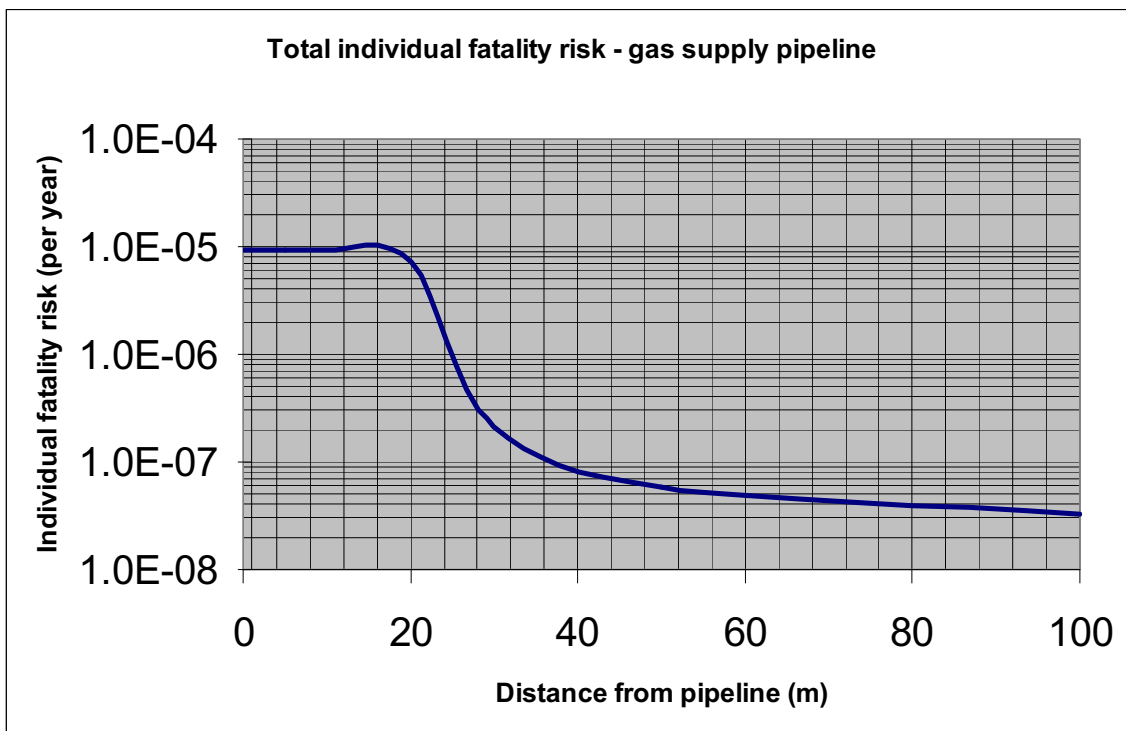


Figure 18-2 Individual Risk Transects for the Gas Supply Pipelines

Turbine Housing

The likelihood of a confined explosion inside the turbine housing was estimated taking into account a number of assumptions and recommendations.

With four housings, the total frequency of explosion inside turbine housing is:

$$F(\text{explosion in turbine housing}) = 2.9 \times 10^{-7} \text{ per year.}$$

This frequency is very low.

A confined explosion may generate high over pressures which could damage neighbouring equipment and turbines. It is however understood that the housings would be designed with explosions vents (and / or panels) which would blow out in case of a pressure event, thereby reducing the effect of the confinement. Further, the turbines would be separated from each other by a 20 metre buffer zone.

With proper design it is unlikely that an explosion at one turbine would have a serious effect at a neighbouring turbine.

The separation distance to the site boundary is very large for this development. Providing the recommendations presented in **Appendix O** are carried out, the risk from an explosion at turbine housing would be contained well within the site boundary.

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Diesel storage

The consequences of a diesel fire were calculated using the Point Source method.

The likelihood of a diesel fire at the site, taking into account the properties of the material and its use within the site, is very low. The risk of a diesel fire is minimal, provided the storage is designed in accordance with code requirements (in particular AS1940).

The consequence distanced to 4.7 kW/m^2 (injury radiation) and 23 kW/m^2 (propagation risk) are contained well within the site boundary.

Transport Risk

Once the site has been built and is operational, the frequency of road transportation to the site of dangerous goods and potentially hazardous material would be minimal. It is expected that one delivery (up to a maximum of three deliveries) per year would be sufficient for the operation of the site, consisting of the occasional diesel and oil top up and possibly the transport of some other material used for maintenance or cleaning (e.g. acetone). Note that oil and diesel would be transported to the site in relatively small quantities. Diesel is used only occasionally in the stand-by emergency generator (in case of a power failure, diesel is the fuel for the generator used to run the UPS - *Uninterrupted Power Supply*). Oils are used to top up the gear boxes of the turbines, pumps, air compressors etc.

Road transportation would use Appin Road and then turn west into the access road to the site. The access road to the site is to be of adequate construction for the use and to be maintained and repaired as required. General transport risks of these materials are handled by transport companies' internal safety requirements. Clean up and incident management would be as per the transport company's procedures.

The quantities and transport movement of potentially hazardous materials for this site are well below those listed in the *Transportation Screening Threshold* table as defined by the Department of Planning.

The review of road transport risks concludes that the risk associated with the transport of dangerous goods and potentially hazardous material to the site is negligible.

18.4.3 Risk Results

The quantitative analysis showed that:

Individual Risk of Fatality: The risk of fatality at the nearest residential area is well below the criterion for new installations of one chance in a million per year ($1 \times 10^{-6}/\text{yr}$). The $1 \times 10^{-6}/\text{yr}$ individual fatality risk for the Power Plant is contained well within the site boundaries.

It follows that the risk of fatality at the nearest open space and the nearest industrial area are also well below the criterion of ten and fifty chances per million years respectively ($10 \times 10^{-6}/\text{yr}$ and $50 \times 10^{-6}/\text{yr}$) and contained within site boundaries.

The risk associated with the gas supply pipelines is well below all current criteria for new development. The maximum risk level experienced at 25 m from the pipelines is less than $1 \times 10^{-6}/\text{yr}$. This risk level is contained well within site boundaries.

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Injury Risk: The $50 \times 10^{-6}/\text{yr}$ risk contour is contained within the site boundary. The risk of injury at the nearest residential area is well below the criterion for new installations of fifty chances per million years ($50 \times 10^{-6}/\text{yr}$).

Propagation Risk: The $50 \times 10^{-6}/\text{yr}$ risk contour is contained within the site boundary. The risk of propagation of an incident at the power station does not encroach into any other industrial areas.

Societal Risk: The risk of fatality does not extend anywhere close to any residential area and is well within the criteria for business / industrial areas. It is therefore considered that the current installation does not have a significant impact on societal risk.

The detailed design has not been completed as yet for this development. A set of very conservative assumptions as to the design and operation of the plant have been made, including a 100 % on-line operation of the plant (as a worst case assumption, with appropriate fire proof isolation valves separating the plant from pressurised gas supplies). It is also noted that the assessment addresses the plant comprising four turbines although it is noted that this Project Application seeks approval for two turbines.

Despite the conservatism built into the risk assessment, the results show that the risk associated with this development is very low. The most stringent risk criteria, as required by the Department of Planning, are adhered to.

Mine subsidence at the site has been addressed in detail in **Chapter 9 Soils Geology and Groundwater** and **Appendix H**.

18.5 Mitigating Measures

A summary of the mitigation measures in terms of hazard is provided **Table 18-6**.

Table 18-6 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Conduct an assessment of the safety management system implemented and used at the site, specifically as it applies to the proposed hazardous materials handling, pipelining and storages within the first year of operation.			✓
High and low pressures of the natural gas supply to be monitored during (and, if applicable, outside) operation of the Power Plant. If required (as defined in a detailed HAZOP study) these conditions may need to be associated with an automatic trip / shut down.			✓
Use fusible tubing around high risk natural gas piping to be investigated – such tubing would be linked to automatic shut down of the fuel source.			✓

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Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
The detailed design of the turbine housing and associated equipments should clearly outline the safety measures used to ensure that explosive situations do not arise (the risk is rendered negligible). Reference should be made to European ATEX Directive and the UK HSE PM84 or other guidance / regulation of equivalent safety.	✓		
Fire protection inside the turbine housing to be determined, including use of explosion panels and use of fire retardant material.	✓		
A system implemented to ensure that any removal of critical safety functions (e.g. for repair or exchange) is subject to careful scrutiny by plant management (decisions on whether to shut down plant or a turbine if a critical safety function is removed need to be canvassed).	✓		✓
Rotating machines to be designed such that risk associated with projectile is minimised (gas pipelines protected or not in probable line of projectile, people protected etc.)	✓		
Loud alarm and visual indication (e.g. strobe light) to be installed within the turbine housing, alerting any persons within these housings of the pending discharge of asphyxiants and allowing escape.	✓		✓
A safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.	✓	✓	✓

Bush Fire Assessment – Summary of Key Outcomes

A preliminary bush fire hazard assessment was completed as part of the Environmental Assessment process. Whilst the bush fire planning provisions of the NSW *Rural Fires Act 1997* and the EP&A Act do not apply to Part 3A developments, the guidelines set out in *Planning for Bush Fire Protection* (RFS 2006) have been addressed and applied to the proposal as a guide for site planning and risk mitigation.

Parts of the site are mapped as 'bush fire prone land' by Campbelltown City Council and correspond to areas of native bushland in the south western and western parts of the Development Site. The forested areas along Leaf's Gully and the Nepean River constitute a bush fire hazard to the proposed facility. The proposed plant would be located adjacent to (and partially within) these areas and accordingly, bush fire protection measures are recommended for the proposal.

The key elements to bush fire protection on the site would be set out in a Bush Fire Management Plan for the plant and would comprise:

- Asset Protection Zones (APZs) extending from the edge of proposed buildings, plant and structures to the north, west and south.
- Installation of reticulated mains water (or tank water) with hydrants around the perimeter of the facility, for fire fighting purposes. The proposal includes water supply tankage for this purpose.
- Allowance for access for fire fighting vehicles and for maintenance of the Asset Protection Zones. The proposed access road (from Appin Road) and internal road system would provide adequate access and egress for fire fighting vehicles and for staff evacuation.
- Allowance for a 'defendable space'. The proposed hardstand areas around the facility, particularly the laydown area, would be suitable for this purpose.
- Design and management of proposed landscaping to avoid creation of a new bush fire hazard.
- Installation of fire protection systems where appropriate, which mitigate flame and heat attack during fire, for plant and structures containing flammable liquids and gases.

It is also recommended that above-ground structures such as the diesel tank and Gas Receiving Station be repositioned further away from the perimeter to further reduce bush fire risk. This would have the dual benefit of increasing the Asset Protection Zone setbacks and eliminating the need for any modification of high value vegetation to create a compliant Asset Protection Zone on the southern boundary.

With the installation and maintenance of the above measures, the risk of bush fire attack on the proposed plant would be managed to an acceptable level. Notwithstanding this, consultation during detailed design with the Rural Fire Service is recommended regarding access, water supply and defendable space.

Chapter 19

Bush Fire Assessment

19.1 Introduction

The proposal, as a Major Project to be determined under Part 3A of the EPA Act, does not require approvals for bush fire under either the *Rural Fires Act 1997* (RF Act) or the EP&A Act. Additionally, the proposal does not require referral to the NSW Rural Fire Service under Section 79BA of the EP&A Act as neither residential nor rural–residential development are proposed. Notwithstanding, as part of the Part 3A process, the Department of Planning may choose to refer the application to the Rural Fire Service for advice.

Whilst there is no formal requirement for consideration of bush fire risk under Part 3A, URS have considered the guidelines and requirements of the document *Planning for Bush fire Protection* (RFS 2006) for site planning purposes, to determine the potential risk of bush fire to the proposed facility and to provide mitigation measures to address any potential risk.

It is noted that the bush fire assessment has been conducted from the conservative assumption that the plant (subject to future separate approvals) could be expanded to include another two turbines. It is noted however, that this Environmental Assessment is seeking approval for only two turbines.

19.2 Methodology

A bush fire hazard assessment was carried out by URS in April 2007 and involved a desktop review and site inspection.

The desktop review involved detailed review of the planning and hazard management requirements contained in the RFS (2006) document *Planning for Bush fire Protection* (referred to herein as the *Bush fire Guideline*) and a review of the relevant standards under the Building Code of Australia¹. Bush fire prone land mapping for Campbelltown LGA was obtained from Council.

A site inspection was carried out on 16 April 2007 during which the following were surveyed and determined:

- the potential bush fire hazard in the vicinity of the proposed facility;
- vegetation type, condition and class (as per the *Bush fire Guideline*) on land surrounding the site of the proposed facility;
- slope in these surrounding areas; and
- fuel load on the ground within the vegetated areas.

¹ The *Bush fire Guideline* recognises AS 3959 – 1999 as the appropriate guide for certain classes of building. Where development occurs in a bush fire prone area certain bush fire provisions of the BCA will apply for building classes 1, 2, 3, 4 and class 9 buildings that are also for special fire protection purposes.

Slope and vegetation class for the site are required in order to determine the appropriate bush fire protection measures under *the Bush fire Guideline*.

19.2.1 Vegetation

Vegetation typically provides the primary source of fuel for bush fires, and different vegetation types provide different fuel loads and therefore bush fire risk. Accordingly, *the Bush fire Guideline* provides broad categories for vegetation class to assist in the determination of bush fire risk. The vegetation type, condition and class within the area surrounding the proposed site of the facility (which constitutes the potential bush fire hazard on and adjacent to the site) was assessed during the site inspection. Current fuel load was also assessed during the survey.

19.2.2 Slope

Slope affects the speed and intensity of bush fires with steep slopes presenting a greater hazard than flatter slopes or downslopes. Using topographic data (in GIS) and on-site inspections, the slope of the proposed site and surrounding land was assessed over a distance of 100 m, measured from the proposed building footprint towards the adjoining bushland in all directions. This was used to calculate 'effective slope', which is defined under the *Bush fire Guideline* as 'that slope within the hazard which most significantly affects fire behaviour of the site'.

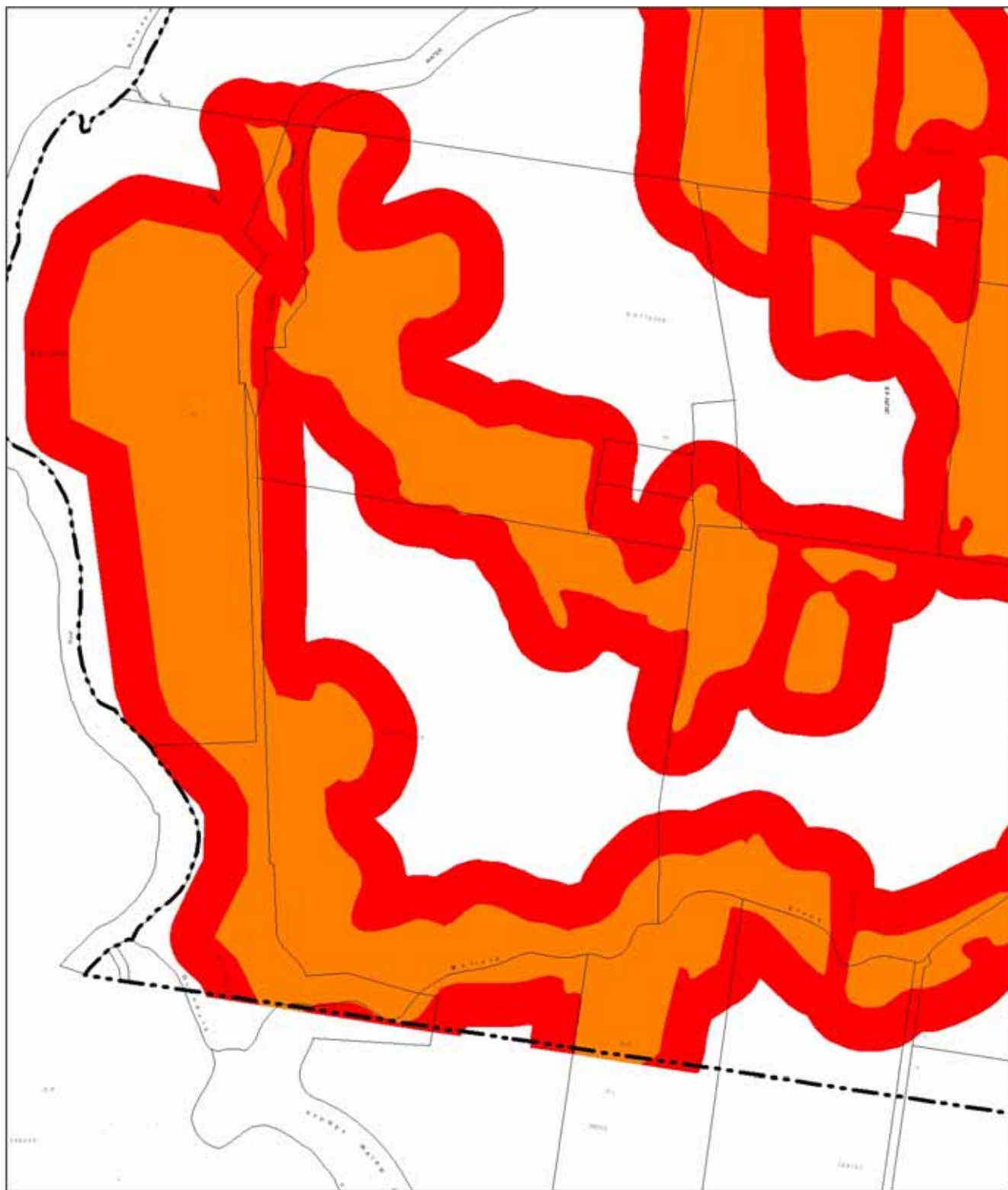
19.3 Assessment

19.3.1 Bush Fire Prone Land

An extract from the Campbelltown Bush Fire Prone Land Map indicates that part of the site is mapped as bush fire prone land (**Figure 19-1**). The mapped areas correspond to areas of vegetative canopy cover visible in aerial photography of the site (refer **Figures 1-2, 4-1**) and in vegetation mapping shown in **Figure 13-3**.

The areas mapped as bush fire prone correspond to the stands of Shale/Sandstone Transition Forest depicted in **Figure 13-3**, which occur in the south-western parts of Lot 102, associated with Leaf's Gully and through most of Lot 103, which are associated with the Nepean River gully to the west. The north-eastern parts of Lot 101 are also mapped similarly, although the eastern and western hazard area are separated by several hundred metres of cleared grassland.

The main hazard applicable to the site and the proposed facility would be the extensive stands of forest located along the Nepean River and to a lesser degree, along Leaf's Gully.



Source: An extract from the Campbelltown LGA - Bush Fire Prone Land Map

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title BUSHFIRE PRONE LAND
	Drawn: AJW Approved: FINAL Date: 15-05-06 Job No: 43177401 File No: 43177401-076.wor	Figure: 19-1

19.3.2 Indicative Asset Protection Zones

Asset Protection Zones (APZs) are recommended in the *Bush fire Guideline* as a key measure for the mitigation of bush fire risk. They are an interface area between the proposed development and the adjacent bushland that is managed to minimise fuel loads. The aim of an Asset Protection Zone to minimise fuel loads to ensure radiant heat levels at buildings are below critical limits and to prevent direct flame contact with a building.

The Asset Protection Zone generally comprises two sections: an Inner Protection Area and Outer Protection Area. The Inner Protection Area is located adjacent to the building with the aim of reducing heat intensity at the building surface. It is maintained largely fuel-free and can contain widely spaced trees, but low density understorey vegetation and low fuel loads in the ground layer. Perimeter roads, car parks and cycleways can be located in the Inner Protection Area and serve as a 'defendable space' for fire fighting activities and for access to manage the Asset Protection Zone. The Outer Protection Area is managed as a fuel-reduced zone between the Inner Protection Area and the adjoining bushland and aims to reduce the length of flames, filter embers and suppress a crown fire. The Outer Protection Area can be maintained as managed bushland, with canopy thinning so there is limited canopy connection into the Inner Protection Area and a reduced density of understorey vegetation.

The *Bush fire Guideline* provides minimum setback requirements for habitable buildings in residential developments on bush fire prone land. Appendix 2 of the *Bush fire Guideline* was used to determine what Asset Protection Zone would apply if the proposal was considered as equivalent to a residential subdivision.

The procedure for determination of Asset Protection Zones for rural and residential subdivisions is as follows:

- determine vegetation formation (for areas that adjoin the proposed development and hence constitute a bush fire hazard);
- calculate effective slope within the vegetation surrounding the site; and
- determine the 'fire (weather) area' of the site. The site lies within the 'Greater Sydney Region' fire area, which is ascribed a general Fire Danger Index (FDI) of 100².

The resulting vegetation formations, effective slopes and minimum specifications for Asset Protection Zones (for FDI 100 areas) in all directions from the proposed development site are listed in **Table 19-1**.

² FDI = Fire Danger Index, a measure of probability of fire within a given region.

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Table 19-1 Recommended Asset Protection Zones for the Proposed Facility

Boundary	Vegetation Formation ³	Effective Slope ⁴	Asset Protection Zone ⁵ (m)	OPA ⁶ (m)
Northern (measured from diesel tank)	Dry sclerophyll Forest	4°	25	10
North-western (measured from Admin Bld)	Dry sclerophyll Forest	6°	35	15
Western (measured from western limit of turbines)	Dry sclerophyll Forest	15°	50	25
South-western (measured from Gas Receiving Station)	Dry sclerophyll Forest	12°	50	25
Southern (measured from Gas Receiving Station)	Dry sclerophyll Forest	13°	50	25

Table 19-1 shows that the vegetation formation surrounding the proposed plant footprint is 'dry sclerophyll forest', which forms the main fire hazard of relevance to the proposal. As discussed in **Chapter 13 Flora and Fauna**, forest vegetation occupies the flatter ground and adjoining slopes and gullies associated with Leaf's Gully and the Nepean River in the western and south-western portions of the site. This vegetation is Shale Sandstone Transition Forest, which of high conservation significance, being listed as an Endangered Ecological Community under the TSC Act.

Effective slopes to the north and northwest are between 0-5° and 5-10° and accordingly the Asset Protection Zone required on these boundaries is 25 m and 35 m respectively. As shown in **Figure 19-2**, a cleared area (i.e. pasture grass with scattered trees) in excess of 36m would exist between the proposed edge of the diesel storage tank and the administration building and the nearest vegetation formation. Hence the site already satisfies the minimum requirement for an Asset Protection Zone on these boundaries. No modifications to the adjacent vegetation would be required to create a satisfactory Asset Protection Zone on these boundaries.

Slopes to the south and west are higher by virtue of the steep sandstone terraces adjoining the Leaf's Gully and Nepean River water courses. Steeper slopes with dry sclerophyll forest that are positioned downslope of a building constitute a high bush fire hazard. Hence the *Bush fire Guideline* prescribes a minimum Asset Protection Zone of 50 m, with an Outer Protection Area of 25 m for this category of slope (**Table 19-1**). This means that only the inner 25 m of the Asset Protection Zone must be maintained as a fuel free Inner Protection Area (i.e. only scattered trees in grass, with no canopy connection and no dense shrub growth), with the outer 25 m comprising an Outer Protection Area that can contain canopy trees but reduced fuel loads in the ground layer. As **Figure 19-2** shows, the cleared land between the gas receiving station and the nearby vegetation formation is approximately 33 m to 46 m. Hence, some of the Outer Protection Area would occur within this bushland and the

³ As measured over 140m from the proposed boundary of the facility.

⁴ As measured over 100m within the adjoining bushland.

⁵ Source: Table A2.4 of the *Bush fire Guideline*.

⁶ Outer Protection Area

bushland would have to be modified accordingly to comply with *the Bush fire Guideline* requirements for Outer Planning Areas. Alternatively, the Gas Receiving Station could be repositioned to avoid any impact on the vegetation.

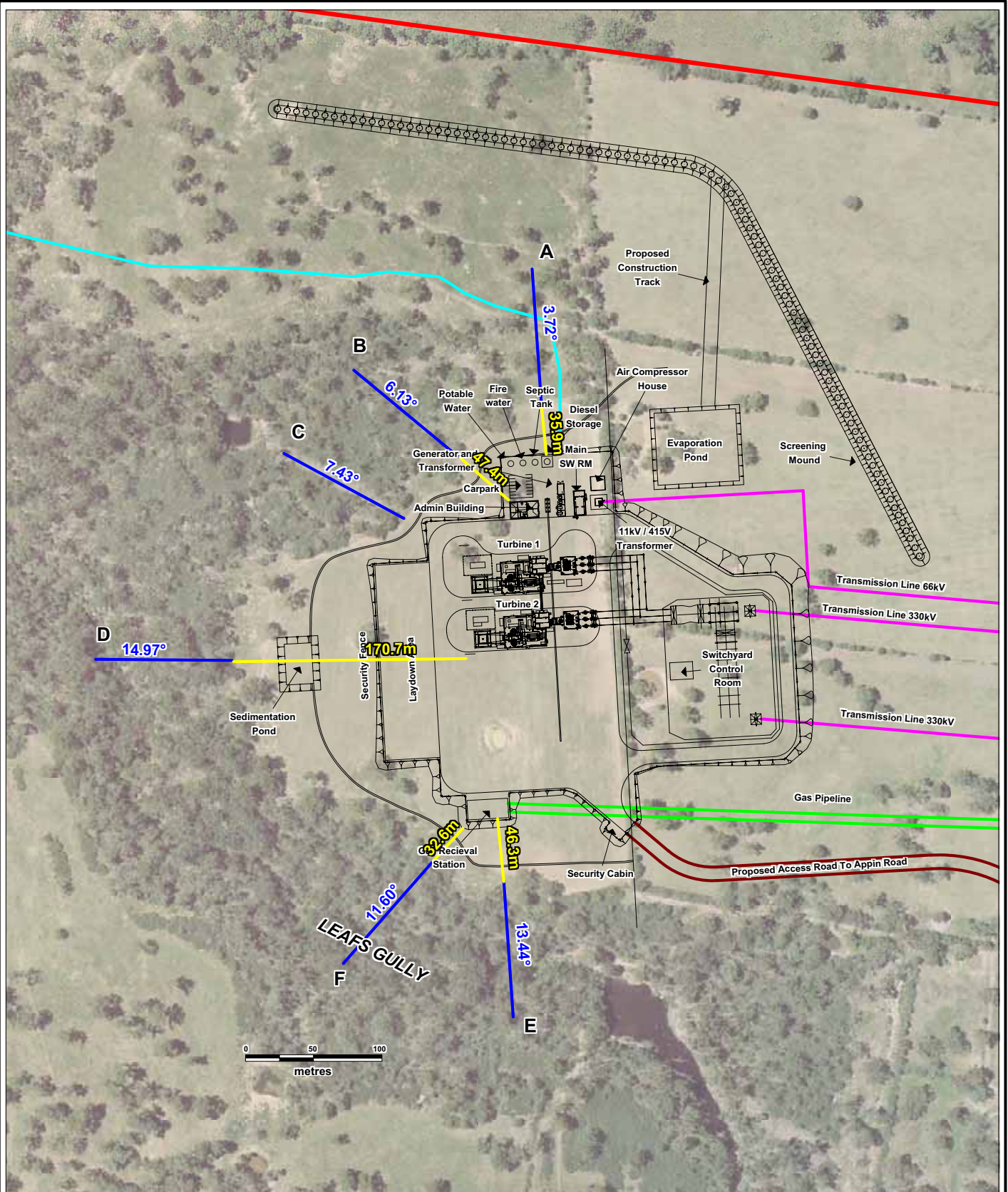
Land to the east of the proposed facility is largely cleared and thus there is no bush fire hazard in the eastern parts of the subject site and no requirement for an Asset Protection Zone.

19.3.3 Bush Fire Attack Assessment

The *Bush fire Guideline* also prescribes minimum building standards or level of construction (according to the Building Code of Australia (BCA)) for buildings in bush fire prone areas. In NSW the bush fire protection provisions are applied to Class 1, 2, 3 building, parts of Class 4 buildings and Class 9 buildings that are for Special Fire Protection Purposes.

Building classes 5-8 and 10 include industrial facilities such as the proposed power project. The Building Code of Australia does not provide for any bush fire specific performance requirements and as such AS 3959 does not apply to such developments. However, the aims of the *Bush fire Guideline* apply in relation to other matters such as access, water and services, emergency planning and landscaping. For developments such as the current proposal, the Rural Fire Service would assess the project on a merits basis, taking into consideration proposed Asset Protection Zones, water supply and hydrants, access and egress and defensible space.

Given that most structures within the facility would be constructed of sheet metal or brick, the construction standards that would apply would be met.



Source: KBR, 2006

Map compiled using MapInfo StreetPro Data. © 2004 MapInfo Australia Pty Ltd, URS Australia and PSMA Australia Ltd. URS Australia, MapInfo Australia or PSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title BUSHFIRE RISK - SLOPE AND RECOMMENDED SETBACKS						
	<table border="1"> <tr> <td>Drawn: AJW</td> <td>Approved: FINAL</td> <td>Date: 15-05-06</td> </tr> <tr> <td>Job No: 43177401</td> <td colspan="2">File No: 43177401-071.wor</td> </tr> </table>	Drawn: AJW	Approved: FINAL	Date: 15-05-06	Job No: 43177401	File No: 43177401-071.wor		Figure: 19-2
Drawn: AJW	Approved: FINAL	Date: 15-05-06						
Job No: 43177401	File No: 43177401-071.wor							

19.3.4 Water Supply

The water mains should be designed to allow placement of fire hydrants and appropriate locations along the northern, western, and southern perimeters of the proposed facility. The proposed water tank (refer **Figure 4-2**) would also serve as a water supply for fire fighting. These locations would be discussed with the local Rural Fire Service during detailed design. As an emergency alternative, the sedimentation pond could serve as a water source during bush fire.

19.3.5 Access/Egress

The key access and egress issues of relevance to planning for bush fire protection during operation of the facility relate to:

- adequate access for fire fighting vehicles using public roads to a defensible space between an approaching bush fire and the facility;
- safe evacuation egress for fire fighting vehicles and staff vehicles; and
- allowance for a defensible space, which should be a cleared area located between the hazard and the facility that can accommodate fire fighting vehicles safely and provide a staging place for fire fighting.

The proposed facility will be connected to the public road system via a sealed two-way access road from Appin Road. A sealed internal road would be constructed throughout the plant, leading to a paved at-grade car park on the northern side of the plant (**Figure 4-2**). Additionally, a paved 'laydown area' would be constructed on the western side of the turbines, which would adequately serve as a defensible space.

Arrangements should be made with the Rural Fire Service to allow safe and ready access to the laydown area during bush fire. Alternatively, a dedicated perimeter road could be constructed around the outside of the proposed security fence.

19.4 Mitigation Measures

The site is located within and adjacent to bush fire prone land and the proposed facility would be surrounded by a bush fire hazard to the north, west and south. Whilst the minimum specifications of the *Bush fire Guideline* do not apply to Part 3A development proposals, it is considered prudent to design and manage the proposed facility to minimise the risk of bush fire attack. The key elements to bush fire protection on the site would be set out in a Bush Fire Management Plan for the site and would comprise:

- Asset Protection Zones extending from the edge of proposed buildings, plant and structures to the north, west and south;
- installation of reticulated mains water (or tank water) with hydrants;

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- creation of access for fire fighting vehicles and for maintenance of the Asset Protection Zones;
- design and management of proposed conservation area (refer to **Figure 4-11**) to avoid creation of a new bush fire hazard; and
- installation of fire protection systems, which mitigate flame and heat attack during a bush fire, for plant and structures containing flammable liquids and gases.

Although an adequate Asset Protection Zone can be created adjacent to the proposed structures, it is also recommended that during detailed design consideration be given to the concept layout be amended to reposition above-ground storage of flammable substances away from the perimeter of the site, particularly the diesel storage tank near the northern boundary and the Gas Receiving Station in the south-western corner of the site. This would reduce the potential bush fire risk and negate the need for disturbance to Shale Sandstone Transition Forest (SSTF) vegetation to create an Outer Protection Area on the south-western boundary. This could be achieved by changing their location or by underground construction, depending on site constraints. Should the Receiving Station be moved north and east, the full 50 m Asset Protection Zone required on the southern side would be achieved within existing cleared grassland and there would be no need to modify SSTF vegetation to the south to create a suitable Outer Protection Area.

A summary of the mitigation measures for bush fire hazard is provided **Table 19-2**.

Table 19-2 Summary of Bush fire Hazard Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Prepare Bush Fire Management Plan, which would include management and maintenance of APZs, threatened species management (i.e. <i>Pultenaea pendunculata</i> and SSTF), water supply, access and other bush fire protection measures for the site.		✓	✓
Create Asset Protection Zones on northern, western and southern and eastern sides of proposed facility as follows: • 25 m Asset Protection Zone on northern side (measured from diesel tank) • 35 m Asset Protection Zone on northwestern side (measured from the Admin Building) • 50 m Asset Protection Zone on the western side (measured from the western limit of the turbines) • 50 m Asset Protection Zone on the south and southwest (measured from the Gas Receiving Station).	✓	✓	✓
Detailed design to position diesel tank storage and Gas Receiving Station with consideration of <i>Bush fire Guideline</i> to reduce potential bush fire risk and avoid disturbance of SSTF vegetation in creating an Outer Protection Area. For the diesel tank consider altering the location of the diesel tank or constructing underground.	✓		

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Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Ensure adequate Asset Protection Zone achieved between the facility and proposed mass plantings shown in the Landscape Plan. Asset Protection Zones should be managed according to 'Standards for Asset Protection Zones (RFS undated).	✓		
Ensure adequate water supply (through installation of water reticulation and hydrants and/or tanks) at appropriate locations around the northern, western and southern perimeters of the facility, in consultation with Rural Fire Service. The proposed water supply tank should have fittings suitable for Rural Fire Service uses. Water should not be reliant upon external power supply. Hydrants should be installed according to AS 2419 <i>Fire Hydrant Installation</i> and delivered via a ring main system.	✓	✓	✓
Creation of a sealed two-way all weather perimeter access road for fire fighting vehicles. Consultation with Rural Fire Service regarding adequacy of proposed laydown area for this purpose.	✓	✓	✓
Ensure medium to long-term maintenance of proposed mass plantings to minimise fuels loads and fire risk. Avoid contiguity of vegetation (vertical and horizontal) in landscaping areas, including dense plantings of sclerophyllous native shrubs. Choose mesic or rainforest species in locations subject to potential flame attack. Ensure watering systems are maintained in working order. Avoid stockpiling of mulch and other organic materials for extended periods.	✓	✓	✓
Trees and other vegetation in the vicinity of power lines should be managed in accordance with specifications in Vegetation Safety Clearances (Energy Australia 2002).			✓
Prepare Emergency Response Plan as part of the CEMP and OEMP. The Plan would include emergency response provisions for bush fire in site Emergency Response Plan. Ensure Plan includes evacuation arrangements, routines, and nominated control staff for bush fire events. Consult local Rural Fire Service branch in preparation of Plan.	✓	✓	✓
Remove flammable weed species (e.g. African Olive) from bushland to be retained on-site.		✓	

Draft Statement of Commitments

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Draft Statement of Commitments - Summary of Key Outcomes

The Draft Statement of Commitments has been prepared in accordance with section 75F (6) of the EP&A Act. The inclusion of appropriate environmental management measures into the detailed design and construction of the project would minimise adverse impacts on the environment. The proposed adoption of the relevant measures identified in the Draft Statement of Commitments into a Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP) would be an important component of the proposal and reiterate the commitment of AGL and its contractors to mitigation of environmental impacts identified in this assessment.

The Draft Statement of Commitments describes the environmental management and monitoring to be undertaken during the construction and operation of Leaf's Gully Power Project.

Chapter 20**Draft Statement of Commitments****20.1 Introduction**

This chapter details the Draft Statement of Commitments in accordance with section 75F (6) of the EP&A Act. The inclusion of appropriate environmental management measures into the detailed design and construction of the project would minimise adverse impacts on the environment. The proposed adoption of the relevant measures identified in the Draft Statement of Commitments into a Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP) would be an important component of the proposal and reiterate the commitment of AGL and its contractors to mitigation of environmental impacts identified in this assessment.

The Draft Statement of Commitments describes the environmental management and monitoring to be undertaken during the construction and operation of Leaf's Gully Power Project.

20.2 Environmental Management**20.2.1 Construction Environmental Management Plan**

Environmental management during the construction phase of the proposed project would be undertaken in compliance with the requirements of a Construction EMP (CEMP). The CEMP is an administrative tool outlining environmental management practises, safeguard measures to be implemented, timing of their implementation, and management and monitoring of the process and procedures. The CEMP must be adhered to during the construction of Leaf's Gully Power Project.

The key objectives of the CEMP would include:

- ensuring that works are carried out in accordance with appropriate environmental statutory requirements, the conditions of approval for the project, relevant guidelines and existing environmental management systems and procedures at the site;
- ensuring that works are carried out in accordance with the goals and requirements presented in the Environmental Assessment;
- ensuring that works are carried out in such a way as to minimise the likelihood of environmental degradation occurring;
- ensuring that works are carried out in such a way as to manage the impact of the works on neighbouring land uses;
- ensuring that all workers engaged in the works comply with the terms and conditions of the CEMP;
- providing clear procedures for management of environmental impact including corrective actions; and
- identifying management responsibilities and reporting requirements to demonstrate compliance with the CEMP.

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The CEMP would serve as a working document to be used during the implementation of the proposal.

Generally the Construction EMP will include:

- establishment of environmental goals and objectives;
- conditions of project approval;
- lists of actions, timing and responsibilities;
- identification of areas of responsibility for environmental management of the project;
- statutory requirements – licences and approvals required;
- a structured reporting system detailing all relevant matters on a regular basis;
- procedures and forms for documentation and reporting of issues;
- training of personnel in environmental awareness;
- guidelines for emergencies, contact names and corrective actions for non-conformance and notifications to appropriate authorities and affected parties;
- auditing implementation of the CEMP;
- review procedures and protocols for modification of the CEMP;
- complaint handling procedure;
- site management and control procedures; and
- monitoring procedures.

Specifically, the CEMP would provide management actions in relation to:

- erosion and sediment control;
- surface water management;
- waste generation and disposal;
- flora and fauna management
- Aboriginal cultural heritage;
- the control of atmospheric emissions;
- the control of construction traffic movements; and
- the control of noise emissions.

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20.2.2 Operational Environmental Management Plan

An Operational EMP (OEMP) would be prepared for the proposed power station, which would address the key ongoing monitoring requirements. The OEMP for the operational phase would include information on:

- details of proposed maintenance and monitoring programs;
- responsibility for maintenance and monitoring;
- reporting requirements;
- permits, approvals and consents issued under the approval process;
- community liaison such as complaints registers and a 24-hour hotline;
- the appropriate standards and protocols for the necessary controls, monitoring and remediation measures;
- auditing procedures;
- response plans for contingency events;
- properly established operating procedures;
- environmental training and education at all levels;
- monitoring system, review of plans and progress toward achieving objectives and goals;
- non-compliance handling procedures;
- environmental quality controls; and
- plant closure and rehabilitation plan.

20.3 Environmental Safeguards

A number of environmental safeguards and mitigations measures to prevent or minimise environmental impacts that may be generated by the construction and operation of Leaf's Gully are proposed. These measures would be incorporated in both EMPs and implemented throughout the life of the project.

Table 20-1 summarises these safeguard measures, sets out priorities for implementation (construction and operation), and lists the responsibility for ensuring that these safeguard procedures are undertaken.

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Table 20-1 Summary of Mitigation Measures and Commitments

Item	Mitigation Measures / Commitments	Implementation	Responsibility
General			
A1	- AGL would carry out construction and operation generally in accordance with the: - Project application - EA - Draft Statement of Commitments	Design, Construction and Operation	AGL
A2	AGL would ensure that all buildings are constructed generally in accordance with the plans provided as part of the EA, the Building Code of Australia and the relevant parts of the EP&A Act building certification.	Design and Construction	AGL
A3	AGL would ensure that all practicable measures are implemented to prevent or minimise any impacts to the environment that may arise from the construction, commissioning and operation.	Design, Construction, Operation	AGL
A4	Leafs Gully Power Project would only operate on natural gas for firing in the power station turbines. AGL would not use liquid fuels to fire the proposal without the written approval of the Director-General.	Operation	AGL
A5	Leafs Gully Power Project would operate as a peaking plant for up to 15% of the year with any exceedances of this capacity to be approved by the relevant government authority	Design and Operation	AGL
A6	- Prepare and implement: - CEMP; and - OEMP.	Construction and Operation	AGL and Contractor
Consultation			
B1	Consultation with landholders in proximity to the site during key phases of project development i.e. pre-construction, construction and initial operation.	Design, Construction and Operation	AGL and Contractor
B2	Ongoing consultation with local landholders and key community groups to inform them of development progress.	Design, Construction and Operation	AGL and Contractor
Air Quality			
C1	As part of the detailed design of the development, the assumptions and emission estimates used in this assessment will be reviewed and should the expected emission rates used in the Environmental Assessment alter detrimentally, the modelling will be revised to ensure that DECC air quality standards and goals will be met.	Design	AGL
C2	Nitrogen oxide emissions would be measured throughout operation, using a Constant Emissions Monitoring System (CEMS).	Design and Operation	AGL
C3	Undertake further liaison with CASA regarding aviation safety.	Design	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
C4	Throughout the design process, opportunities to further minimise emissions to air will be investigated and implemented wherever feasible to ensure that off-site impacts are kept to a minimum.	Design	AGL
C5	Emissions of particulates (dust) would be specifically controlled through the implementation of mitigation measures, which would be incorporated into a construction environment management plan (EMP) including but not limited to dust suppression, stockpile stabilisation, and construction access road management.	Construction	AGL
C6	All major access roads would be sealed and vehicle speeds on unsealed areas would be controlled to minimise dust.	Construction and Operation	AGL
Soils			
D1	A nominal east to west cross-fall of 3 % shall be applied to the platform to provide adequate site surface drainage.	Design	AGL
D2	Where excavation work extends into bedrock, suitable material would be reused as engineering fill on the site.	Design and Construction	AGL and Contractor
D3	Weathered sandstone from the proposed excavation to 12 m depth on the eastern side of the switchyard would be used; where practical; to create a reasonable all-weather surface for the site platform and laydown areas.	Design and Construction	AGL and Contractor
D4	Assess need for groundwater control and collection system.	Design and Construction	AGL and Contractor
D5	Where practicable, material excavated from the site (except for say 150 mm of topsoil and root-affected material) would be suitable for use as engineered fill in any cut/fill operations.	Design and Construction	AGL and Contractor
D6	The visual screening mound located towards the northern perimeter of the Site would be constructed from excess fill generated in excavations where practical.	Design and Construction	AGL and Contractor
D7	A Construction Soil and Water Management Plan would be developed and implemented as part of the CEMP for the construction works to ensure effective management of potential soil erosion issues.	Construction	AGL and Contractor
D8	Construction would be planned to minimise the time that disturbed land is exposed.	Construction	AGL and Contractor
D9	Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.	Construction	AGL and Contractor
D10	Use of cement-stabilised layers in flexible pavements and use of rigid pavements would be avoided, wherever possible to protect against subsidence effects.	Design	AGL
D11	All structures would be designed to accommodate the strains and tilts arising from the predicted subsidence. Approval of the structural design would be sought from the Mine Subsidence Board.	Design	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
D12	Provision of a synthetic liner (probably high density polyethylene) for the evaporation pond. The liner would not be covered by a "protective" soil layer.	Design	AGL
D13	Evaporation pond(s) will be designed such that they can be maintained and operated without overflow under the range of operational and climatic conditions expected.	Design	AGL and Contractor
D14	Discharge from the sedimentation pond would be through an appropriately designed dissipating structure to minimise soil erosion potential in Leafs Gully.	Operation	AGL
D15	Appropriately bunded areas would be installed and maintained for storage of fuels, oils and chemicals.	Construction and Operation	AGL and Contractor
D16	Areas within the operational plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater.	Operation	AGL
Landscape and Visual			
E1	Colour and texture of structures in the power station should be dark in tone and utilise non-reflective materials unless required otherwise by a government authority.	Design	AGL
E2	Create an earth mound on the northern side of the power station to provide visual screening to views from the north generally in accordance with the landscape plan using excess fill generated from foundation excavations.	Design and Operation	AGL and Contractor
E3	Broad scale tree and shrub planting would be carried out on the top and side slopes of the proposed earth mound as well as to other areas surrounding the power plant site identified in the Flora and Fauna section of the EA. AGL will consult with suitably qualified consultants to develop a vegetation plan.	Operation	AGL
E4	Woodland species indigenous to the area would provide additional screening potential to views from the north and east of the power plant site. These will be planted in accordance with a vegetation plan.	Operation	AGL
E5	Lighting of external plant areas would avoid direct line of sight from homesteads to the east of the site.	Design and Operation	AGL
E6	Top of the stacks would not have lighting unless required by CASA.	Design and Operation	AGL
E7	Large floodlights not to be used for normal operations.	Design and Operation	AGL
E8	Security lighting would not spill onto neighbouring residences or onto the SSTF in Leafs Gully. This will be achieved through the use of down lights and motion sensor lighting.	Design and Operation	AGL
Traffic and Transportation			
F1	Separate right turn lane priority intersection (RTA intersection type 'CHR') will be installed at the intersection of the access road and Appin Road. An additional right turn lane will be provided for the residence on Appin Road opposite the access road.	Design , Construction and Operation	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
F2	Large rigid and articulated vehicles approaching from the south to be directed north to u-turn at the Copperfield Road roundabout and enter the site using the separate right turn lane.	Construction and Operation	AGL and Contractor
F3	Sufficient signposting would be installed as necessary to reinforce the banned left turn movement for oversize vehicles.	Construction and Operation	AGL and Contractor
F4	Undertake further assessments to identify and cater for any necessary remedial treatments to facilitate passage once the actual weight and dimensions of the proposed plant equipment are known.	Design	AGL and Contractor
F5	Transport of over-mass and over- dimensional loads to be undertaken under RTA and NSW Police permit conditions and approved routes	Construction	AGL and Contractor
Noise and Vibration			
G1	A Construction Noise Management Plan is to be developed as part of the CEMP to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary.	Construction	AGL and Contractor
G2	The Construction Noise Management Plan would consider, if appropriate, the use of temporary barriers and the positioning of plant / processes.	Construction	AGL and Contractor
G3	Limiting the “clustering” of plant / processes.	Design and Construction	AGL and Contractor
G4	Include noise attenuation (such as an upgraded silencer on the stack and upgrading the façade enclosure for the turbine and generator) in detailed design such that the INP noise goals are met for the existing residences. These requirements would be referred to the preferred Tenderer.	Design and Operation	AGL
G5	Low frequency noise to be addressed during detailed design consistent with the most recent assessment process that has been developed overseas, in lieu of the INP.	Design	AGL
G6	Confirm assumptions used in operational noise modelling based on choice of final turbine system. Confirm requirements for mitigation.	Design	AGL
Flora and Fauna			
H1	Land identified for the Conservation Area would be re-titled for conservation purposes either through a Voluntary Conservation Agreement (VCA) or AGL would enter the land into the NSW Biobanking Scheme or some other enduring protection mechanism. A decision on which conservation mechanism is to be adopted would be made following the determination of the Project and would depend on whether the Biobanking Scheme is operational and details of that scheme.	Design, Construction and operation	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
H2	A Management Plan would be developed for Conservation Area including Management of the conservation area would include measures as discussed in the Section 8.3 of the Biodiversity Assessment (Appendix K). Full details of the proposed management regime would be included in a management plan that would be prepared in consultation with DECC.	Design, Construction and Operation	AGL and Contractor
H3	The management of the Conservation Area would be funded by proceeds of the Biobanking Trust Fund if that mechanism is chosen, or from revenue from the operation of the power plant.	Construction and Operation	AGL
H4	A Construction Environmental Management Plan (CEMP) would be developed for the Site and would include measures for the minimisation or avoidance of impacts on native flora and fauna in accordance with the recommendations in Section 7.2 of the Biodiversity Assessment (Appendix K) and include: - ground cover management; - tree- fauna management; - site management procedures; - weed and pest management; and - soil erosion and runoff control.	Design and Construction	AGL and Contractor
H5	Create and manage the Pultenaea Recovery Area by: • Ceasing grazing. • Controlling invasive exotic grasses, particularly <i>Pennisetum clandestinum</i> (Kikuyu); and <i>Paspalum dilatatum</i> (Paspalum). Thinning of the native shrub <i>Kunzea ambigua</i> (Tick Bush) may be required at a later stage to prevent shading of <i>Pultenaea pedunculata</i> seedlings (if present). • Monitoring of regenerating species for <i>Pultenaea pedunculata</i> seedlings. • Prior to the installation of the water pipeline to the Upper Canal, further targeted surveys for <i>Pultenaea pedunculata</i> and, if necessary, placement of the pipeline adjacent to the visual screening mound is recommended to avoid potential habitat disturbance. Conduct a low intensity burn within the area (excluding the location of the <i>Pultenaea pedunculata</i> record) to facilitate germination from the seed bank.	Design and Operation	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
H6	Qualified ecologists shall conduct a detailed pre-clearance survey prior to development of the Site in accordance with the recommendations in the Biodiversity Assessment in (Appendix K). If nests or nestlings of Threatened species are observed within, or close to, the development footprint then construction should be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC should be consulted to determine if relocating the species is acceptable.	Design	AGL
H7	Complementary planting and rehabilitation shall use local provenance seed, propagules, or saplings where possible for plantings and utilise best practice bush regeneration techniques.	Design, Construction and Operation	AGL
H8	Prior to the installation of the water pipeline to the Upper Canal, further targeted surveys for <i>Pultenaea pedunculata</i> should be conducted and, if necessary placement of the pipeline adjacent to the visual screening mound is recommended to avoid potential habitat disturbance.	Design	AGL
H9	During detailed design for Appin Road widening, a survey of the area shall include plotting individual trees within the road corridor to better quantify the extent of tree removal necessary.	Design	AGL
Water Management – Soil Erosion			
I1	At a minimum the measures outlined in the Managing Urban Stormwater – Vol 1 Soils and Construction would be implemented. Measures may include: • limiting slope length, • installation of sediment filters and • the construction of a sedimentation basin downstream of the plant area	Construction	AGL and Contractor
I2	Soil erosion and sedimentation devices would remain in place until the surface is restored. These devices would also capture any gross pollutants.	Construction	AGL and Contractor
Water Management – Spills and Site Management			
J1	All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines and stored in a designated covered area.	Construction and Operation	AGL and Contractor
J2	Waste collection areas would be designated.	Construction and Operation	AGL and Contractor
J3	Waste disposal and collection would be undertaken in an appropriate manner.	Construction and Operation	AGL and Contractor
J4	All major vehicle and equipment maintenance would be undertaken offsite.	Construction and Operation	AGL and Contractor

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
J5	Any vehicle washing on-site (if not restricted by Sydney Water from time to time) would be restricted to specific bunded areas.	Construction and Operation	AGL and Contractor
J6	Staff facilities would be provided, installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater	Construction and Operation	AGL and Contractor
J7	Water for dust suppression would be sourced from the existing dams on the site or imported if required	Construction	AGL and Contractor
Water Management – Surface water			
K1	There will be no direct drainage from power plant site to Upper Canal lands.	Design, Construction and Operation	AGL and Contractor
K2	Further consultation with Sydney Catchment Authority for necessary approvals to be undertaken should the Upper Canal water supply source option be the preferred water source.	Design	AGL
K3	Water management strategies will be developed and implemented to maintain zero water discharge from the power plant site except for natural surface flows.	Design and Operation	AGL
K4	Water from the power plant site would be directed through oil and grit traps before discharge from the site designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge. This system would also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater.	Operation	AGL
K5	The outlet of the power plant site's stormwater system would be designed to maximize the dispersion of these high flows and spread the flow out over a wider area and thereby minimize their potential to cause soil erosion downstream.	Design and Operation	AGL
K6	Blow down water would be collected in evaporation ponds lined with a synthetic liner (such as high density polyethylene) to minimise the risk of the saline blow down water escaping into the natural groundwater system.	Design and Operation	AGL
K7	Landscaping around the base of the screening mound would minimise the potential for soil erosion.	Design	AGL
K8	Undertake hydrologic and hydraulic studies and implement mitigation measures if required to address local flooding from Leaf's Gully.	Design	AGL
K9	Domestic wastewater would be treated by a zero discharge proprietary treatment system or stored and disposed of offsite by a licensed contractor.	Design, Construction and Operation	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
Aboriginal Heritage			
L1	Undertake a program of archaeological subsurface testing across a representative sample of the LGPAD1 deposits with the aim of determining the nature and significance of any Aboriginal objects present as detailed in the indicative program and scope of subsurface testing provided in the Cultural Heritage Assessment (Appendix M). The draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation would be followed. On completion of the program DECC are to be provided with updated site information for inclusion in their AHIMS register.	Design	AGL
L2	If necessary, appropriate management strategies should be formulated to mitigate any development impacts to identified heritage values.	Design	AGL
L3	No development-related ground disturbance is to occur until this program has been completed.	Design and Construction	AGL
L4	The CEMP would be developed and implemented addressing heritage issues. The CEMP would detail the management strategies to be followed in the event that an Aboriginal object or non Aboriginal archaeological relic is uncovered during construction as detailed in the indicative program and scope of subsurface testing provided in the Cultural Heritage Assessment (Appendix M). In the first instance, all works must cease in the affected area. A protocol for Human Skeletal Remains will be developed and followed.	Construction	AGL and Contractor
European Heritage			
M1	A pipeline connection with the Upper Canal will:		
M1.1	Be designed to minimise direct and indirect impacts to the fabric and context of the canal;	Design	AGL
M1.2	Be consistent with the provisions of the existing Conservation Management Plan for the Upper Canal (Higginbotham and Associates 2002).	Design and Construction	AGL and Contractor
M1.3	Comply with any heritage impact mitigation actions as required by Conservation Management Plan (such as conduct archival recording)	Design and Construction	AGL and Contractor
Socio-Economic Assessment			
N1	Where practicable, local contractors and supply companies would be utilised for the provision of labour and services during the construction phase and subsequent operation and maintenance of the plant.	Construction and Operation	AGL and Contractor
Waste Management			
O1	Store and dispose all hazardous and industrial waste (as defined by <i>Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes</i> (Environment Protection Authority 1999)	Construction and Operation	AGL and Contractor

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
O2	Prepare Waste Management and Re-use Sub-Plans as part of the CEMP and OEMP addressing the management of wastes during these stages. The Sub-Plans will include:	Construction and Operation	AGL and Contractor
O2.1	Application of the waste minimisation hierarchy principles of avoid / reduce / reuse/ recycle and dispose	Construction and Operation	AGL and Contractor
O2.2	Waste handling and storage	Construction and Operation	AGL and Contractor
O2.3	Disposal of waste with specific details provided for cleared vegetation, glass, metals and plastics hydrocarbons (lubricants and fuels) and sanitary wastes.	Construction and Operation	AGL and Contractor
O2.4	Any waste material that is unable to be reused, reprocessed or recycled will be disposed at a facility approved to receive that type of waste.	Construction and Operation	AGL and Contractor
Preliminary Hazard Analysis			
P1	Conduct an assessment of the safety management system to be implemented and used at the site, specifically as it applies to the proposed hazardous materials handling, pipelining and storages within the first year of operation.	Operation	AGL
P2	High and low pressures of the natural gas supply to be monitored during (and, if applicable, outside) operation of the Power Plant. If required (as defined in a detailed HAZOP study to be conducted) these conditions may need to be associated with an automatic trip / shut down.	Operation	AGL
P3	Use of fusible tubing around high risk natural gas piping to be investigated – such tubing would be linked to automatic shut down of the fuel source.	Operation	AGL
P4	The detailed design of the turbine housing and associated equipments should clearly outline to basis of safety used to ensure that explosive situations do not arise (the risk is rendered negligible). Reference should be made to European ATEX Directive and the UK HSE PM84 or other guidance / regulation of equivalent safety.	Design	AGL
P5	Fire protection inside the turbine housing to be determined, including use of explosion panels and use of fire retardant material.	Design	AGL
P6	A system should be put in place to ensure that any removal of critical safety function (e.g. for repair or exchange) is subject to careful scrutiny by plant management (decisions on whether to shut down plant or a turbine if a critical safety function is removed need to be canvassed).	Design and Operation	AGL
P7	Rotating machines to be designed such that risk associated with projectile is minimised (gas pipelines protected or not in probable line of projectile, people protected etc.)	Design	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
P8	Loud alarm and visual indication (e.g. strobe light) to be installed within the turbine housing, alerting any persons within these housings of the pending discharge of asphyxiants and allowing escape.	Design and Operation	AGL
P9	A safety assessment process would continue throughout the design, construction and commissioning of a potentially hazardous facility to refine and update the outcome of the development approval / environmental risk process.	Design, Construction and Operation	AGL and Contractor
	Bush Fire		
Q1	Prepare Bush Fire Management Plan, which would include management and maintenance of APZs, threatened species management (i.e. <i>Pultenaea pendunculata</i> and SSTF), water supply, access and other bush fire protection measures for the site.	Construction and Operation	AGL
Q2	Create Asset Protection Zones on northern, western and southern and eastern sides of proposed facility as follows: 25 m Asset Protection Zone on northern side (measured from diesel tank) 35 m Asset Protection Zone on northwestern side (measured from the Admin Building) 50 m Asset Protection Zone on the western side (measured from the western limit of the turbines) 50 m Asset Protection Zone on the south and southwest (measured from the Gas Receiving Station).	Design, Construction and Operation	AGL and Contractor
Q3	Detailed design to position diesel tank storage and Gas Receiving Station with consideration of <i>Bush fire Guideline</i> to reduce potential bush fire risk and avoid disturbance of SSTF vegetation in creating an Outer Protection Area. For the diesel tank consider altering the location of the diesel tank or constructing underground.	Design and Operation	AGL
Q4	Ensure adequate Asset Protection Zone achieved between the plant and proposed mass plantings for the Conservation Area. Asset Protection Zones should be managed according to 'Standards for Asset Protection Zones (RFS undated).	Design and Operation	AGL
Q5	Ensure adequate water supply (through installation of water reticulation and hydrants and/or tanks) at appropriate locations around the northern, western and southern perimeters of the facility, in consultation with Rural Fire Service. The proposed water supply tank should have fittings suitable for Rural Fire Service uses. Water should not be reliant upon external power supply. Hydrants should be installed according to AS 2419 <i>Fire Hydrant Installation</i> and delivered via a ring main system.	Design and Operation	AGL

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Item	Mitigation Measures / Commitments	Implementation	Responsibility
Q6	Creation of a sealed two-way all weather perimeter access road for fire fighting vehicles. Consultation with Rural Fire Service regarding adequacy of proposed laydown area for this purpose.	Design and Operation	AGL
Q7	Ensure medium to long-term maintenance of proposed mass plantings to minimise fuels loads and fire risk. Avoid contiguity of vegetation (vertical and horizontal) in landscaping areas, including dense plantings of sclerophyllous native shrubs. Choose mesic or rainforest species in locations subject to potential flame attack. Ensure watering systems are maintained in working order. Avoid stockpiling of mulch and other organic materials for extended periods.	Design and Operation	AGL
Q8	Trees and other vegetation in the vicinity of power lines should be managed in accordance with specifications in Vegetation Safety Clearances (Energy Australia 2002).	Design and Operation	AGL
Q9	Prepare Emergency Response Plan as part of the CEMP and OEMP. The Plan would include emergency response provisions for bush fire in site Emergency Response Plan. Ensure Plan includes evacuation arrangements, routines, and nominated control staff for bush fire events. Consult local Rural Fire Service branch in preparation of Plan.	Design, Construction and Operation	AGL
Q10	Remove flammable weed species (e.g. African Olive) from bushland to be retained on-site.	Design and Operation	AGL

21.1 Ecologically Sustainable Development

The *Environmental Planning and Assessment Regulation 2000* requires that an Environmental Assessment include:

"The reasons justifying the carrying out of the development or activity in the manner proposed having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development."

The principles of Ecologically Sustainable Development, as listed in the Regulation, are as follows:

"The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation."

Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations."

Conservation of biological diversity and ecological integrity."

Improved valuation and pricing of environmental resources."

21.1.1 Precautionary Principle

AGL's precautionary approach is demonstrated by the design and management controls to be implemented as part of the proposed Leaf's Gully Power Project. The controls proposed specifically address the threat of serious or irreversible damage from:

- land use change;
- air emissions;
- noise emissions;
- surface water discharges;
- soil and groundwater contamination;
- impacts on flora and fauna;
- visual impacts;
- damage to cultural artefacts;
- wastewater disposal; and
- potential hazards.

Monitoring of these aspects would be carried out in accordance with regulatory and licence requirements. Where deviations from expected conditions are recorded, the matter would be investigated immediately and appropriate action taken as necessary, to prevent any adverse environmental impact as required by the Environmental Management Plans (Construction and Operation) for the proposed Leaf's Gully Power Project.

The proposed Leaf's Gully Power Project would utilise modern technology with known consequences and effects. The technology proposed represents the best industry standard for modern power plants and is used throughout the world by the leading electricity generating companies.

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21.1.2 Inter-Generational Equity

AGL proposes to construct a gas fired power plant with a total generation capacity of about 300 MW. Leaf's Gully Power Project, comprising the installation of two gas turbine generators, each rated at approximately 150 MW each run in open cycle mode. The type of power plant proposed, has been designed to meet with the principles of inter-generational equity in the following ways:

- the use of gas fired technology which has less environmental impacts than traditional coal fired technology, through the elimination of a need to mine, transport and store coal as a fuel source;
- the use of open cycle gas turbine technology which represents industry best practice, in meeting peak load demand; and
- throughout the lifespan of the proposed power plant opportunities to minimise resources and maximise recycling and reuse of materials would be continually identified. This would be effected through the implementation of a waste management policy and associated plan, which would influence the design and management of both the construction and operational phases.

21.1.3 Conservation of Biological Diversity and Maintenance of Ecological Integrity

The proposed project would not significantly affect the biological diversity or ecological integrity of the Appin area.

Studies conducted on the flora and fauna of the area indicate that no rare, endangered or threatened species are likely to be impacted adversely by the proposed development. However, mitigation measures would be implemented during both the construction and operational phases of the project, to ensure the existing ecological integrity is maintained in the Appin area.

Subject to consent conditions determined by the Minister for Planning, AGL would agree to permanently conserve vegetation communities in the area between the Nepean River and the Upper Canal as well existing vegetation and fauna habitat around the facility footprint comprising approximately 170 ha of vegetation within the Development Site. The Voluntary Conservation Agreement or biobanking agreement or some other enduring protection mechanism becomes permanent upon implementation of the agreement and transfers with title to the land so that any future landowners have to abide by the agreement.

21.1.4 Improved Valuation and Pricing of Environmental Resources

It is difficult to assign a monetary value to the environment of the locality, given the lack of precedence and guidelines in the valuation of environmental resources not considered for commercial use. The approach taken would be to manage any environmental impacts by identifying appropriate mitigation measures to minimise adverse environmental impacts and including the cost of these safeguards in the total project cost.

AGL would invest approximately \$168.3 million for the construction and commissioning of the project. The cost of implementing these mitigation measures would be reflected in the overall cost of providing electricity to consumers hence improving the pricing of environmental resources. This approach would allow the value and price of environmental resource protection to be more accurately quantified.

21.2 Environmental Assessment Findings

A brief summary of the main findings of the Environmental Assessment is presented below. Detailed descriptions of each aspect are presented in the separate sections of the Environmental Assessment. Details of environmental management and monitoring techniques and the commitments made by AGL which would be implemented for the proposed Leaf's Gully Power Project are presented in Chapter 20.

21.2.1 Bio-physical Environment

The main findings of the biological and physical environment assessment are summarised below.

Air Quality

Modelling of the regional air quality impacts did not show any substantial adverse impacts on photochemical smog formation that may be produced as a result of operation of a power plant.

Modelling of the local air quality impacts for the worst case scenario showed that ground level concentrations of NO₂, PM₁₀, CO, SO₂ and HAP were found to be below the NSW DECC criteria. On this basis it is considered that the impacts on local air quality from this development would be minor and adverse impacts are unlikely.

The plume rise assessment found that consideration should be given for the plant to be designated a hazard to aircraft operators in the area. Further discussions would be held with CASA to address these issues.

The greenhouse gas production from the Leaf's Gully Power Project represents 0.37 % of the stationary energy emissions from other power generation in NSW in Australia, and just 0.10% of all power generation in Australia.

Health Impact

An assessment of the possible health consequences arising from operation of the proposed Leaf's Gully Power Project concluded that at the projected levels of the potential pollutants considered in the air quality impact document there is unlikely to be any adverse effect on mortality, lung development in children and adolescents, decline in lung function or rates of asthma development."

Soils and Geology

The Development Site is located within Area 5 of the West Cliff Colliery. The mining of this area may cause subsidence at the site. Subsidence has been predicted and it was concluded that should subsidence occur, the power plant would be able to withstand the predicted maximum subsidence impacts. The gas pipeline and electricity transmission line connections would be designed to allow for movement associated with mine subsidence.

Impacts on soils resulting from the construction and operation of the proposed Leaf's Gully Power Project are likely to be negligible with the implementation of mitigation measures.

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Landscape and Visual

The Visual Assessment concluded that the proposed Leafs Gully Power Project would have a low visual impact on people in areas surrounding the site. This resulted from a combination of factors including natural screening of the site from existing vegetation as well as proposed planting, construction of a screening mound that would reduce the visual contrast of the structures.

Traffic and transport

The traffic and transport assessment found that the arterial road network can satisfactorily and safely accept the additional traffic generated by the development during the construction, operational and maintenance phases if a separate right turn lane priority intersection is installed at the Appin Road / access road intersection. This type of intersection limits the impact on Appin Road traffic flow and provides a safe area for queuing right-turning vehicles. The right turn opportunity would be extended to include a separate lane access for a property driveway on the eastern side of Appin Road located opposite the access road for the site.

Noise

A preliminary assessment of noise during the construction phase shows no exceedances at the existing residential receivers which would be confirmed with the Contractor prior to commencement.

No noise exceedances at surrounding residences have been predicted for the plant with mitigation measures. It is noted that during the tendering and detailed design process the plant would be designed to meet the specified noise limits and mitigation measures would be finalised at that stage. For the purposes of the assessment it was assumed that standard plant items are installed with an upgraded silencer on the air intakes and an upgrading of the façade enclosure for the turbine and generator enclosure is undertaken.

Flora and Fauna

Parts of the property are dominated by Shale Sandstone Transitional Forest (SSTF), an Endangered Ecological Community listed under the *EPBC* and *TSC* Acts. The iterative design process has allowed for the footprint of the proposed Leafs Gully Power Project, access roads and bund to be positioned so that it does not impact directly on remnant Shale Sandstone Transitional Forest or the vegetated tributaries. Disturbance would be contained within areas previously used for agriculture. The proposed Leafs Gully Power Project and associated infrastructure would avoid clearing of any Endangered Ecological Community.

In addition to the above measures, AGL are proposing to establish a Conservation Area within the Development Site of approximately 170 ha. The land would be re-titled for conservation purposes in consultation with DECC, either through a Voluntary Conservation Agreement (VCA), a Biobanking Agreement, or some other enduring protection mechanism. A decision on which conservation mechanism is to be adopted would be made following the determination of the project and would depend on whether the Biobanking Scheme is operational and details of that Scheme.

Water Management

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. Wastewater volumes have been estimated and management strategies developed to maintain zero water discharge from the site except for natural surface flows.

Heritage

Although no Aboriginal objects or sites were located during the field survey, a substantial area of potential archaeological deposit was identified in the study area. As the area of potential archaeological deposit would be subject to development impact, a program of archaeological subsurface testing across a representative sample of potential archaeological deposits is required with the aim of determining the nature and significance of any Aboriginal objects present.

While a small section of the Upper Canal System is impacted by the proposed Leaf's Gully Power plant development, the expected impact of the connection would be minor in nature.

Land use and property impacts

Mitigation measures detailed in this Environmental Assessment would be implemented to ensure that the proposal is managed in an effective and efficient manner, with minimal impact on existing or possible future surrounding land uses during construction or operation.

The potential for interaction of the proposal with new urban development in the region was considered in the context of the NSW Government's plans for development: the Sydney Metropolitan Strategy and the Metropolitan Development Plan. It is noted that the Sydney Metropolitan Strategy focuses on the South West Growth Centre and the Development site is not within the boundaries of this growth area. However, Mount Gilead has been identified in the Metropolitan Development Plan. This area is approximately 2 km from the Development Site. No other areas closer to the Development Site have been identified in the Metropolitan Development Plan. It is noted that the Sydney Metropolitan Strategy states that lands outside growth centres which are not on the Metropolitan Development Plan are not targeted for development over the next 25 years. A strategic review undertaken in 2007 which addressed housing demand and land supply in the Macarthur South area determined that Macarthur South was not required to address regional and metropolitan housing needs.

Socio Economic

The analysis shows positive economic and social benefits at a national level in terms of contribution to Gross Domestic Product, income and employment resulting from the plant construction and operation. It is believed, that a large proportion of the benefits from the Project would eventuate in the local or state regions.

Preliminary Hazard Analysis

The results of the PHA show that the risk associated with this development is very low using mostly highly conservative assumptions. The most stringent risk criteria, as required by the Department of Planning, are adhered to.

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21.3 Conclusion

Project Approval under Part 3A of the EP&A Act is being sought by AGL for the construction and operation of a gas fired power plant at Gilead near Appin, NSW. The power plant would use natural gas as its primary fuel and have a total generating capacity of approximately 300 MW.

The proposed Leaf's Gully Power Project would be constructed in one stage comprising the installation of two gas turbine generators, rated at approximately 150 MW each run in open cycle mode. The power plant would operate in open cycle mode during times of peak electricity demand and it is expected that the plant would be required to operate for up to 15 % of the year with any exceedances of this capacity to be approved by the relevant authorities.

Mitigation measures to ensure impacts to both the bio-physical and socio-cultural environment remain at an acceptable level throughout the planned lifespan of the proposed power plant have been factored in to the proposal in the following ways:

- proposed generation technology;
- specific power plant design and site layout; and
- adherence to Environmental Management Plans (EMP) including a Construction EMP and Operation EMP, which would dictate the specific environmental policies and management plans that the site would operate in accordance with.

The Environmental Assessment has been produced to ensure that the following regulatory and community requirements have been addressed:

- Environmental Planning and Assessment Act 1979;
- State Environmental Planning Policies and Regional Environmental Plans;
- specific requirements identified by the Department of Planning Director – General; and
- local residents and businesses.

Having regard to the Environmental Assessment findings and the principles of ESD, the reasons justifying the carrying out of the development in the manner proposed are as follows:

- environmental issues associated with the proposed development of the power plant have been fully considered;
- where modelling of impacts was carried out it was on the basis of the worst case scenario, considered cumulative impacts with existing known facilities, and utilised conservative assumptions;
- potential impacts identified are capable of being mitigated and the proposed development does not represent a threat of serious or irreversible environmental damage; and
- biological diversity and ecological integrity of the area would not be affected by the proposed development.

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Environmental impacts associated with the proposed power plant have been identified and addressed in this Environmental Assessment according to the Environmental Assessment Requirements issued by the Department of Planning. Where appropriate, environmental safeguards in the form of mitigation measures have been recommended to minimise the environmental effects of the project.

No significant adverse environmental impacts have been identified through the course of studies. Environmental impacts that have been identified comply with relevant standards and are capable of being mitigated through the use of appropriate environmental controls.

AGL Greenhouse Gas Policy

<http://www.agl.com.au/AGLNew/About+AGL/Environment/Greenhouse+gases/default.htm>

AGL Greenhouse Gas Reduction Program

<http://www.agl.com.au/AGLNew/About+AGL/Environment/Greenhouse+gases/default.htm>

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Study Team

AGL Power Generation (NSW) – Project Management Team

Steven Jackson / Justin Flood

Project Manager

URS Australia Pty Ltd – Environmental Assessment Study Team

Nicole Brewer

Project Manager

Ian McCardle

Project Director

Specialist Studies

Regional Air Quality Assessment

CSIRO Energy Technology

Local Air Quality Assessment

Stephen Bowly –Air Quality Scientist
URS Australia Pty LtdJames Grieve, Air Quality Scientist
URS Australia Pty Ltd

Health Assessment

Associate Professor David McKenzie
Head, Respiratory and Sleep Medicine, Prince of Wales
HospitalDr Elizabeth Brown Research Fellow,
Prince of Wales Medical Research Institute

Geotechnical Assessment

Dr Neil Mattes, Senior Principal Geotechnical
URS Australia Pty Ltd

Noise Assessment

Wilkinson Murray Pty Ltd

Heritage

Navin Officer Heritage Consultants

Flora and Fauna Assessments

Mark Adams, Associate Environmental Scientist
URS Australia Pty LtdJoanne Lawry, Senior Environmental Scientist
URS Australia Pty LtdBen Harrington, Environmental Scientist
URS Australia Pty LtdJeremy Pepper, Associate Environmental Scientist
URS Australia Pty Ltd

Preliminary Hazard Assessment

Planager Pty Ltd

Water Management

Peter Dalglish, Principal Water/Wastewater
URS Australia Pty LtdEmma Roberts, Senior Civil Engineer
URS Australia Pty LtdChad Casey, Project Mechanical Engineer
URS Australia Pty Ltd

Bushfire Assessment

Jeremy Pepper, Associate Environmental Scientist
URS Australia Pty Ltd