

VOLUME 2 APPENDICES JULY 2011

AGL Dalton Power Project Environmental Assessment

MP10-0035

Appendix H

Flora and Fauna

URS



Switched on Business.



Report

Dalton Power Project

Flora and Fauna Assessment

JULY 2011

Prepared for
AGL Energy Limited

Level 22
101 Miller Street
North Sydney NSW 2060

43177661

URS

Project Manager:

Nicole Brewer
Senior Associate
Environmental Engineer

URS Australia Pty Ltd
Level 4, 407 Pacific Highway
Artarmon NSW 2064
Australia

Author:

Kathryn Chesnut
Ecologist

T: 61 2 8925 5500
F: 61 2 8925 5555

Reviewer:

Jane Murray
Associate Ecologist

Date: **July 2011**
Reference: 43177661/43177661/6
Status: **FINAL**

Document delivery

URS Australia provides this document in either printed format, electronic format or both. URS considers the printed version to be binding. The electronic format is provided for the client's convenience and URS requests that the client ensures the integrity of this electronic information is maintained. Storage of this electronic information should at a minimum comply with the requirements of the Commonwealth Electronic Transactions Act (ETA) 2000.

Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by URS and a copy will be provided if requested.

Table of Contents

Executive Summary	xi
1 Introduction	1
2 Project Description	5
2.1 Project Location	5
2.1.1 The Facility	5
2.1.2 Facility location considerations	7
2.1.3 Gas Pipeline and Access Road	7
2.1.4 Communications Tower and Hut Footprint	10
2.1.5 Communications Tower Services and Access Track	10
2.2 Site Description	11
2.2.1 Soils and Geology	11
2.3 Topography and Hydrology	12
2.4 Climate	12
3 Legislative Framework	13
3.1 State	13
3.1.1 Environmental Planning & Assessment Act 1979	13
3.1.2 Threatened Species Conservation Act 1995	13
3.1.3 Native Vegetation Act 2003	14
3.1.4 Noxious Weeds Act 1993	14
3.1.5 NSW Fisheries Management Act 1994	14
3.1.6 State Environmental Planning Policy 44 – Koala Habitat Protection	15
3.2 Commonwealth	15
3.2.1 Environment Protection and Biodiversity Conservation Act 1999	15
4 Methodology	17
4.1 Literature Review	17
4.2 Field Surveys	17
4.2.1 Flora	24
4.2.2 Fauna	28
4.2.3 Staff Qualifications	32
4.2.4 Survey Limitations	34
5 Results	35

5.1	Literature Review	35
5.2	Field Survey.....	36
5.2.1	Flora	36
5.2.2	Fauna.....	42
5.2.3	Critical Habitat.....	50
6	Impact Assessment	51
6.1	Threatened Species, Populations and Ecological Communities	51
6.1.1	Threatened Flora.....	51
6.1.2	Threatened Fauna	51
	Threatened Populations	52
6.1.3	Endangered Ecological Communities	52
6.2	Key Threatening Processes	53
6.3	Site Establishment Impacts	55
6.3.1	Flora	55
6.3.2	Fauna.....	56
6.3.3	Threatened Species	58
6.3.4	Endangered Ecological Communities	60
6.4	Indirect and Operational Impacts	60
6.4.1	Artificial Lighting	60
6.4.2	Roads and Access	60
6.4.3	Groundwater and Hydrology	61
6.4.4	Edge Effects and Habitat Fragmentation	61
6.5	Long Term Impacts.....	62
7	Biodiversity Maintenance and Improvement	65
7.1	Impact Avoidance	65
7.2	Impact Mitigation	65
7.2.1	Management Planning.....	65
7.3	Impact Offset	78
7.3.1	Proposed Offset Area	84
7.3.2	Management of Offset Site.....	85
8	Conclusion.....	87
9	References.....	89

10 Limitations97**L.11.1 Introduction42****Tables**

Table 2-1	Route Options and Relative Clearing Impacts.....	8
Table 4-1	Summary of Field Survey Effort.....	20
Table 4-2	URS Ecology Personnel and Experience	32
Table 5-3	Vegetation Communities Recorded Within the Site.....	35
Table 5-4	Noxious Weeds Recorded Within the Site and Relevant Control Requirements.	40
Table 7-1	Potential impacts & mitigation measures for Matters of NES	67
Table 7-2	Characteristics of tree hollows used by key threatened species	81
Table 7-3	Project Impacts, Mitigation Measures and Potential Offsets	83
Table 7-4	Proposed Offset Strategy.....	85

Figures

Figure 1	Regional Location	2
Figure 2	Site Layout	3
Figure 3	DECCW Threatened Species Records.....	18
Figure 4	Flora Survey Sites.....	27
Figure 5	Fauna Survey Sites.....	33
Figure 6	Vegetation Communities.....	36
Figure 7	Habitat Resources within Development Footprint.....	48
Figure 8	Connectivity Map	63
Figure 9	URS Vegetation Mapping Offsets	86

Appendices

Appendix A	NPWS Atlas Data Search
Appendix B	EPBC Act Matters of National Environmental Significance Search
Appendix C	CMA Sub-region Search
Appendix D	I&I NSW Fisheries Lachlan CMA Search
Appendix E	Flora Habitat Assessment
Appendix F	Fauna Habitat Assessment

- Appendix G Flora Survey Results
- Appendix H EPBC Act Box Gum Woodland Definition
- Appendix I Fauna Survey Results
- Appendix J Anabat Survey Results
- Appendix K Assessments of Significance
- Appendix L Commonwealth Significant Impact Criteria Assessments
- Appendix M Director General's Requirements
- Appendix N Supplementary Director General's Requirements
- Appendix O EnviroKey Target Surveys Supporting Report
- Appendix P URS Hollow Bearing Tree Inventory

Abbreviations

Abbreviation	Description
°C	Degrees Celsius
ACT	Australian Capital Territory
AHD	Australian Height Datum
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
DBH	Diameter at Breast Height
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEWHA	Commonwealth Department of Environment, Water, Heritage and the Arts
DPI	NSW Department of Primary Industries
EEC	Endangered Ecological Community
EP&A Act	New South Wales <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFMP	Flora and Fauna Management Plan
FM Act	Fisheries Management Act
GIS	Geographic Information System
ha	Hectares
hr	Hour
hrs	Hours
I&I NSW	NSW Department of Industry and Investment (formerly DPI)
km	Kilometres
KTP	Key Threatening Process
kV	Kilovolt
LGA	Local Government Area
mm	Millimetres
MW	Megawatt
NSW	New South Wales
NV Act	Native Vegetation Act
NW Act	Native Wildlife Act
OEMP	Operational Environmental Management Plan
s.5A	Section 5A
SEPP	State Environmental Planning Policy
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
SIS	Species Impact Statement
sp.	Species
spp.	Species'
TSC Act	New South Wales <i>Threatened Species and Conservation Act 1995</i>
URS	URS Australia Pty Ltd

Executive Summary

AGL is proposing to develop a gas fired peaking power station (the facility) at a site in Dalton, New South Wales (NSW). To enable access to the facility and to supply gas to the power station, a gas pipeline and associated easement, access road, and valve station will also be constructed. The Project would also incorporate a communications tower and hut to the east of the power station which would be connected via underground services and an access track. Collectively, these components form the development footprint.

This report relates the findings of the flora and fauna assessment of the development footprint and includes a range of recommended mitigation measures to minimise impacts to native species within the locality. The Project is being assessed under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979*, and this assessment was undertaken in line with Director General's Requirements issued pursuant to that Act, and associated assessment guidelines.

A total of 26 threatened species and one endangered ecological community (EEC) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) were considered to have the potential to occur within the development footprint, and, as such, have been assessed in this report. A total of nine threatened species and one EEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were considered to have the potential to occur within the development footprint, and as such have been assessed via the Commonwealth Significant Impact Criteria assessment guidelines in this report.

Nine threatened fauna species were observed during field surveys. However, no threatened flora species were observed. Two EECs were found to occur within the development footprint; *White Box – Yellow Box – Blakely's Red Gum Woodland* – referred to as Box Gum Woodland, listed under the TSC Act and *Natural Temperate Grassland of the southern Tablelands of NSW and the ACT* – referred to as Natural Temperate Grasslands, listed under the EPBC Act. The proposed works will involve the clearing of approximately 5.94 ha of Box Gum Woodland and 9.07 ha of Natural Temperate Grassland.

Initial survey results suggested that the development footprint and surrounding site (the Study area) supported both Natural Temperate Grassland as well as Commonwealth listed Box Gum Woodland. Consequently, the project has been the subject of an EPBC Referral (11 May, 2010) to the Minister of the Department of Environment, Water, Heritage and the Arts (DEWHA, now the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)).

Following review of the referral, on 11 June 2010, the Project was declared a Controlled Action under the EPBC Act. Consultation with SEWPaC commenced on 16 June, 2010 and supplementary DGRs were issued by the NSW DoP on 5 July, 2010 to take into account the EPBC Act referred matters.

Appendix M contains correspondence confirming that the Project is a controlled action and the accompanying supplementary Director General Requirements (DGRs) for the Project.

Since this time, further survey work has been undertaken across the Study area to assess all vegetation formations with a particular emphasis on the EECs and their extent and condition. Results have determined that the Box Gum Woodland within the study area did not adequately meet the Commonwealth criteria for the listing of the Box Gum Woodland EEC (**Appendix H**) although it was confirmed to meet the criteria relevant to the TSC Act listing of Box Gum Woodland EEC.

Executive Summary

The results of the assessment of the Dalton Power Project suggest that it has the potential to adversely impact to the TSC Act listed EEC Box Gum Woodland, but will not result in a significant impact to any other threatened species or populations listed under the TSC Act and assessed within this report.

To minimise the potential impact of this project, this report contains detailed recommended mitigation measures. These measures include management plans for the construction and operational stages of the project, clearing strategies, habitat replacement plans and rehabilitation and land management strategies. Each of these mitigation measures would be addressed during the construction and operational phase for the Dalton Power Project.

In addition to these measures, and in order to offset the potential loss of the project on Box Gum Woodland (5.94 ha loss) and Natural Temperate Grassland (9.07 ha loss), AGL proposes to agree with the NSW DECCW and SEWPaC the following offsets:

- 77.57 ha of Box Gum Woodland to be managed for environmental purposes in perpetuity within the AGL owned lands adjoining the development footprint, and
- 80.71 ha of Native Temperate Grassland and 24.97 ha of exotic pasture with the potential if managed to become Natural Temperate Grassland to be managed for environmental purposes in perpetuity within the AGL owned lands adjoining the development footprint.

With AGL's commitment to the biodiversity offset strategy and mitigation measures for the project, it is considered that the overall biodiversity of the local area will be 'maintained or improved' as is required under biodiversity assessment guidelines under Part 3A of the EP&A Act. The offset arrangements are also consistent with the Commonwealth's principles for environmental offsets established under the EPBC Act (Department of Environment and Water Resources, 2007a; Department of Environment and Water Resources, 2007b).

Introduction

URS Australia Pty Ltd (URS) was engaged by AGL to undertake a flora and fauna assessment of several properties and a proposed gas pipeline and access road easement in Dalton, NSW (**Figure 1**). This report assesses the flora and fauna impacts associated with the Dalton Power Project and easement with regard to Commonwealth and NSW State planning and environmental legislation.

The Project is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as a major project with the Minister for Planning as the Consent Authority for the Project Application.

AGL is proposing to develop a peaking power station, together with an associated gas metering, conditioning and control facility, (collectively referred to as 'the facility') at a site in Dalton, NSW. In addition to this, a gas pipeline and access road easement will also be developed to connect the site to Walshs Road. Beyond this point the gas pipeline easement will be located in the existing Walshs Road easement until the connection point is reached at the Moomba – Sydney pipeline. At this point, a Valve Station will be constructed to connect the facility to this gas supply. To support the peaking power station a communications tower and hut footprint would also be constructed beyond the Facility footprint and connected to the Facility via underground services. Furthermore, a new services track would be constructed to link these project components.

The facility will consist of up to six gas turbines with approximately 1500 Megawatt (MW) total generating capacity, and will be constructed over two stages:

- Stage 1: the installation of gas turbine generators with a maximum generating capacity of between 250 and 780 MW. These turbines would consist either of between two to four "E" class turbines, with capacity between 125 and 200 MW run in open cycle mode, or two to three "F" class machines with a generation capacity of between 200 and 320 MW
- Stage 2: any underbuild to a nominal capacity of 1500 MW

The footprint of the facility is approximately 26 ha, and the gas pipeline and access track easement is approximately 4.7 ha in size. The Valve Station will be approximately 0.2 ha in size. The communications tower and hut footprint will be approximately 0.16 ha in size and the communications tower services would be approximately 1.2 ha in size.

The facility will be constructed within the boundary of lands owned by AGL, and consisting of several properties collectively referred to as 'the Site'. These are shown on **Figure 2**.

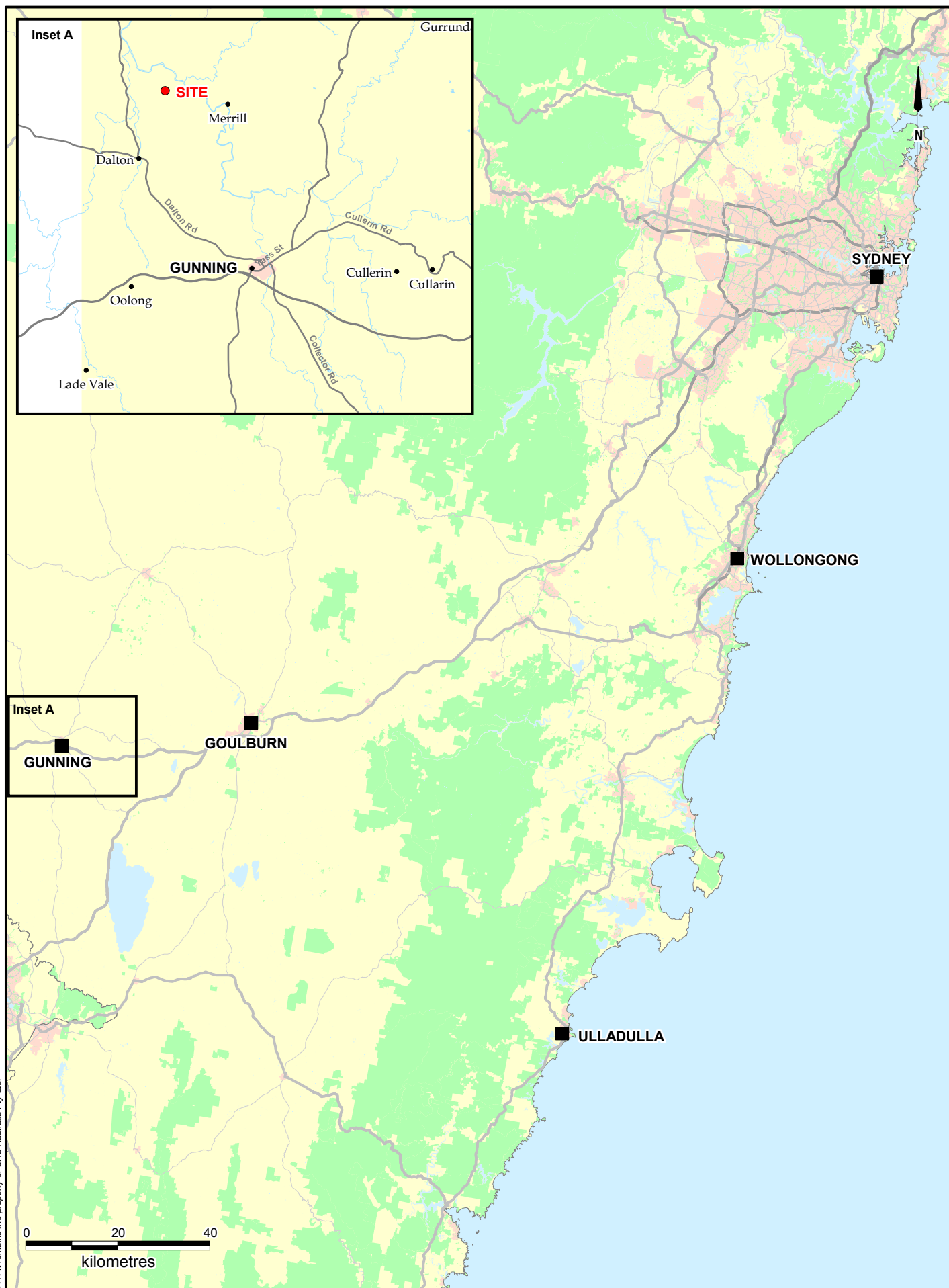
The proposed gas pipeline, to be located underground, and access road have been split into two clear sections for the purposes of this assessment (**Figure 2**). The gas pipeline (northern portion), access road, communications tower and hut footprint and communications tower services are located within properties that AGL now owns. The gas pipeline (southern portion) is located in the western side of the roadway of Walshs Road.


The first section is the proposed gas pipeline (northern portion) and comprises the access road easement incorporating the gas pipeline route as well as a new road to allow access from the facility to Walshs Road.

The second section is the gas pipeline (southern portion) and comprises Walshs Road and the gas pipeline that will be located in the western side of the existing road easement until the connection point to the Moomba – Sydney pipeline.

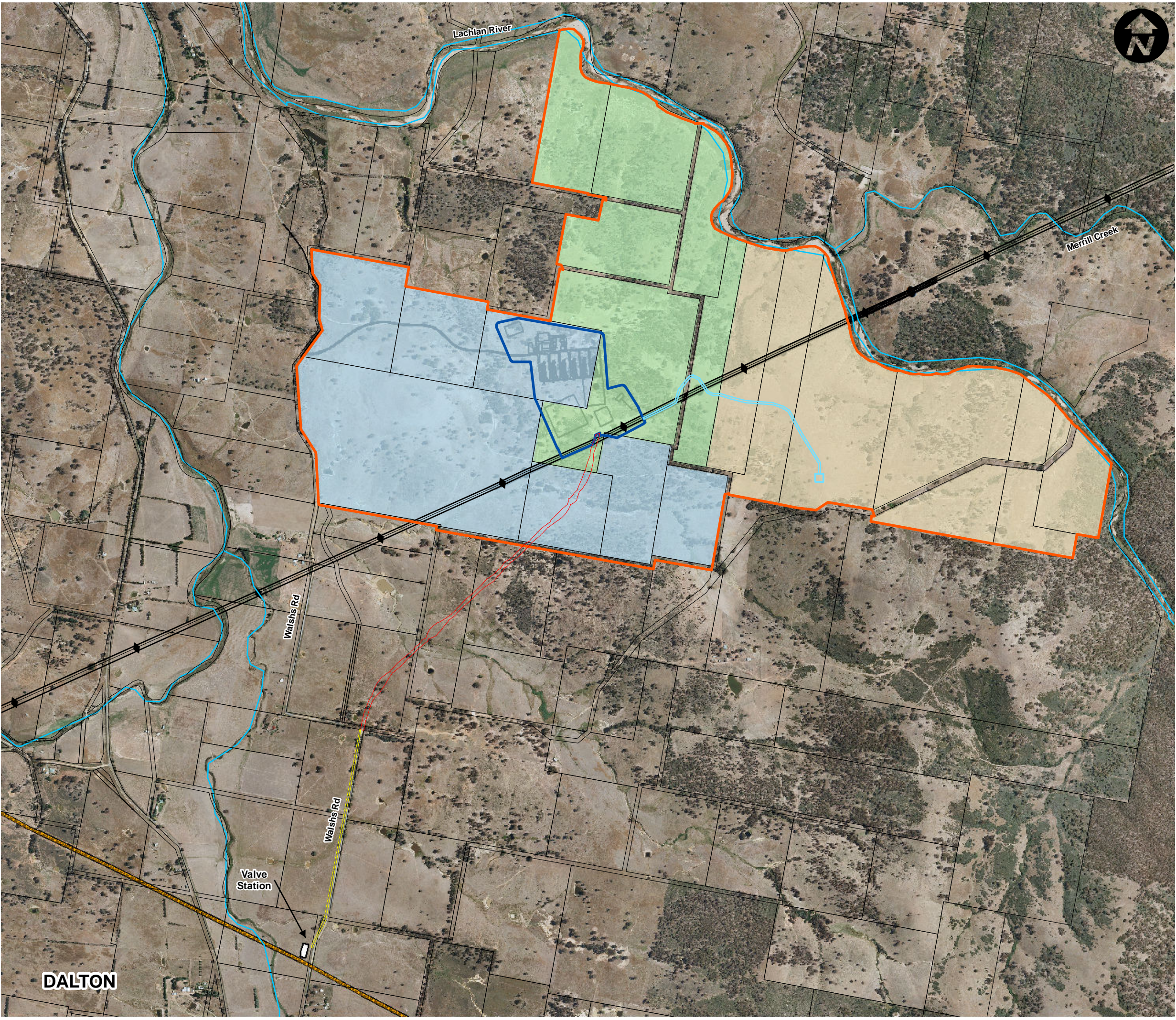
The valve station will be located at the connection point to the Moomba – Sydney pipeline, the valve station is located on Lot 30 in DP754111.

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.



Client	Project		Title
AGL	DALTON POWER PROJECT		REGIONAL LOCATION
	Drawn: AO	Approved: KC	Date: 08/06/2010
	Job No: 43177661	File No: 43177661-002.wor	
			Figure: 1

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line
- Riverview
- Holmes
- The Elms



Source: Aerial Image from AGL

Drawn: SB | Approved: JM | Date: 24/06/2011

Job No.: 43177661 | File No.: 43177661.036.mxd

Client

AGL

Project

DALTON POWER PROJECT

Title

PROPOSED SITE LAYOUT

Figure: 2



DALTON

Project Description

AGL proposes to build a gas-fired power plant (the facility) at a site north of Dalton, in NSW. The Dalton Power Project would include up to six open cycle gas turbines and have a nominal total power generating capacity of approximately 1500 MW (depending on final turbine design selection).

The electricity generated would be fed into the 330 kilovolt (kV) transmission network via a new switchyard on the Site. The power plant would be supplied by natural gas delivered to site by a lateral gas pipeline connecting to the Moomba – Sydney Gas Pipeline.

The power plant would be constructed and operated on an area of approximately 26 ha located within the Site covering the approximately 508 ha. A gas metering, conditioning and control facility is included within the Facility. Together, these are referred to as ‘the Facility’.

The new pipeline connecting the facility to the existing pipeline would be located underground. The proposed access track and pipeline will be located in an easement over several private landholdings and roadside verge along Walshs Rd located in Dalton (**Figure 2**). The communication tower and associated services would be constructed to facilitate communications to the facility and would potentially improve communications for the broader region.

2.1 Project Location

There are five main components of the project footprint:

- The facility;
- Gas Pipeline (northern portion) and access road;
- Gas Pipeline (southern portion) and valve station;
- Communications tower and hut; and
- Communications tower services.

This report references the overall footprint of these five components as the ‘development footprint’.

All works (including the facility, the access road and pipeline easement, the valve station, the communications tower and hut footprint and communications tower services) will be undertaken on AGL owned land, private owned land with easements secured by AGL, or public road easements.

Additional information on the location, design and placement of the final proposed footprint and project components is provided in **Chapter 4** of the **EA**.

2.1.1 The Facility

The proposed facility is located in the southern tablelands region of NSW at a site approximately 3 km north of the town of Dalton, itself located approximately 12 km north west of Gunning in south-western NSW. The development footprint falls within the Upper Lachlan Shire Council Local Government Area (LGA). The Lachlan River forms the northern boundary of the site (**Figure 1**).

The facility would be within a series of properties currently owned by AGL. The historic land use for the study area and surrounds is predominantly for rural enterprises; typically sheep and cattle farming for the wool and dairy industries.

The titles for the development area are presented in **Table 2-1**.

2 Project Description

Table 2-1 Titles for Development Area

Lot identifier	Owner	Comment	Proposed Use
Lot 115,249,252,253,305,307 in DP754111	AGL	Formerly "The Elms"	Part infrastructure - gas pipeline (northern section) and access road; transmission connection Part Facility footprint Part access track and underground services to communications tower
Lot 14, 183,184,187,200,283,306 in DP 754111; and Lots 1 & 2, DP 126122	AGL	Formerly The "Holmes"	Part infrastructure - gas pipeline (northern section) and access road; transmission connection Part Facility footprint
Lot 116, 321, 322, 162, 317, 318 in DP754111	AGL	Formerly "Riverview"	Traversed by transmission line Communications tower and part access track and underground services
Lots 21,186 and 251 in DP754111; Lot 1 DP 126119	AGL		Part infrastructure - gas pipeline (northern section) and access road
Walshs Road easement and parts of Lots 30 and 31 in DP754111	AGL; the Crown; Baines and Baines		Part infrastructure -gas pipeline (southern portion)
Lot 30 in DP754111	AGL		Valve station

Although AGL owns the additional properties traversed by the gas pipeline (northern portion) and access road, the assessment in these locations has focussed only on the footprint within these properties. Collectively the following properties are referred to as the Site and are shown on **Figure 2**:

- "The Elms" encompassing Lot 115,249,252,253,305,307 as part of DP754111;
- "Holmes" encompassing Lot 14, 183,184,187,200,283,306 as part of DP 754111; and
- "Riverview" encompassing Lot 116, 321, 322, 162, 317, 318 as part of DP754111

A total of approximately 32.43 ha of the approximately 508 ha site owned by AGL is required for the proposed Dalton Power Project. The facility comprises the following key components:

- power plant comprising up to six gas turbines, generators and ancillary plant;
- associated gas metering, conditioning and control facility;
- high voltage switchyard comprising high voltage transformers and switchgear;
- transmission line connection to the 330 kV network;
- control room, administration, amenities, car parking and workshop facility;
- connecting gas pipelines, gas receiving station and gas conditioning station;
- fire protection tank;
- process water tank;
- domestic/rainwater tank(s);
- domestic wastewater treatment and disposal system;
- sedimentation pond and associated earth bund and diversion drain;
- evaporation pond to accommodate waste water discharges from the evaporative air inlet cooler;
- air compressor plant;
- switch room;

2 Project Description

- emergency generator and transformers;
- other plant, roads, ponds, etc; and
- landscaping and tree planting to provide visual screening of the facility.

The facility is to be located as indicated on **Figure 2**, approximately in the middle of the AGL owned lands (**Figure 2**), to the north of the existing transmission line that bisects the Site.

2.1.2 Facility location considerations

As the development footprint would require a small portion (less than 7 %) of the site, the location of the power station within the wider site was considered in some detail prior to a preferred site being confirmed. Seven alternative footprints were considered and these were assessed in terms of:

- land topography and aspect;
- ongoing land use and geotechnical suitability;
- accessibility for construction and operation;
- proximity to nearby structures and services;
- noise transmission;
- visual impacts;
- potential water supplies;
- water management;
- vegetation coverage; and
- waste management and handling.

The site assessment outcomes were determined to a large extent by the existence of sensitive receptors (residences) in proximity to each site, the distances from closest structures, and the comparative number of potentially affected neighbours within a 1, 2 and 3 km radius of the proposed footprint location.

The preferred development footprint would minimise potential biodiversity impacts through its location on previously grazed areas, where native vegetation is of poor condition and of lower ecological value.

Project alternatives and changes in the route design are discussed in more detail in **Chapter 3** of the **EA**.

2.1.3 Gas Pipeline and Access Road

The route for the access road and gas pipeline was developed iteratively through consideration of several factors including:

- selection of a direct route between the facility and the Moomba to Sydney Gas Pipeline to minimise cost and land disturbance and the number of bends required;
- shortest length to minimise cost and land disturbance;
- land availability; and
- minimising vegetation clearance requirements, specifically relating to EECs.

The considerations for routing the access road included:

- engineering design feasibility considerations; and
- minimising vegetation clearance, specifically EECs.

The following options for the access road and gas pipeline were considered:

2 Project Description

- Access Road Option 1;
- Gas Pipeline (northern portion) and Access Road Option 1;
- Gas Pipeline (northern portion) and Access Road Option 2 (*final alignment*);
- Gas Pipeline (southern portion) Option 1;
- Gas Pipeline (southern portion) Option 2; and
- Gas Pipeline (southern portion) Option 3 (*final alignment*).

These options were considered and are illustrated in **Chapter 3; Figure 3-14** of the **EA**. Of these options **Table 2-1** outlines the clearing related impact on EECs.

Table 2-1 Route Options and Relative Clearing Impacts

Option	Area (ha)					
	Natural Temperate Grassland	Red S'Yellow Box Woodland	Box Gum Woodland	Exotic Pasture	Grey Box over Exotic Pasture	Willow / Elms/ Birch Woodland
Listing	EPBC	EPBC	TSC	-	-	-
Access Road Option 1	1	0.8	-	0.1	0.2	-
Northern portion						
Gas Pipeline (northern portion) and Access Road - Option 1	3.2	2.2	0.03	0.2	-	-
Gas Pipeline (northern portion) and Access Road - Option 2	1.8	1.2	0.02	1.2	-	-
Southern Portion						
Gas Pipeline (southern portion) Option 1	3.1	1.7	-	0.9	-	0.5
Gas Pipeline (southern portion) Option 2	0.1	0	-	0.4	-	-
Gas Pipeline (southern portion) Option 3	-	-	-	0.8	-	-

Notes:

Areas rounded to one significant figure

Grey shading highlights the final alignment

Table 2-1 shows that as the options were refined the area of EPBC listed Natural Temperate Grassland and TSC listed Box Gum Woodland reduced in the following areas of note:

- For the Gas Pipeline (northern portion) and Access Road, the area of EPBC listed Natural Temperate Grassland was reduced significantly and TSC listed Box Gum Woodland was reduced to a lesser extent.
- For the Gas Pipeline (southern portion), the area of EPBC listed Natural Temperate Grassland was reduced to zero.

Gas Pipeline (northern portion) and Access Road Option 2 and Gas Pipeline (southern portion) Option 3 were chosen (shaded grey in **Table 2-1**) as the preferred alignments as it had the following benefits:

- Reducing the areas of clearing of
 - EPBC Act listed Natural Temperate Grassland; and
 - TSC Act listed Box Gum Woodland.

2 Project Description

- Advantages of collocating the road and the gas pipeline together;
- Addressed engineering design constraints.

Project alternatives and changes in the route design are discussed in more detail in Chapter 3 of the **EA**.

Final details of the proposed Gas Pipeline and Access Track, northern and southern sections are discussed below.

Gas Pipeline (northern portion)

The gas pipeline (northern portion) includes the gas pipeline and access road easement that would be developed to connect the site to Walshs Road. The gas pipeline and access road would be incorporated into the one easement, as shown in **Figure 2**.

The proposed pipeline and access road easement would include portions of the following Lots, as well as unnamed roads, as shown in **Figure 2**:

- Lot 21 as part of DP754111
- Lot 186 as part of DP754111
- Lot 251 as part of DP754111
- Lot 1 as part of DP 126122

The gas pipeline would be located underground. An access road would be constructed to allow access to the proposed facility. This access road is illustrated on **Figure 2**, and would join Walshs Road to the west of the Site. The design of this access road includes a number of stockpiling and laydown areas, hence its irregular shape.

Vegetation would be cleared to construct the access road, and would remain permanently cleared. Areas including stockpiling and construction impacts would be allowed to regenerate following completion of construction. The maximum area of the gas pipeline (northern portion) including access road easement footprint is approximately 4.2 ha.

The pipeline and access road easement outlined on **Figure 2** is wider than the total area that is likely to be required. However, it is provided to encompass a worst case potential impact scenario for assessment purposes. This easement allows for all laydown, construction and stockpiling activities. The area of impact for the access road is determined by the cut and fill areas required for construction. These range from 10 to 45 m in width for the access road. The gas pipeline will be laid within this easement.

Some vegetation cleared to facilitate the construction of this pipeline would be allowed to regenerate following completion of construction. Consequently, all vegetation clearing figures included in this report relating to the pipeline easement are maximum areas of clearing required. The final total amount of clearing may be less than this. The majority of the gas pipeline route would be located beneath existing agricultural land and would be incorporated into the same easement at the access road.

The gas pipeline and access road would also traverse up to four unnamed waterways or drainage lines with intermittent flow, or that flow only following rain events.

2 Project Description

Gas Pipeline (southern portion)

The southern portion of the gas pipeline extends from the junction of Walshs Road to the Moomba – Sydney pipeline. This portion of the gas pipeline will utilise Walshs Road and the gas pipeline will be located in the western side of the existing road easement until the connection point is reached at the new valve station.

The gas pipeline will be located underground (except at entry and exit points) extending from the end of the gas pipeline (northern section) and access road to the existing Sydney – Moomba supply line. A valve station would be located on a site adjoining the road reserve, directly adjacent to Walshs Road (**Figure 2**). It will occupy an area in the order of 0.22 ha. The gas pipeline would connect to the Moomba – Sydney pipeline at this point.

The proposed pipeline, valve station and access road easement as well as the associated valve station, would include portions of the following Lots, as well as unnamed roads and Walshs Road, as shown in **Figure 2**:

- Lot 30 as part of DP754111
- Lot 31 as part of DP754111

The maximum area of the Gas Pipeline (southern section) footprint is approximately 0.6 ha (or 8 ha including the valve station).

2.1.4 Communications Tower and Hut Footprint

The location for the communications tower and hut was determined through consideration of several factors including:

- siting of the tower on a hill top;
- close proximity to the facility and transmission line;
- land availability;
- minimising vegetation clearance requirements, specifically relating to EECs; and
- engineering design feasibility considerations.

A communications tower and associated hut would need to be constructed beyond the Facility footprint. The tower would be approximately 60 m in height, and would be located on an elevated area approximately 1.5 km to the east of the Facility. The tower would be connected to the Facility via underground services. The total area of the tower and hut footprint is approximately 0.16 ha.

2.1.5 Communications Tower Services and Access Track

The selected route for the communications tower services and access track was determined through consideration of several factors including:

- connection between the facility and the communications tower;
- land availability;
- minimising vegetation clearance requirements, specifically relating to EECs; and
- engineering design feasibility considerations.

The communications tower services would need to be constructed to serve as a connection between the facility and the communications tower. The communications tower services would comprise an access road and underground infrastructure within the same easement. The total area of this portion is approximately 1.2 ha.

2 Project Description

2.2 Site Description

The site is located approximately 4 km north of the town of Dalton, in the Southern Tablelands of NSW. The area is within the Upper Lachlan Shire Council, and is in the Lachlan Catchment Management Authority (CMA), Murrumbateman subregion. Much of the land in the local area has been used for agricultural activities in the past; primarily sheep and cattle grazing. The site is bordered to the north and east by the Lachlan River, by Walshs Road to the west and agricultural land to the south. Neighbouring properties are dominated by agricultural activities, and land both within the site and on adjacent properties is used primarily for sheep farming.

2.2.1 Soils and Geology

The soils and geology in the vicinity of the Dalton Power Project have been described in the Siting Study Report for the Dalton Gas Turbine Power Station (Aurecon Australia 2009).

The soils are described by Aurecon Australia (2009) as follows:

“The Soil Conservation Service of New South Wales 1:250,000 Goulburn Soil Landscape Map indicates the two predominant soil types in the project area are Blakney Creek soloth and Midgee yellow earths.

The Blakney Creek unit is located on the footslopes and valley floors and comprises undifferentiated Ordovician and early Silurian metasediments. It is an acid to neutral yellow duplex soil with minor stony yellow earths and red podzolic soils. Erosion hazard for this soil type is high (topsoil) and low to high (sub-soil).

The Midgee unit occurs on the rolling hills at higher elevations and comprises Ordovician and some Devonian and Silurian metasediments. It is commonly acid stony yellow earths and yellow podzolic soils in association with lithosols and red earths. Erosion hazard for this soil type is high to very high.

While detailed mapping of soils has not been undertaken there is some evident variation in soil depth and characteristics across the site. Variations relate to the underlying geology, slope, position on the slope and ground water level and variations in ground water levels. It is considered that soils should be regarded as erodible and managed to limit erosion and off site sedimentation”.

The geology of the Site is described by Aurecon Australia (2009) as follows:

“The proposed development footprint area lies within the Lachlan fold belt, and is underlain by a series of metamorphosed Ordovician Age sediments and Silurian Age intrusives. The major rock unit in the area is the Adaminaby Group, which in this area comprises mostly phyllite and metamorphosed quartz arenite with some chert. These beds are folded and generally steeply dipping. This rock type mostly forms rounded hills with varying degrees of outcrop and soil depth.

To the south of the project area, the Adaminaby Group is intruded by the Silurian Age Wyangala Batholith, which comprises a typical granitic material, known locally as the Oolong Granite. The granite area is characterised by steep sided hills with numerous rounded boulder (Tors) outcrops.

2 Project Description

The Tertiary age Wheeo Basalt forms a capping on the ridge tops to the east of the project area, but is also indicated to be present on only one hill top on the South western side of the Dalton Gas Turbine project area.

The Wheeo Basalt comprises black alkali basalt to basanite flows, containing porphyritic olivine and titanium augite, with flow banding, vesicles and doleritic textures. The basalt is more resistant than the phyllites but like the phyllite can be closely jointed.

The weathering process has resulted in the formation of broad flat alluvial soil deposits in the valleys of the creek that forms the southern boundary of the project area and in the valley of the Lachlan River along the northern side of the project area."

2.3 Topography and Hydrology

Much of the Site consists of undulating hills, with areas of gently sloping plains to the south and west. A large hill is present in the south-west section of the Site. The Lachlan River forms a boundary to the north and east of the Site. The western and eastern sections of the Site gently slope towards the river. However, some sections of the property in these locations are quite steep.

The majority of the Site drains to the north, directly into the Lachlan River, while the south-western portion of the Site drains to the west. There are a number of farm dams within the Site that were historically used for agricultural purposes.

The gas pipeline (northern portion) and access road easement is situated on gentle, undulating topography, primarily used for agricultural (grazing) purposes. The easement traverses up to four unnamed waterways or drainage lines with intermittent flow, most which only flow immediately following rain events.

2.4 Climate

The project area is subject to a dry, temperate climate. The closest Bureau of Meteorology (BOM) monitoring station is situated approximately 60 km to the south-west of the Site at Yass (Linton Hostel) (site number 070091 at 520 m AHD).

The BOM records show that the rainfall is generally greater in winter and spring, specifically between June and October. On average October is the wettest month, and February is the driest, with the area experiencing an average of 108 days of rain (≥ 1 mm) per year, with a mean total annual rainfall of 647.5 mm.

The warmest month of the year, on average, is January, which has a mean maximum temperature of 29.4°C. July is the coolest month with a mean maximum temperature of 11.6°C. Night temperatures are typically cool, even in summer, with January having a mean minimum temperature of 13.9°C and July having a mean minimum temperature of 1.1°C. The overall annual mean maximum temperature is 20.7°C and the mean minimum is 7.2°C (BOM 2010).

Legislative Framework

3.1 State

3.1.1 Environmental Planning & Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) forms the legal and policy platform for development assessment and approval in NSW and aims to, *inter alia*, 'encourage the proper management, development and conservation of natural and artificial resources'.

The project meets the criteria to be considered a Major Project under the *State Environmental Planning Policy (Major Projects) 2005* (SEPP MP). Consequently, the project is being assessed under the provisions of Part 3A of the EP&A Act, with the Minister for Planning as the approval authority for the Project Application. Director General's requirements for assessment of the project have been issued by the Department of planning.

For the purposes of assessing the potential impact of the project on threatened species, populations and ecological communities, the Department of Planning has issued guidelines drafted jointly by the Department of Environment and Conservation, and the Department of Primary Industry (DEC/DPI 2005). The *Draft Guidelines for Threatened Species Assessment* identifies a series of steps to be followed in that assessment process. These include:

- Evaluation of impacts.
- Avoiding, mitigating and offsetting impacts.
- Project justification against 4 key thresholds.

The Threatened Species Conservation Act lists threatened species, populations or ecological communities (or their habitats) that should be considered in assessing the impacts of projects being assessed under Part 3A of the EP&A Act. Section 5A (s.5A) of the EP&A Act lists key assessment criteria that must be taken into account with the determination of the significance of potential impacts of a proposed development on 'threatened species, populations or ecological communities (or their habitats)', as listed under the TSC Act. Part 3A of the EP&A Act removes the requirement for the proponent and consent authority to consider s.5A of the EP&A Act when determining a Project Application. Notwithstanding, the Assessment of Significance (previously called seven part tests) pursuant to s.5A of the EP&A has been used as part of this report methodology to inform the evaluation of impacts that the Project may have on threatened species, populations and ecological communities.

3.1.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to, *inter alia*, 'conserve biological diversity and promote ecologically sustainable development'. The TSC Act covers the following:

- protection of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A and vulnerable species and communities listed under Schedule 2;
- listing of 'Key Threatening Processes' under Schedule 3;
- preparation and implementation of Recovery Plans and Threat Abatement Plans;
- guidelines for the preparation of Species Impact Statements; and
- listing of identification of critical habitat for threatened species.

3 Legislative Framework

The Director General's Requirements issued under Part 3A of the EP&A Act require that potential impacts relating to threatened species, populations and ecological communities are assessed for the Project. Schedules to the TSC Act provide the listings of terrestrial threatened species, populations and ecological communities that would be considered in this assessment.

This assessment includes retrieval of previous records of threatened species within the locality of the facility, targeted searches for threatened species and their habitats during field surveys, and thorough evaluation of impacts on threatened biota.

3.1.3 Native Vegetation Act 2003

The *NSW Native Vegetation Act 2003* (NV Act) was established to prevent broad scale clearing, protect native vegetation of high conservation significance, improve the condition of existing native vegetation and encourage the regeneration of native vegetation in NSW. In assessing applications, consent authorities apply the 'maintain or improve test', which means assessing how the project maintains or improves environmental values such as salinity, water, soils and biodiversity.

The NV Act requires approval from the relevant Council or CMA for the clearing of native vegetation (with the exception of land listed in Schedule 1 of the Act).

Notwithstanding the above, projects assessed under Part 3A of the EP&A Act do not require consideration in terms of the requirements of the NV Act. However, the principles of the 'maintain improve test' as required under guidelines for biodiversity assessment for Part 3A assessments, and which is also required under the NV Act, have been used to guide this assessment, and related offset processes, for this project.

3.1.4 Noxious Weeds Act 1993

Under the *NSW Noxious Weeds Act 1993* (NW Act), all councils are responsible for the control of noxious weeds within their local government area (LGA). The NW Act provides for the declaration of noxious weeds by the Minister of Agriculture. Weeds may be considered noxious on a national, state, regional or local scale. All private landowners, occupiers, public authorities and councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. Noxious weeds in the footprint have been addressed as part of this assessment.

3.1.5 NSW Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

The Director General's Requirements issued under Part 3A of the EP&A Act require that potential impacts of a proposal on threatened species, populations and ecological communities. Schedules to the FM Act provide the listings of aquatic threatened species, populations and ecological communities that would be considered in this assessment.

The FM Act provides for the conservation of all biological diversity of aquatic and marine vegetation. It provides the relevant listings of aquatic threatened species, populations or ecological communities that are the basis for assessed undertaking assessments of aquatic biodiversity impacts for Part3A project assessments.

3 Legislative Framework

This assessment includes retrieval of previous records of threatened species listed under the FM Act. Within the locality of the alignment, targeted searches for threatened species and their habitats during field surveys and an assessment of impacts on threatened biota.

Permits under Section 219 (fish passage) are not required for Part 3A approvals. Despite the Part 3A exemption from this formal requirement, all Project works relating to riparian areas would be consistent with the Department Water and Energy's Controlled Activity Guidelines (2008) and all watercourse crossings would be constructed in accordance with the NSW Department of Primary Infrastructure & Industries policies and guidelines.

3.1.6 State Environmental Planning Policy 44 – Koala Habitat Protection

State Environmental Planning Policy No.44 Koala Habitat Protection (SEPP 44) aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for koalas'. SEPP 44 applies to local government areas (LGAs) listed under Schedule 1 of the Policy. All LGAs within the project area (**Figure 2**) are listed under Schedule 1 of SEPP 44.

SEPP 44 requires that consent authorities making determinations under Part 4 of the EP&A Act consider whether 'potential koala habitat' and 'core koala habitat' would be affected. Where core koala habitat is found to occur, SEPP 44 requires that a site-specific Koala Plan of Management be prepared.

Notwithstanding the above, projects assessed under Part 3A of the Act do not require consideration of the requirements of SEPP 44. However, the principles of SEPP 44 have been addressed in the current study by conducting searches for koala habitat trees and signs of koala activity during field surveys.

3.2 Commonwealth

3.2.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on a matter of national environmental significance undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, would have or is likely to have a significant impact on a matter of national environmental significance' may not be undertaken without prior approval from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (SEWPaC formerly known as DEWHA).

The EPBC Act identifies matters of national environmental significance as:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

3 Legislative Framework

The Administrative Guidelines for the EPBC Act set out criteria intended to assist in assessing whether an action requires approval. In particular, the Guidelines contain criteria for assessing whether a proposed action is likely to have a 'significant impact' on a matter of National Environmental Significance (NES) and hence called 'Significant Impact Criteria' (SIC) assessment guidelines. Should the proponent deem the project to have a significant potential impact on a matter of NES, a referral to the Commonwealth Minister for Sustainability, Environment, Water, Population (formerly the Minister of Environment, Water, Heritage and the Arts) would be undertaken to obtain a confirmation as to whether the Commonwealth considers the project a "controlled action".

To comply with the requirements of the EPBC Act, Significant Impact Criteria Assessments (as per the *EPBC Act Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DEWHA 2009a)) have been undertaken for all matters of NES. An EPBC referral has been submitted covering the potential impacts on Endangered Ecological Communities as listed under the EPBC Act (submitted 11 May, 2010). The project was determined a Controlled Action by the Commonwealth Department of Environment, Water, Heritage and the Arts on 11 June 2010.

Methodology

4.1 Literature Review

A literature review was undertaken by URS to identify threatened species, populations and ecological communities listed under the TSC, FM and EPBC Acts that could be expected to occur within the study area. To this end, the following documentation was reviewed prior to the field investigations:

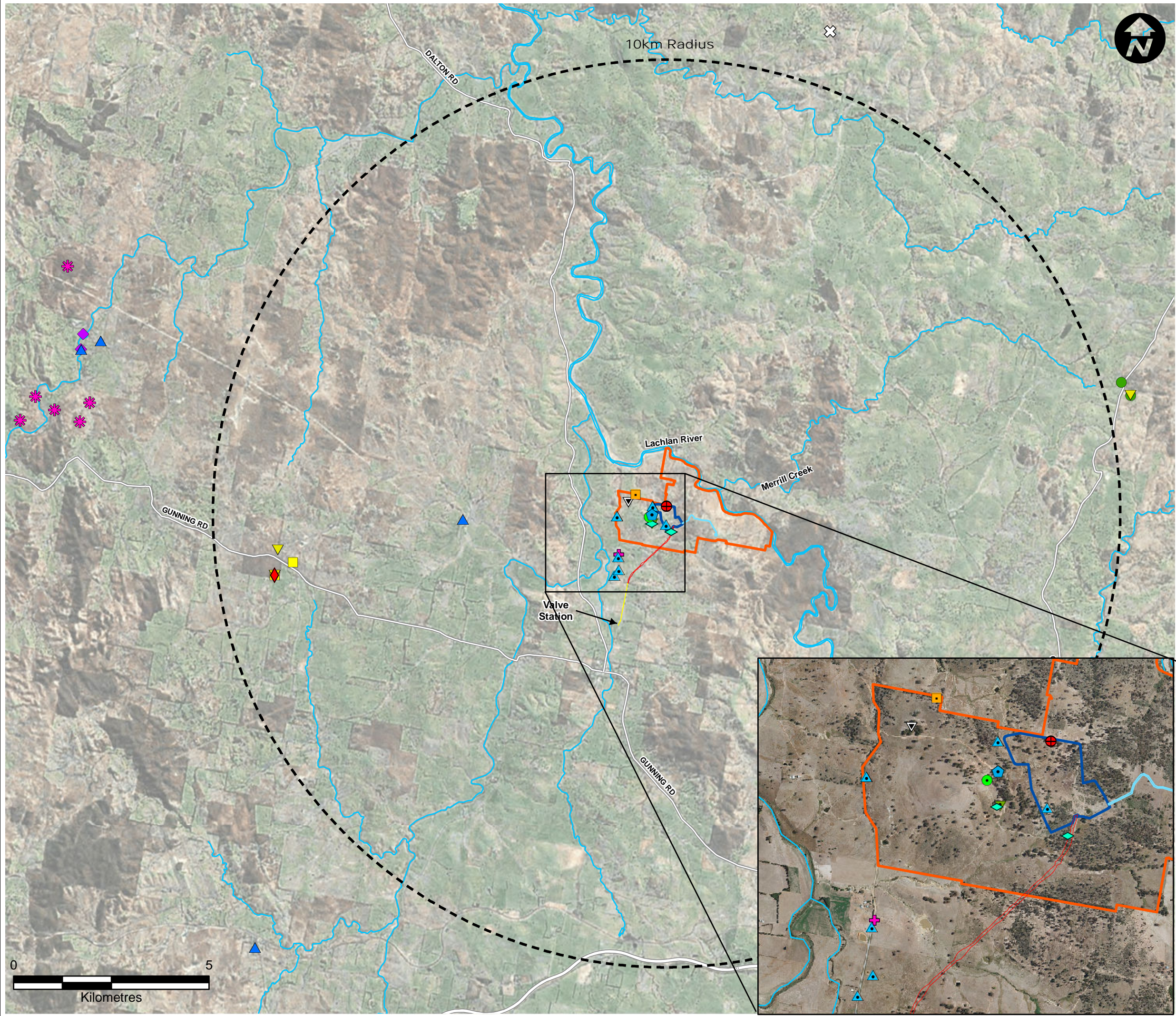
- The NSW National Parks and Wildlife Service Atlas of NSW Wildlife online database selected for a 10 km buffer around the Site (NSW National Parks and Wildlife Service 2010) (**Appendix A**).
- A Geographic Information System (GIS) data request was sent to the Spatial Data Programs at the NSW Department of Environment, Climate Change and Water (DECCW) for all records of threatened species within the Gunning 8728 1:100,000 map sheet on 7 June 2010 (**Figure 3**).
- The Commonwealth EPBC Online Protected Matters Database search tool, selected for a 10 km buffer of the site on 7 June 2010 (Department of Environment, Water, Heritage and the Arts 2010) (**Appendix B**).
- The DECCW 'Find by Geographic Region' threatened species, populations and ecological communities online search tool for the Lachlan Catchment Management Authority (CMA) Murrumbateman sub-region (Department of Environment and Climate Change 2010) (**Appendix C**).
- The NSW Department of Industries and Investment 'Threatened fish and marine vegetation – find a species by geographic region' online search tool for the Lachlan CMA (NSW DII 2010) (**Appendix D**).
- The Forest Ecosystem Classification and Mapping for the Southern Comprehensive Regional Assessments (SCRA) Region (Thomas *et al.* 2000) was accessed and descriptions were used as reference points for vegetation community descriptions within the site.
- Ocean Shores to Desert Dunes: the native vegetation of New South Wales and the ACT. (Keith 2004) was used to as reference material for vegetation community descriptions within the site.
- The NSW Biometric Database (DECC 2008a) was used as a guide to vegetation communities within the CMA area.
- The threatened species lists provided as part of the supplementary DGRS (**Appendix N**).

4.2 Field Surveys

A summary of field work conducted is provided in **Table 4-1**. Field surveys primarily focused on surveys for flora and fauna within the development footprint; with additional surveys undertaken across other areas with the broader Site. The primary scope of works for this assessment included detailed flora and fauna surveys, targeted threatened species surveys, as well as vegetation mapping within all areas of proposed works, to ensure appropriate impact assessment.

Targeted threatened species surveys have been conducted with a focus on the proposed development footprint. However, additional surveys have been undertaken in areas of suitable habitat outside of the development footprint, within the broader Site. Surveys outside of the development footprint have focussed on broad vegetation mapping and potential offset location mapping, as well as opportunistic observations and random meander surveys to target threatened species if appropriate habitat is observed.

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line

DECCW Previous Threatened Species Records*

- Brown Treecreeper
- Diamond Firetail
- Hooded Robin
- Regent Honeyeater
- Scarlet Robin
- Speckled Warbler
- Varied Sittella
- Ammobium craspedioides*

URS & EnviroKey Threatened Species Records

- Brown Treecreeper
- Diamond Firetail
- Flame Robin
- Gang Gang Cockatoo
- Rainbow Bee-eater
- Scarlet Robin
- Speckled Warbler
- Varied Sittella
- White-fronted Chat

*Source: DECCW, 2010
Aerial Image from ©BingMaps 2010
(c) 2010 Microsoft Corporation and its data suppliers

Drawn: SB Approved: KC Date: 23/06/2011

Job No.: 43177661 File No.: 43177661.065.mxd

Client

AGL

Project

DALTON POWER PROJECT

Title

THREATENED SPECIES RECORDS

Figure: 3



4 Methodology

Field surveys have been undertaken on the following dates:

- 31 March– 2 April, 2009;
- 22 -23 February, 2010;
- 8 July, 2010;
- 27-30 July, 2010;
- 10-11 February, 2011;
- 21-24 February, 2011;
- 6-7 June, 2011; and
- 20-21 June, 2011

Opportunistic observations of target threatened species were made whenever relevant during each visit.

Field surveys targeting threatened species predicted to occur were undertaken within the development footprint and immediate surrounds, referred to as the 'study area'. Broad vegetation mapping to determine appropriate offset locations were undertaken throughout the broader Site.

The location of the proposed access track and pipeline easement has changed since the beginning of field investigations. Consequently, field surveys were undertaken in many of the surrounding areas as well as the preferred development footprint. This has at times necessitated multiple field surveys to ensure the entire development footprint has been appropriately and adequately assessed.

4 Methodology

Table 4-1 Summary of Field Survey Effort

Date	Survey Type	Technique	Total Effort ¹	Season	Personnel/
31 March 2009	Preliminary site visit	Site walk/drive over	4 hours	Autumn	KC (Ecologist) MB (Ecologist)
31 March 2009	Preliminary site visit	Aerial photo interpretation	1 hour	Autumn	KC (Ecologist) MB (Ecologist)
31 March 2009	Preliminary site visit	Ground truthing of existing mapping	4 hour	Autumn	KC (Ecologist) MB (Ecologist)
31 March 2009	Vegetation community mapping	Random meander / Site walkover	8 hours	Autumn	KC (Ecologist) MB (Ecologist)
31 March 2009	Initial vegetation community mapping	Aerial photo interpretation	1 hour	Autumn	KC (Ecologist) MB (Ecologist)
31 March 2009	Initial vegetation community mapping	Biophysical information quadrants/ Biometrics association	10 hours	Autumn	KC (Ecologist) MB (Ecologist)
1 – 2 April 2009	Targeted threatened flora survey	20m by 20m quadrats	15 hours	Autumn	KC (Ecologist) MB (Ecologist)
1 – 2 April 2009	Targeted threatened flora survey	Random meanders	5 hours	Autumn	KC (Ecologist) MB (Ecologist)
1 – 2 April 2009	Habitat mapping	Mapping of all habitat features including hollow bearing trees, stags and rocky outcrops.	5 hours	Autumn	KC (Ecologist) MB (Ecologist)
1 – 2 April 2009	Targeted threatened flora survey	Targeted flora searches and habitat assessment	8 hours	Autumn	KC (Ecologist) MB (Ecologist)
31 March – 2 April 2009	Targeted threatened fauna survey	Anabat recording	96 hrs over 2 nights	Autumn	KC (Ecologist) MB (Ecologist)
31 March – 2 April 2009	Targeted threatened fauna survey	Spotlighting	3 hrs over 2 nights	Autumn	KC (Ecologist) MB (Ecologist)
31 March – 2 April 2009	Targeted threatened fauna survey	Call playback	2 hrs over 2 nights	Autumn	KC (Ecologist) MB (Ecologist)
31 March – 2 April 2009	Targeted threatened fauna survey	Diurnal bird survey	6 hrs over 2 days	Autumn	KC (Ecologist) MB (Ecologist)

4 Methodology

Date	Survey Type	Technique	Total Effort ¹	Season	Personnel/
31 March – 2 April 2009	Targeted threatened fauna survey	Track and scat searches	15 hours	Autumn	KC (Ecologist) MB (Ecologist)
31 March – 2 April 2009	Targeted threatened flora survey	Targeted habitat assessment	5 hours	Autumn	KC (Ecologist) MB (Ecologist)
22 – 23 February 2010	Vegetation mapping	On going vegetation mapping	2 hours	Summer	KC (Ecologist) MB (Ecologist)
22 – 23 February 2010	Targeted threatened flora survey	Site walkover	8 hours	Summer	KC (Ecologist) MB (Ecologist)
22 – 23 February 2010	Targeted threatened flora survey	20m by 20m quadrats	7 hours	Summer	KC (Ecologist) MB (Ecologist)
22 – 23 February 2010	Targeted threatened flora survey	Targeted threatened species habitat assessment	10 hours	Summer	KC (Ecologist) MB (Ecologist)
8 July 2010	Potential Offset Area Survey	Site walkover / vegetation mapping / biobanking t0072ansects	8 hours	Winter	JM (Associate Ecologist) KC (Ecologist)
8 July 2010	Potential Offset Area Survey	Targeted habitat assessment	5 hours	Winter	JM (Associate Ecologist) KC (Ecologist)
27 – 28 July 2010	Refinement of all Vegetation Mapping	Site walkover / vegetation community boundary mapping	32 hrs	Winter	JM (Associate Ecologist) KC (Ecologist)
29 – 30 July 2010	Targeted threatened flora survey	20m by 50m transects and quadrats	32 hrs	Winter	JM (Associate Ecologist) KC (Ecologist)
29 – 30 July 2010	Potential Offset Area Survey	Biometrics association / ecological community profiling	4 hrs	Winter	JM (Associate Ecologist) KC (Ecologist)
29 – 30 July 2010	Potential Offset Area Survey	Vegetation community condition assessment – BioBanking assessment methodology	32 hrs	Winter	JM (Associate Ecologist) KC (Ecologist)
29 – 30 July 2010	Targeted threatened fauna survey	Targeted habitat assessment	5 hours	Winter	JM (Associate Ecologist) KC (Ecologist)
29 – 30 July 2010	Targeted threatened flora survey	Targeted habitat assessment	5 hrs over 2 days	Winter	JM (Associate Ecologist) KC (Ecologist)
29 – 30 July 2010	Targeted threatened fauna survey	Track and scat searches	5 hrs over 2 days	Winter	JM (Associate Ecologist) KC (Ecologist)

4 Methodology

Date	Survey Type	Technique	Total Effort ¹	Season	Personnel/
10 – 11 February 2011	Targeted threatened flora and fauna survey	Site walkover	16 hours/2 days	Summer	JM (Associate Ecologist) KC (Ecologist)
10 – 11 February 2011	Vegetation mapping	Site walkover	8 hours over 2 days	Summer	JM (Associate Ecologist) KC (Ecologist)
10 – 11 February 2011	Targeted threatened species survey	Active reptile searches	16 hours – 400 rocks across broader site	Summer	JM (Associate Ecologist) KC (Ecologist)
10 – 11 February 2011	Targeted threatened species survey	Active Golden Sun Moth searches in appropriate habitat	8 hours over 2 days	Summer	JM (Associate Ecologist) KC (Ecologist)
21 – 24 February 2011	Habitat Feature Assessment	Mapping of all habitat trees including number, size and location of hollows	10 hours	Summer	SS (Principal Ecologist)
21 – 24 February 2011	Targeted threatened species survey	Active Golden Sun Moth searches	12 hours over 3 days	Summer	SS (Principal Ecologist)
21 – 24 February 2011	Targeted threatened species survey	Active hand searches - reptile	8 hours – 505 rocks across nine locations	Summer	SS (Principal Ecologist)
21 – 24 February 2011	Targeted threatened reptile survey	Funnel traps	72 trap nights – 3 pairs of funnels across 6 drift fences for 4/5 nights	Summer	SS (Principal Ecologist)
21 – 24 February 2011	Targeted threatened reptile survey	Walking transects	8 hours	Summer	SS (Principal Ecologist)
21 – 24 February 2011	Opportunistic observations	Site walkover	35 hours	Summer	SS (Principal Ecologist)
6 - 7 June 2011	Targeted threatened species survey	Infra-red Digital Camera (Spotted-tail Quoll)	6 June – 1 July	Winter	KC (Ecologist), AC (Graduate Ecologist)
6 - 7 June 2011	Targeted threatened species survey	Call playback (Barking Owl & Squirrel Glider) & Spotlighting	1 hour	Winter	KC (Ecologist), AC (Graduate Ecologist)
6 - 7 June 2011	Opportunistic nocturnal survey	Driving transect - Spotlighting	0.5 hours	Winter	KC (Ecologist), AC (Graduate Ecologist)
6 - 7 June 2011	Targeted threatened species survey	Opportunistic bird surveys	16 hours over 2 days	Winter	KC (Ecologist), AC (Graduate Ecologist)
6 - 7 June 2011	Habitat mapping (of the Footprint extension)	Mapping of all habitat features including hollow bearing trees, stags and rocky outcrops	6 hours	Winter	KC (Ecologist), AC (Graduate Ecologist)
6 - 7 June 2011	Vegetation community mapping (of the Footprint extension)	Random Meander and Targeted threatened species habitat assessment	4 hours	Winter	KC (Ecologist), AC (Graduate Ecologist)

4 Methodology

Date	Survey Type	Technique	Total Effort ¹	Season	Personnel/
6 - 7 June 2011	Access track survey (Riverview to Walshe's Rd)	Visual mapping of condition of access track	2 hours	Winter	KC (Ecologist), AC (Graduate Ecologist)
20 -21 June 2011	Targeted threatened species survey	Infra-red Digital Camera - rebait traps (2)	1 hour	Winter	KC (Ecologist), GB (Fauna Ecologist)
20 – 21 June 2011	Targeted threatened species survey	Call playback (Barking Owl & Squirrel Glider) & Spotlighting	1 hour	Winter	KC (Ecologist), GB (Fauna Ecologist)
20 – 21 June 2011	Targeted threatened species survey	Opportunistic bird surveys	16 hours over 2 days	Winter	KC (Ecologist), GB (Fauna Ecologist)
20 – 21 June 2011	Habitat mapping (of the Communications Tower, Hut Footprint & Access Track)	Mapping of all habitat features including hollow bearing trees, stags and rocky outcrops	6 hours	Winter	KC (Ecologist), GB (Fauna Ecologist)
20 – 21 June 2011	Vegetation community mapping (of the Communications Tower, Hut Footprint & Access Track)	Random Meander Targeted threatened species habitat assessment	4 hours	Winter	KC (Ecologist), GB (Fauna Ecologist)
20 – 21 June 2011	Opportunistic nocturnal survey	Driving transect - Spotlighting	0.5 hours	Winter	KC (Ecologist), GB (Fauna Ecologist)

¹Total Effort = person hours

4 Methodology

Field surveys were undertaken in accordance with the following guidelines and protocols:

- Draft guidelines for threatened species assessment for part 3A project (DEC/DPI, 2005);
- Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft (DEC, 2004);
- BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC 2008c);
- Random meander surveys (Cropper 1993);
- DECCW Threatened Species; Profiles and Recovery Plans;
- I&I NSW Threatened Species Profiles and Recovery Plans; and
- SEWPaC Threatened Species, Profiles and Recovery Plans.

4.2.1 Flora

Surveys targeted threatened flora species identified in the desktop review as potentially occurring on site, as well as habitat based assessments conducted during the survey periods. Survey techniques included vegetation community surveys, flora surveys (including gathering of floristics data), weed assessments and opportunistic observations including identification of potential habitat.

Flora survey methods are outlined in detail below.

Vegetation Community Surveys

Aerial photographs and regional vegetation mapping data available for the study area was studied prior to visiting the site. Preliminary vegetation mapping within the study area was conducted on the morning of 31 March, 2009. Following this, vegetation communities were mapped from 31 March to 2 April, 2009, with additional vegetation mapping undertaken from 22 – 23 February, 2010, 27 – 30 July, 2010 and 10 – 11 February, 2011.

The primary objectives of the vegetation mapping survey were to:

- map the extent and describe the vegetation community association (according to Biometrics) within the development footprint; and
- map the extent and describe the vegetation community association (according to Biometrics) within the AGL site boundary for possible project offset locations.

The conservation status of communities recorded during field surveys was determined with reference to relevant legislation including the TSC Act and the EPBC Act.

Endangered Ecological Community Surveys

Endangered Ecological Community (EEC) surveys were undertaken to identify the EECs present within the development footprint, and assess potential impacts of the proposed development on these EECs.

The primary objectives of the EEC survey were to:

- map the extent and describe the vegetation community association (according to Biometrics) within the development footprint;
- map the extent and describe the vegetation community association (according to Biometrics) within the AGL site boundary for possible project offset locations;

4 Methodology

- undertake vegetation condition assessment in line with OEH and SEWPaC threatened ecological community guidelines as well as BioBanking assessment methodologies. These included quadrants, transects and Biometrics association; and
- identify potential areas for project offsets.

Initial vegetation mapping was refined at a later stage (post EPBC Referral) by senior URS botanical staff. This resulted in modifications to the original vegetation mapping provided within the EPBC Referral. Modifications to vegetation mapping were made in reference to DEH (2006) *EPBC Act policy statement 3.5 - White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*. Mapping of EECs was undertaken during the periods 27 – 30 July 2010 and 10 – 11 February, 2011.

The survey design took into account the need to confirm the presence or absence of the following vegetation communities, based on the following vegetation community descriptions and conditions:

- Threatened Species Scientific Committee, (2006a) Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.
- Threatened Species Scientific Committee, (2006b) Commonwealth Conservation Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.
- DEH, (2006a) EPBC Act policy statement 3.5 - White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands.
- DEH, (2006b) Box-Gum grassy woodlands and derived native grasslands - Information Guide
- DEH (2006c) Species list for the EPBC Act policy statement 3.5 - White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands.
- Endangered Species Scientific Subcommittee, (2000) Commonwealth Listing Advice on Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory.
- Environment ACT, (2006) National Recovery Plan for Natural Temperate Grassland of the Southern Tablelands (NSW and ACT): An Endangered Ecological Community.
- Environment Australia, (2003) Map of Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory threatened ecological community.

Flora Quadrat Surveys

Quadrat surveys were undertaken to establish floristic lists for all vegetation communities occurring within the site. Twenty-five 20 m x 20 m quadrats were surveyed during March/April 2009 field investigations. Within each quadrat species composition and structural diversity were recorded, along with the presence of noxious weeds if present. An additional six quadrats were surveyed in February 2010.

Surveys using the BioBanking Methodology were undertaken in July 2010. These entailed twelve 20 m x 50 m transect quadrat sites. The locations of quadrats are provided in **Figure 4**. Targeted flora surveys were conducted from 31 March to 2 April, 2009. Targeted flora surveys locations (quadrats and transects) were randomly located in vegetation communities within and adjacent to the development footprint (**Figure 4**). Vegetation floristics were surveyed throughout all quadrat and transect efforts, and were recorded opportunistically where necessary.

4 Methodology

Plant specimens were identified using standard botanical texts and where required were compared with voucher specimens held in the National Herbarium of New South Wales Online Reference Collection. Vegetation structure is described according to classifications made by Specht (1981). Plant identifications were made according to nomenclature in Harden (2000, 2002, 1992, and 1993). Any unknown species were submitted to the NSW National Herbarium for identification.

The conservation status of species recorded during field surveys was determined with reference to relevant legislation including the TSC Act and the EPBC Act, and related Scientific Committee determinations.

Targeted Threatened Flora Species Survey

Random meander surveys (Cropper 1993) were used to determine the distribution of any threatened flora species, communities and their habitat within the development footprint. Species targeted included all flora species considered likely to occur within the development footprint based on the desktop literature review and the presence of suitable habitat (**Appendix E**). Species targeted included:

- Yass Daisy (*Ammobium craspedioides*);
- Hoary Sunray (*Leucochrysum albicans* var. *tricolor*);
- Button Wrinklewort (*Rutidosis leptorrhynchoides*); and
- Silky Swainson-pea (*Swainsona sericea*).

Random Meander

Random meander surveys were undertaken using the random meander method (Cropper 1993), during all field surveys (**Figure 4**), and any previously unidentified or new flora specimens were identified. Although surveys were not undertaken during the optimal flowering period (i.e. Spring), for some species, surveys attempted to identify every flora species on site.

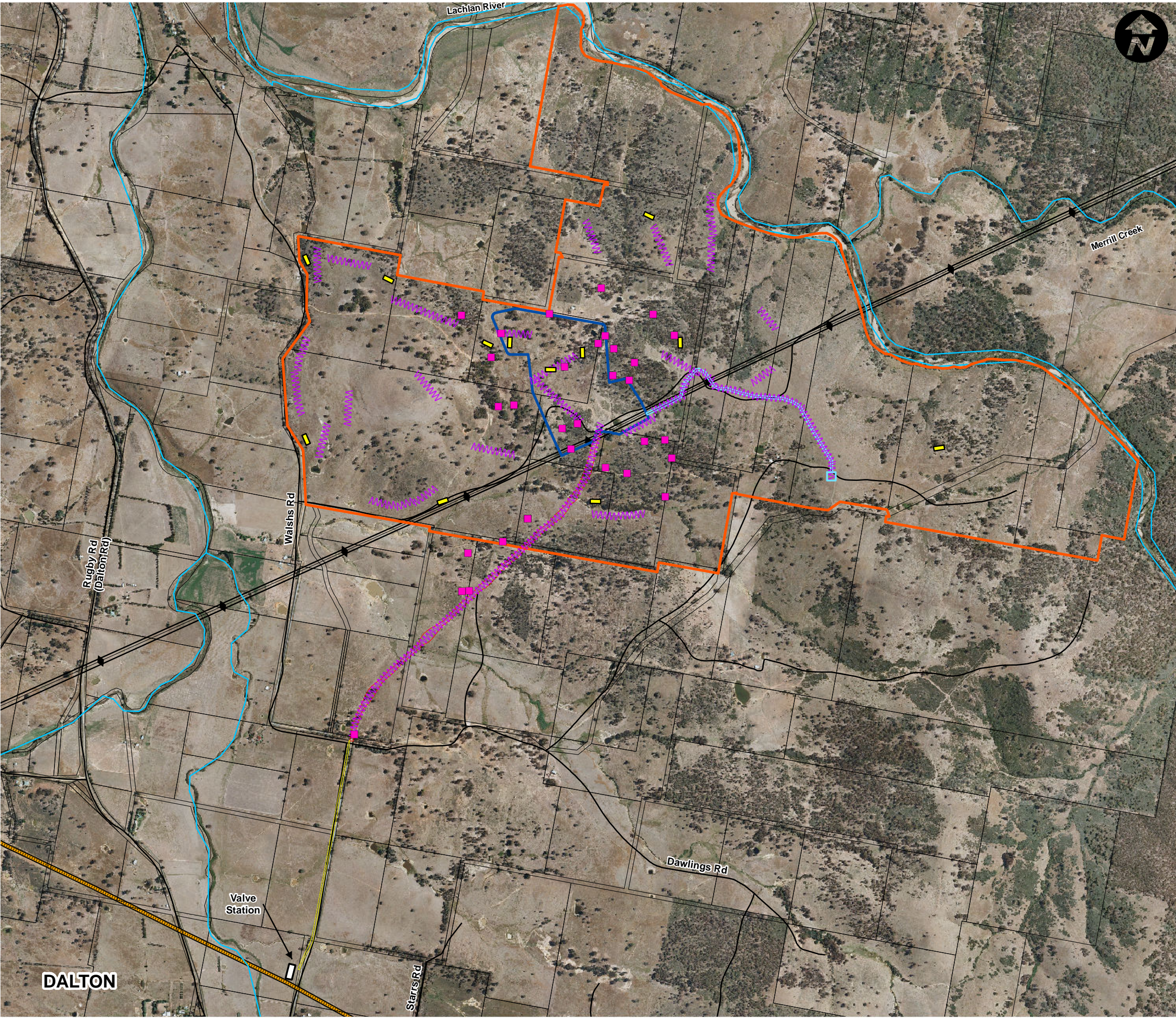
Habitat Suitability Assessment

An assessment of the quality of habitats present for both TSC and EPBC Act listed flora species within the study area was made during March/April 2009, February 2010 and June 2011 field surveys. This technique is important in determining the potential for listed species to use the site rather than relying solely on one-off surveys that are subject to seasonal and weather limitations and provide a snapshot of ecological assemblages present. A list of habitat requirements for threatened flora species that potentially occur on the Dalton site is presented in **Appendix E**.

Weed Survey

As part of the desktop review, a list of noxious weeds declared for the Upper Lachlan Shire Council LGA was accessed (I&I NSW, 2010) and used as a reference guide during field surveys. A total of 94 noxious weeds are declared for the LGA, and these species were targeted during field surveys with searches conducted for all species. Any noxious or significant environmental weeds were identified using the random meander method (Cropper 1993), quadrat data and opportunistic sightings.

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.



Legend

- AGL Site Boundary
- Plant Footprint
- Gas Pipeline (northern) and Access Road
- Gas Pipeline (southern)
- Communications Tower and Hut Footprint
- Communications Tower Services and Access Track
- Moomba-Sydney Pipeline
- Transmission Line
- Vegetation Quadrats (20mx20m)
- Vegetation Transects (50mx20m)
- Random Meander



Source: Aerial Image from AGL

Drawn: SB Approved: JM Date: 24/06/2011

Job No.: 43177661 File No.: 43177661.035.mxd

Client

AGL

Project

DALTON POWER PROJECT

Title

FLORA SURVEY SITES

Figure: 4



4 Methodology

4.2.2 Fauna

Targeted fauna surveys were carried out on 31 March – 2 April 2009, with additional active searches and habitat assessments conducted on 10 – 11 February 2011, 21 – 24 February 2011, 6 – 7 June 2011 and 20 - 21 June 2011. Survey techniques were generally consistent with the requirements of *Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft* (DEC 2004), and *Draft Guidelines for Assessment of Threatened Species for Part 3A Projects* (DEC/DPI, 2005). Additional field surveys were undertaken, targeting threatened fauna species.

Weather conditions during the March/April 2009 survey period were mild, with temperatures ranging from 13°C - 26°C, with gusty winds up to 28 km/h. Light rain was experienced on both days (approximately 2 mm). During the February 2010 field survey, temperatures ranged from 15.9°C to 30.8°C, with north westerly winds up to 15 km/h. No rain fell during this time. However, the survey occurred following a period of high rainfall (158.2 mm of rain fell in the three weeks prior to the survey). Weather during the 10-11 February, 2011 survey period ranged from 14 °C overnight to 30 °C during the day, and winds ranged from 4-7 km/h. Weather conditions during the 21 – 24 February, 2011 survey were fine and sunny, with daytime temperatures above 20 °C by 10:00am, and winds either very light or absent. Weather conditions on the 6 – 7 June, 2011 survey were fine with temperatures ranging from -5.7°C to 10.7°C. Winds were moderate from the WNW between 50 - 65 km/h. During the 20 – 21 June, 2011 survey, the weather was cool but mostly fine with some showers. Temperatures ranged from 4°C to 13.4°C and maximum wind speeds reached up to 93 km/h.

Surveys were targeted towards threatened species identified in the desktop review as potentially occurring on Site, and on habitat assessments conducted during the field visit. Techniques included diurnal bird counts, active reptile searches, funnel traps, walking transects, active searches for flying insects, spotlighting, nocturnal call playback, use of ultrasonic call recording (Anabat) to identify presence of microchiropteran bat species, infra-red motion-sensor cameras, and opportunistic observations including identification of scats and tracks.

Fauna survey methods are outlined in detail below.

Diurnal Bird Counts

Diurnal bird counts undertaken during the March/April 2009 surveys consisted of area surveys within the development footprint. Searches were conducted at dawn and dusk for one hour, with each search area ranging in size from 1 ha to 5 ha. The locations of diurnal bird survey sites are given in **Figure 5**.

Opportunistic observations were recorded throughout each field survey. Species were identified visually or by call, and abundance, behaviour, breeding activity and habitat type was documented. Additional surveys were undertaken during the June 2011 surveys, within development footprint and adjacent areas.

Active Reptile Searches

Active reptile searches were undertaken on 10 – 11 February 2011 and 21 – 24 February 2011. Active searches included turning rocks and fallen timber within the development footprint. Rocks and timber were turned in a random manner, in order to avoid broad scale habitat disturbance or destruction. Approximately 400 rocks were turned from 10-11 February, 2011 over approximately 16 person hours, with an additional 505 turned between 21 – 24 February, 2011, over approximately 8 person hours.

4 Methodology

Rocks or timber were turned, soil underneath each rock or log was gently raked using a stick, fingers or a three pronged rake. All rocks and timber were replaced following searches. Special consideration was given to any areas with obvious spider burrows or ant colonies. Species targeted during active reptile searches included:

- Pink-tailed Worm-lizard (*Aprasia parapulchella*); and
- Striped Legless Lizard (*Delma impar*).

Searches also included passive observations of any basking habitat, such as fence posts, rocks and fallen timber for all reptiles.

Survey methods for reptiles excluded the use of pitfall traps, due to potential disturbance to threatened species habitat, and potential increased risk of predation from foxes (many of which have been seen on site) as per DEWHA (2010c) Survey Guidelines for *Delma impar*. Additional information on targeted reptile searches is provided in **Appendix O**.

Funnel Traps

Drift fences with funnel traps were established within the development footprint and proposed offset areas in an attempt to capture and identify reptile species within the Site. Detailed information on funnel trap methods are provided in **Appendix O**, and summarised below:

Funnel trapping was completed in areas mapped by URS as Natural Temperate Grassland and Box-Gum Woodland targeting SLL [Striped Legless Lizard] and other terrestrial fauna. Three trap lines were established within these two vegetation communities giving a total of six trap lines. Each trap line comprised a 25 m long and 0.23 m tall PVC drift fence and six funnel traps (3pr) evenly spaced along the drift fence. Trap lines were activated on the 20th February 2011 and deactivated on 24th February 2011 giving a survey effort of four nights/five days resulting in a total of 36 trap nights per vegetation community and 72 trap nights in total effort (EnviroKey, 2011).

Walking Transects

Walking transects were undertaken during the 21-24 February, 2011 field survey. Walking transects are described in detail in **Appendix O**, and summarised as follows; across eight person hours, four 200m transects were walked by one person between 10 am and 2 pm in search of basking reptiles within grass tussocks (EnviroKey, 2011).

Golden Sun Moth Searches

Based on the results of the desktop literature review, surveys were performed targeting the Golden Sun Moth (*Synemon plana*).

Surveys were undertaken in areas of potential habitat during suitable 10 – 11 February 2011 and 21 – 24 February 2011. Areas of potential habitat included areas of Natural Temperate Grassland within the development footprint and proposed offset area, to determine any areas of suitable habitat, dominated by one or all of the following grass species:

- *Austrodanthonia carphoides*;
- *Austrodanthonia auriculata*;
- *Austrodanthonia setacea*;

4 Methodology

- *Austrodanthonia eriantha*;
- *Themeda australis*; and
- *Austrostipa* spp.

Methods were consistent with DEWHA (2009b) *EPBC Act Policy Statement 3.12 - Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (Synemon plana)*, with the exception of survey timing.

Conditions during the survey met the recommended survey guidelines established by DEWHA (2009), with surveys undertaken across five ideal weather appropriate survey days, between 10:00am and 2:00pm on clear, cloudless days, with temperatures over 20 °C by 10:00am, with little to no wind. Local experts were consulted on the effectiveness of survey in February, given the lack of surveys during optimal flying period (defined by DEWHA (2009b)), and it was determined that there was still value in conducting the survey effort.

Preference was given to sites that supported a dominance of *Austrodanthonia* species, following advice provided by Alistair Cockburn, Rainer Reywinkle and Geoff Robertson of Friends of Grasslands (pers comm February 2011). However, surveys were undertaken in all areas that were thought to provide potential habitat for this species, within the Native Temperate Grasslands community. *Austrodanthonia* species are present over much of the site. However, areas where this species dominates are limited in extent.

Spotlighting

Spotlighting surveys were performed on the evenings of 31 March and 1 April 2009 as well as June 2011 surveys, and involved walking 1 km transects for approximately 30 minutes and surveying from within a vehicle driven at 1 km/hr for 30 minutes along the proposed access road and whilst entering and exiting the site. Refer to **Table 4-2** for details of survey timing.

Call Playback

Call playback was performed on the evening of 31 March and 1 April 2009 targeting the Powerful Owl, and on June 6 and 20 targeting Squirrel Gliders, Powerful Owl and Barking Owl. Call playback surveys were undertaken at night and included at least five minutes of broadcasting each call and 10 minutes of listening. Following completion of call playback of all calls, the immediate area was spotlighted to search for any species that were in the area, but where not broadcasting. Call playback sites are shown on **Figure 5**.

Anabat Recording

Passive Anabat surveys were conducted at four sites on the nights of 31 March and 1 April, 2009, Detectors started recording one hour before dusk until one hour after dawn the following morning. Survey locations are shown on **Figure 5** and timing is outlined in **Table 4-2**. Detectors were placed in areas of potential habitat such as likely fly-ways and creek and drainage channels where sufficient water or habitat resources existed. Anabat recordings were identified to the genus or species level where possible, by a qualified analyst.

4 Methodology

Infra-red Motion-sensor Cameras

Two infra-red motion-sensor cameras were positioned within the development footprint within the areas considered to have the most suitable habitat for the Spotted-tail Quoll. The species is known to have a preference for mature wet forest habitat (SEWPaC 2011d). As such, the first camera was set on an ephemeral drainage line, shaded by mature *Eucalyptus cinerea* and surrounded by a number of small rocky outcrops. The second camera was set up in Box Gum Woodland beside a shallow dam. Potential habitat for this species is limited within the development footprint, with no caves or large rocky outcrops that would form suitable den sites. However, due to the large home-range of the Spotted-tail Quoll (mean home range: Females = 244, Males = 992 hectares) (SEWPaC 2011d), the species is considered to have the potential to travel through the Project Area. Two cameras were set up for a minimum of three weeks, and baited with raw chicken wings secured to coarse woody debris as per Burnett and Holmes (2008) and Claridge *et al.* (2010). The cameras were re-baited once during the survey period (June 20, 2011), to increase the likelihood of detection. Cameras were set up on the 6 June 2011, and activated for a minimum period of 3 weeks in order to fulfill the recommended survey guidelines for the species, as per SEWPaC (2011h). Cameras were collected in the afternoon of July 1, 2011, meaning they were in the field, capturing data for 24 nights and 26 days. Cameras were set in winter, which is noted as being an optimal survey time for the species: “*The optimal survey time is during the breeding season, with peak activity occurring between May and August. Surveys conducted during April to August may detect males in areas where they may not usually occur, either as they move in search of females to mate with or move away from other more competitive males. The locations of these records may indicate important supplementary habitats such as corridors within fragmented landscapes*” (SEWPaC 2011h).

Opportunistic Observations

Opportunistic and incidental observations of fauna species were recorded at all times during all field surveys. Survey effort was concentrated on areas of suitable habitat within the development footprint. However, observational information was recorded on adjoining roads, access tracks, AGL owned lands and property immediately adjacent to them, and within the offset areas.

Fauna Habitat Assessment and Identification

An assessment of the quality of habitats present for both TSC Act and EPBC Act listed species within the study area was made during both of the field surveys. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. The development footprint was walked and all significant habitat features, such as fallen timber, hollow bearing trees, stags, or stands of Box Gum Woodland or Natural Temperate Grassland likely to provide foraging or nesting habitat for threatened fauna species was plotted using a handheld GPS unit.

Hollow bearing trees were assessed to determine the quality and number of hollows present within each tree within the development footprint, gas pipeline and access road and adjoining proposed offset area. The number of hollows per tree, the size of each hollow, and the location of each hollow (branch, trunk, and fissure)

Habitat assessments are important in determining the potential for listed species to use the site rather than relying solely on one off surveys that are subject to seasonal and weather limitations and provide a snapshot of ecological assemblages present. A list of habitat requirements for threatened fauna species that potentially occur on the Dalton site is presented in **Appendix F**.

4 Methodology

4.2.3 Staff Qualifications

Field surveys were undertaken by qualified URS field ecologists with experience as laid out in **Table-4-2**.

Table 4-2 URS Ecology Personnel and Experience

Name	Position	Qualifications	Relevant Experience
Jane Murray	Associate Ecologist (URS) - Botany	Bachelor of Applied Science Environmental Management Bush Regeneration Cert II	10 years
Lauren Branson	Senior Ecologist - Fauna (URS)	Master of Science (Hons) (Research) Bachelor of Science (Biodiversity and Conservation)	7 years
Melina Budden	Ecologist - Fauna (URS)	Bachelor of Environmental Science Bachelor of Science (Biodiversity and Conservation) Masters of Wildlife Management (Habitat) - Partially Complete	5 years
Kathryn Chesnut	Ecologist - Botany (URS)	Bachelor of Environmental Science (Hons) Bush Regeneration Cert II	4 years
Gina Barnett	Ecologist - Fauna (URS)	Bachelor of Environmental Science (Hons)	5 years
Alex Cave	Graduate Fauna Ecologist (URS)	Bachelor of Biodiversity & Conservation; Masters of Wildlife Conservation	1 year
Steve Sass	Sub consultant, Principal Ecologist/Herpetologist (Envirokey)	Bachelor of Applied Science (Environmental Science) (Hons)	10 + years