9. Terrestrial Ecology

9.1 Introduction

This section of the EIS describes the terrestrial ecological (flora and fauna) values of the Project area. This assessment is based on both a desktop analysis of background information and field surveys completed by specialist sub-consultants between December 2006 and June 2007. The tasks and objectives of the assessment were to:

- consult with relevant State agencies and Stanthorpe Shire Council (SSC) to obtain existing information relating to ecological attributes of the project area;
- compile a description of the vegetation assemblages and fauna habitats of the study area;
- complete a field survey program to census terrestrial flora and fauna communities within the study area;
- confirm the occurrence of rare or threatened flora and fauna species within the study area (as listed under Commonwealth and State legislation);
- confirm the extent of remnant native vegetation occurring within the study area;
- assess the habitat values of the study area for flora and fauna species, with an emphasis on significant species;
- assess the potential impact of the Project on rare and threatened species and vegetation communities in the context of relevant legislation, in particular the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Queensland *Nature Conservation Act 1992* (NC Act); and
- provide recommendations for measures to avoid or mitigate adverse impacts on significant terrestrial flora and fauna species and communities at the design and construction phases.

9.2 Legislative Context

The key biodiversity and nature conservation legislation and policy relevant to the Project is described below.

9.2.1 Commonwealth Legislation

The EPBC act prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas. Under the environmental provisions of the EPBC Act, actions that are likely to have a significant impact on a matter of National Environmental Significance (NES) are identified as "controlled actions" and cannot be undertaken without approval under the EPBC Act.

The Project was referred to the Commonwealth Minister for Department of the Environment, Water, Heritage and the Arts (DEWHA) in December 2006. The SSC nominated the Project as a "controlled action" under Section 75 of the EPBC Act on the basis of its potential impact on listed threatened species and ecological communities. A description of the impact of the Project on matters of NES is presented in **Table 9-1**.

Table 9-1 Impact of the Project on Matters of National Environmental Significance

Matter of National Environmental Significance	Impact of Project
World Heritage Properties	There are no World Heritage Properties within the Project area.
National Heritage Places	There are no National heritage places within the Project area.
Wetlands of International Importance (Ramsar wetlands)	There are no listed Ramsar wetlands located within the Project area.
Threatened Ecological Communities	One Threatened Ecological Community (TEC) is listed as occurring within the study area, namely the White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) Grassy Woodland and Derived Native Grasslands. This TEC is represented in the study area as components of Regional Ecosystems (RE) 13.3.1, 13.12.8 and 13.12.9. Potential impacts on these communities from the Project may result in up to 80 ha of vegetation removed.
Listed Threatened Species	Six listed threatened flora species have been identified within the study area, including *Melaleuca williamsii*, *Grevillea scortchinii* subsp. *scortchinii, Goodenia macbarronii, Eucalyptus mckieana, Boronia repanda* and *Acacia pubiflora* and a further 46 listed species are potential occurrences within the study area. The Project is considered likely to impact on six of these species.
Migratory Species	Several listed migratory species have been identified as occurring within the study area, including Great Egret (*Ardea alba*), White-bellied sea-eagle (*Haliaetus leucogaster*), Fork-tailed Swift (*Apus pacificus*), Latham's Snipe (*Galliago hardwickii*), Black-faced Monarch (*Monarcha melanoptis*) , Rufous Fantail (*Rhipidura rufifrons*) and the Rainbow Bee-eater (*Merops ornatus*). The Project is not considered to have a significant impact on these species, their habitat or breeding/feeding resources.
Commonwealth Marine Areas	There are no Commonwealth marine areas located in the vicinity of the Project area.
Commonwealth Lands and Heritage Places	There are no Commonwealth lands or heritage places located within the Project area.
Places on the Register of the National Estate (RNE)	There are no places listed on the RNE located within the Project area.
State and Territory Reserves	Several State reserves are located within the vicinity of the study area. These include; Girraween National Park (NP), Bald Rock NP, Sundown NP and Donnybrook State Forest.
Nuclear Action	The Project does not involve any nuclear actions.

9.2.2 Queensland Legislation

The NC Act provides for the conservation and management of Queensland's native animal and plants. The Act prohibits the taking or destruction, without authorisation, of certain listed flora and fauna species.

The *Nature Conservation (Wildlife) Regulation 2006* lists the plants and animals considered extinct in the wild, endangered, vulnerable, rare, near threatened, least concern, international and prohibited. It states the declared management intent and the principles to be observed in any taking of or destruction for each group.

The *Land Protection (Stock and Pest Route Management) Act 2002* (LP Act) and the *Land Protection (Pest and Stock Route Management) Regulation 2003* provides for pest management in Queensland.

The *Vegetation Management Act 1999* (Qld) (VM Act) regulates the clearing of mapped remnant vegetation on freehold and leasehold land in Queensland. For the purposes of assessing significant projects, the VM Act is supported by the Regional Vegetation Management Code (RVMC) for Brigalow Belt and New England Tablelands Bioregions and Policy for Vegetation Offsets (the Offset Policy).

The *Nature Conservation (Koala) Conservation Plan 2006* and *Management Program 2006 – 2016* (the Koala Plan) provides for the conservation of Koalas (*Phascolarctos cinereus*) in Queensland and includes provisions for the assessment and management of Koalas during the development approval processes and implementation of projects. Differentiated levels of provisions apply to the three different Koala areas that have been delineated

across Queensland. The study area is situated within Koala District C. This district includes local government areas where koalas are known to occur. In this district the Koala is listed as "least concern" under the NC Act.

9.3 Terrestrial Flora Existing Environment

9.3.1 Introduction

This section discusses the assessment of the study area's vegetation coverage and flora species assemblage with reference to relevant legislation. 3D Environmental conducted both the desktop review of existing data and field studies of the existing flora. Vegetation communities within the study area have been mapped under the RE system. REs are vegetation communities that are consistently associated with a particular landform, soils and geology within a bioregion. They are used to define and map remnant vegetation within Queensland and to determine conservation priorities as provided under the VM Act. There are three levels of protection afforded to REs under the following classifications:

- Endangered if:
  - less than 10% of the pre-clearing extent remains, or
  - 10-30% of the pre-clearing extent remains if the area of remnant vegetation is less than 10 000 hectares.
- Of concern if:
  - 10-30% of the pre-clearing extent remains, or
  - more than 30% of the pre-clearing extent remains if the area of remnant vegetation is less than 10 000 hectares.
- Not of concern if:
  - more than 30% of the pre-clearing extent remains, and the area of remnant vegetation is more than 10 000 hectares.

Due to the scale at which REs are mapped throughout Queensland, some vegetation communities are not able to be mapped, or are incorrectly mapped, under the RE system. Therefore, ground-truthing of mapped REs and other vegetation communities is an essential component of this study. 3D Environmental completed complimentary vegetation mapping of the site's vegetation coverage using a combination of aerial photography interpretation and field survey. This section outlines these methodologies and presents the results of the vegetation survey and mapping.

9.3.2 Study Methodology

3D Environmental were commissioned by SSC to provide an independent assessment of the terrestrial flora for the proposed Emu Swamp Dam Project. The assessment examined the potential impact of the construction and operation of both dam options, the Stalling Lane access and the construction of the Urban Pipeline and an Irrigation Pipeline (i.e. the Project area). The flora study methodology comprised of the following:

- desktop review of background information including aerial photography analysis and survey site location:
  - aerial photography analysis included a stereoscopic analysis of the Project area to delineate broad vegetation communities and to determine field sites.
  - survey site location included:
    - targeting a representative range of habitats within the study area;
    - sampling those communities that were useful for providing reference conditions for disturbed communities (best type examples); and
    - directing detailed sampling towards those communities that could not be adequately categorised through aerial photograph interpretation, or were considered critical to a range of Endangered, Vulnerable or Rare flora species

- field surveys in December 2006 and June 2007 using standard Queensland Herbarium methodologies such as secondary, tertiary and quaternary site sampling procedures.

Further detail on the methodology of the flora survey is provided in the Supporting Technical Document– *Terrestrial Flora Baseline Study - Emu Swamp Dam Project, Severn River, Queensland* (3D Environmental 2007).

9.3.3 Results

9.3.3.1 Desktop Review

Mapped Vegetation Communities

A search of the Commonwealth EPBC Online Protected Matters database indicates that the 'Critically endangered' vegetation community described as 'White Box (*Eucalyptus albens*) , Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) Grassy Woodland and derived Native Grassland' is listed as present in the vicinity of the Project area (DEH 2006). Box Gum Grassy Woodlands and Derived Grasslands are characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of White Box, Yellow Box or Blakely's Red Gum trees (DEH 2006).

The current certified 1:100,000 scale Regional Ecosystem (RE) mapping (DNRW version 5, 2003), which shows the distribution of REs in the dam inundation area and the Stalling Lane Access corridor is presented in **Figure 9-1**. Certified RE mapping for the Urban Pipeline and Irrigation Pipeline (which shows Vegetation Management Status) is presented in **Figure 9-2** (north) and **Figure 9-3** (south).

Six REs are mapped within the Project area including all areas impacted by associated infrastructure. Based on classifications provided by the VM Act, three of these REs are listed as 'Endangered', one as 'Of Concern' and one as 'Not of Concern'. REs represented in the Project area and their conservation status is presented in **Table 9-2**.

- **Table 9-2 Mapped REs within inundation area for the proposed Emu Swamp Dam**

Regional Ecosystem	Status (VMA 1999)	Abbreviated Description
13.3.1*	Endangered	*Eucalyptus blakelyi* woodland on alluvial plains
13.12.2	Not of Concern	*E. andrewsii, E. youmanii* woodland on igneous rocks
13.12.5*	Not of Concern	*E. youmanii* on igneous rocks
13.12.6*	Of Concern	Shrubland on igneous rocks
13.12.8*	Endangered	*E. melliodora* and/or *E. moluccana* / *E. macrocarpa* and/or *E. conica* woodland on igneous rocks
13.12.9	Endangered	*E. blakelyi* and/or *E. caliginosa* woodland to open forest on igneous rocks

* The certified RE mapping identifies the 'endangered' RE 13.3.1 as the dominant vegetation community within the inundation area, with smaller areas of the endangered RE 13.12.9 and the 'not of concern' RE 13.12.2 impacted on the margins of the dam footprint.

Rare and Threatened Flora Species

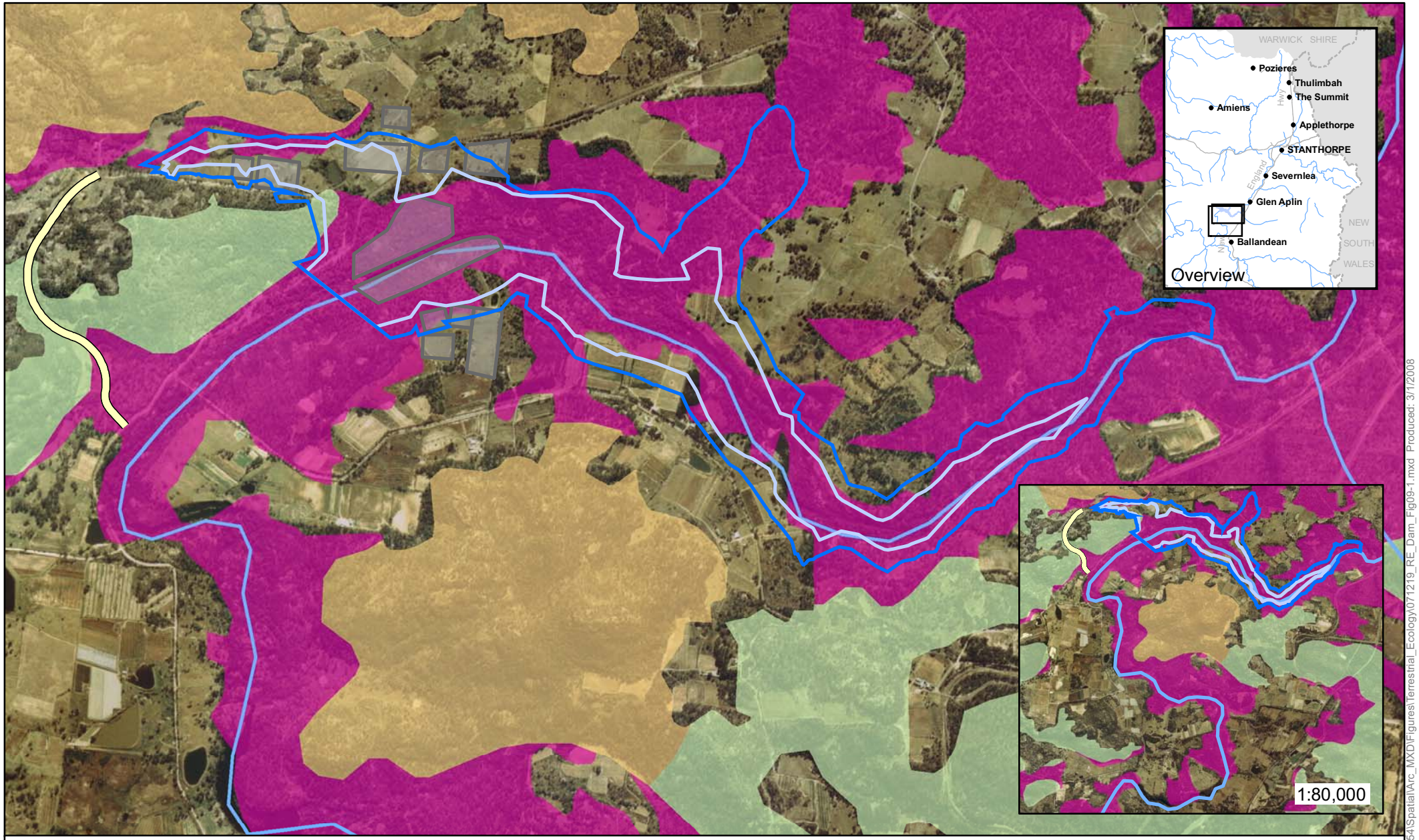
The online EPBC Protected Matters report identified five nationally endangered and thirteen nationally vulnerable flora species with the potential to occur, or with habitat likely within the inundation area. An expanded search to incorporate the Project area and a buffer to include all associated infrastructure, identifies an additional endangered species and two vulnerable species.

The database search area encompasses a historically well-collected area which includes records from the western margins of Girraween National Park. The area is botanically well known as evidenced by the return of 855 individual collections (516 species) from the search of the HERBRECS database. Of the 46 records of Endangered,

Vulnerable, and Rare (EVR) flora, 8 species occur within or in close proximity to the area of impact associated with the Emu Swamp Dam proposal. Furthermore, 62 species of exotic flora are known from the area.

The EPA Wildnet search over the study area identified 594 terrestrial flora species, including 21 EVR species listed (3 species are listed as Endangered, 3 as Vulnerable and 14 as Rare in Queensland) under the NC Act. Six EPBC species are recorded with one being nationally endangered and five listed as nationally vulnerable.

A search request of the Queensland Herbarium CORVEG Database revealed no previous systematic sampling of vegetation communities within the inundation area or wider project area. **Table 9-3** collates the results of the database searches and indicates the conservation status of each species under state and Commonwealth legislation.



SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Stalling Lane Access
- Creeks
- Construction Site Facilities
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Not Of Concern

N W E S

0 100 200 400 600 800

Metres

Scale - 1:20,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Emu Swamp Dam Site

Figure 9-1

EPA Regional Ecosystem mapping for the Inundation Area and the Stalling Lane Access

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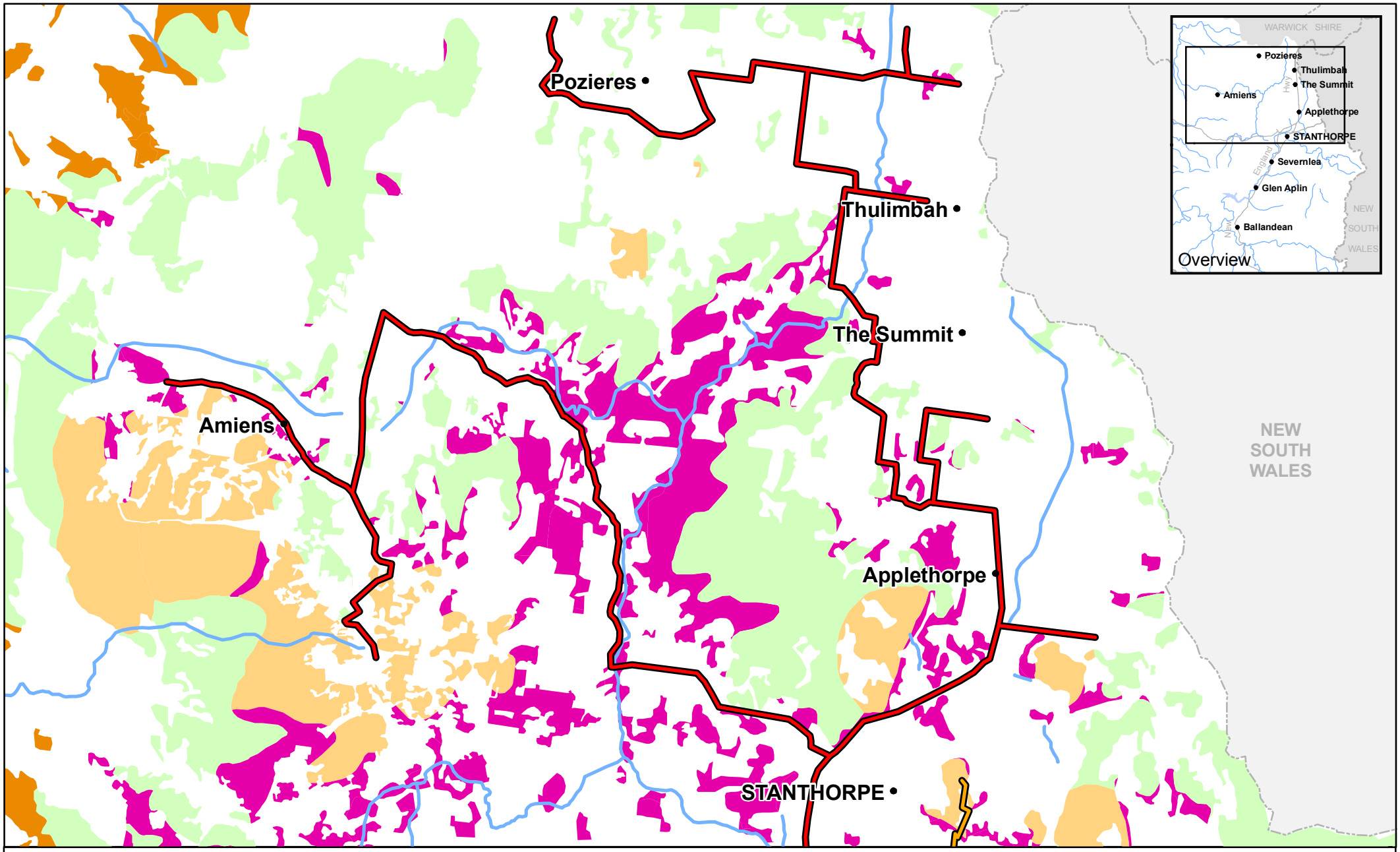

EMU SWAMP DAM EIS

Project Area

Figure 9-2

EPA Conservation Status (VM Act) for the Urban Pipeline and Irrigation Pipeline (North)

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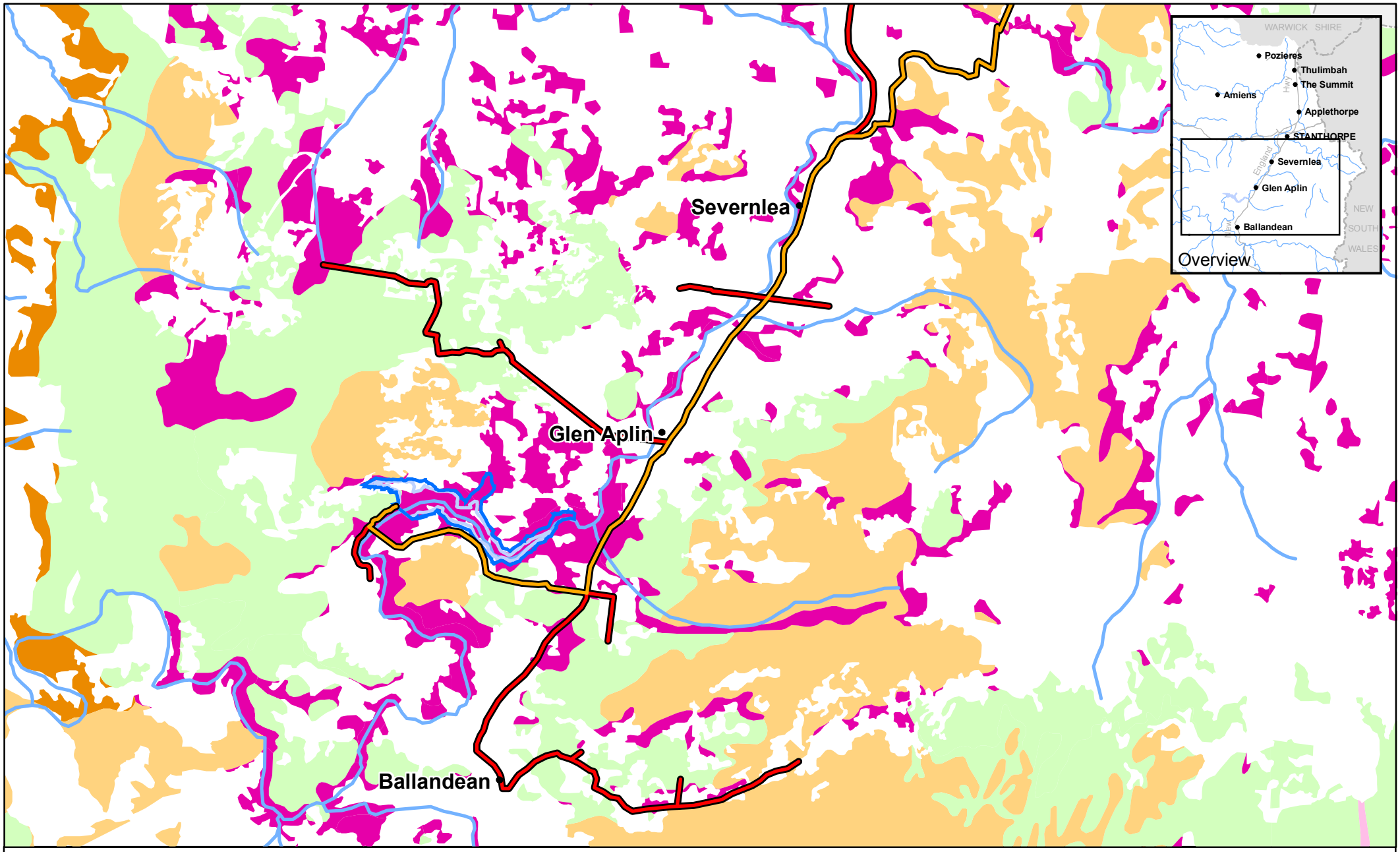

SHIRE OF STANTHORPE

Legend

- Urban Pipeline
- Irrigation Pipeline
- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Not Of Concern

N W E S

0 0.5 1 2 3 4

Kilometres

Scale - 1:100,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-3

EPA Conservation Status (VM Act) for the Urban Pipeline and Irrigation Pipeline (South)

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Table 9-3 Threatened flora species with potential to occur

Species name	NC Act Status	EPBC Status	HERBRECS search records	WildNet search records	Records in Project Area		
					Dam impact area*	Urban Pipeline	Irrigation Pipeline
Acacia brunioides subsp. granitica	R	Not listed	1	1	No	No	No
Acacia latisepala	R	Not listed	4	6	Yes	Yes	Yes
Acacia pubifolia	V	V	2	3	Yes	Yes	No
Acacia ruppii [1]	V	E	1	1	No	No	No
Allocasuarina rupicola	R	Not Listed	2	2	No	No	No
Almaleea cambagei	Not listed	V	0	0	No	No	No
Babingtonia granitica	E	V	4	4	No	No	No
Bertya glandulosa	R	Not listed	1	5	No	Yes	No
Bertya recurvata	R	Not listed	2	2	No	No	No
Boronia amabilis	R	Not listed	0	1	No	No	No
Boronia granitica	E	E	4	5	No	Yes	No
Boronia repanda	E	E	7	7	No	Yes	Yes
Cadellia pentastylis	V	V	2	2	No	No	No
Caladenia atroclavia	E	E	0	0	No	No	No
Conospermum burgessiorum	R	Not listed	4	1	No	No	No
Cryptandra lanosiflora	R	Not listed	2	0	No	No	No
Cryptostylis hunteriana	-	V	0	0	No	No	No
Derwentia arenaria	R	-	2	0	No	No	No
Digitaria porrecta	R	E	0	0	No	No	No
Diuris parvipetala	R	Not listed	5	7	No	Yes	Yes
Diuris sheaffiana [2]	-	V	0	0	No	No	No
Dodonaea hirsuta	R	-	4	4	No	Yes	No
Eucalyptus mckieana	-	V	1	0	No	Yes	No
Eucalyptus scoparia	V	V	0	1	No	Yes	No
Euphrasia orthocheila subsp orthocheila	R	Not listed	1	0	No	No	No
Goodenia macbarronii	-	V	0	0	No	No	No
Grevillea scortechinii subsp. scortechinii	V	V	6	6	No	Yes	Yes
Hakea macrorrhyncha	R	Not listed	1	0	No	No	No
Hibbertia elata	R	Not listed	1	1	No	No	No
Homoranthus montanus	V	V	4	4	Yes	Yes	No
Leionema ambiens	R	-	2	0	No	No	No
Lepidium hyssopifolium	Not listed	E	0	0	No	No	No
Kunzea bracteolata	R	-	5	5	Yes	No	No
Macrozamia occidua	V	V	0	0	No	No	No
Macrozamia viridis	E	Not listed	0	1	No	No	No
Melaleuca flavovirens (syn. Callistemon flavovirens)	R	Not listed	4	4	Yes	No	No
Melaleuca williamsii (syn. Callistemon pungens)	V	V	3	3	Yes	Yes	No

Species name	NC Act Status	EPBC Status	HERBRECS search records	WildNet search records	Records in Project Area		
					Dam impact area*	Urban Pipeline	Irrigation Pipeline
Mirbelia confertiflora	R	Not listed	5	5	No	No	No
Olearia gravis	R	Not listed	1	3	No	No	No
Phebalium glandulosum subsp. eglandulosum	V	V	1	1	Yes	No	No
Phebalium whitei	V	V	3	3	No	No	No
Pterostylis longicurva	R	Not listed	0	2	No	Yes	No
Pterostylis woollsii	R	-	2	3	No	Yes	No
Pultenaea foliolosa (ex P. stuartiana)	V	V	0	0	No	No	No
Rulingia hermanniifolia	R	-	1	1	No	Yes	No
Rulingia salviifolia [3]	R	-	1	1	No	No	No
Rutidosis glandulosa	R	Not listed	1	0	No	No	No
Thelionema grande	R	Not listed	2	0	No	No	No
Tylophora woollsi	E	E	1	0	No	No	No
Wahlenbergia glabra	R	Not listed	0	1	No	No	No
Zornia pallida	R	Not listed	1	0	No	No	No

1 - Not identified in EPBC search although single HERBRECS record in locality from Girraween National Park

2 - Listed in Queensland Flora as *Diuris tricolor* (Bostock and Holland 2007)

3 - HERBRECS record refers to a cultivated specimen from Amethyst Nursery, 74 Ishmael Road, Camira, Brisbane

* Includes Stalling Lane impact area.

9.3.3.2 Field Survey

Vegetation Communities

Vegetation communities identified within the project inundation area are tabulated in **Table 9-5** below with those recorded inside the inundation area indicated with an asterisk. A distribution map of the vegetation communities in the inundation area and the Stalling Lane Access is shown in **Figure 9-4** with vegetation communities within the Urban Pipeline and Irrigation Pipeline presented in **Figure 9-5** (north) and **Figure 9-6** (south).

Vegetation communities with national status are classified in accordance with guidelines outlined in the DEWHA EPBC Policy Statement for White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands (DEH 2006). Vegetation communities form the basis for EPBC classification, and are used here to provide an indication of the spatial distribution of EPBC listed communities within the study area. A classification of EPBC listed communities is provided in **Table 9-4**, with their spatial distribution indicated in **Figure 9-4** for the inundation area and Stalling Lane Access, and **Figure 9-5** and **Figure 9-6** for the northern and southern portions of the Urban Pipeline and the Irrigation Pipeline respectively.

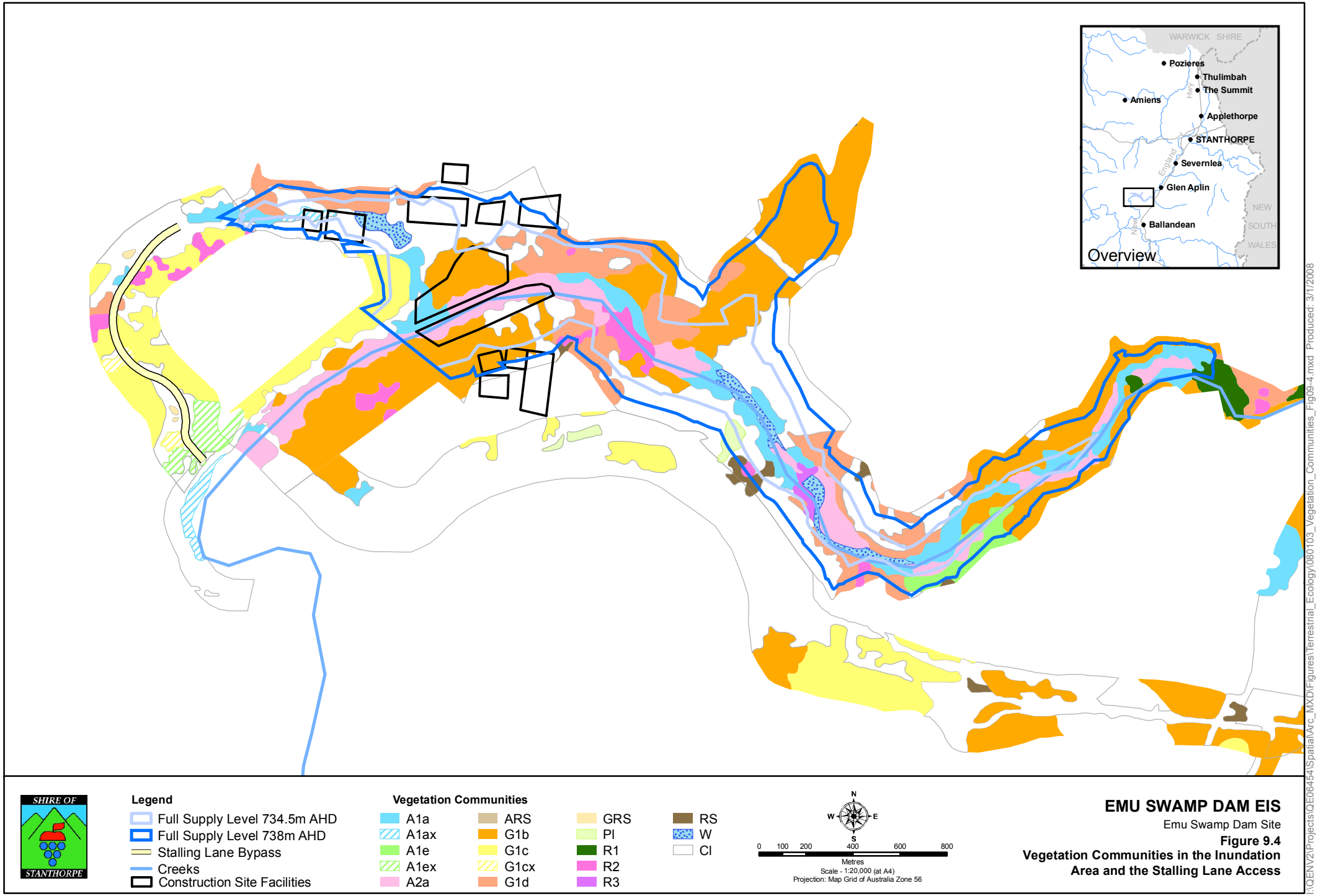
- **Table 9-4 National conservation status (EPBC) of vegetation communities in the Project area**

Vegetation Community	EPBC Status
A1a	Critically Endangered
G1b	Critically Endangered
A1e	Critically Endangered
G1e	Critically Endangered

Table 9-5 Vegetation Communities within the Emu Swamp Dam study area.

Vegetation Community	Description	Reference Sites - Representative
Eucalypt Woodlands and Open Forests		
A1a*	*Eucalyptus blakelyi, E. bridgesiana* shrubby open forest on fluvial deposits.	ES5, ES8,EQ25, EQ28 EPQ2, EPQ8, EPQ34
A1e*	*E. blakelyi* open grassy woodland on alluvial flood plains	EQ37
G1e	*E. blakelyi* woodland and open forest on gentle granite slopes and deeply weathered granite plains.	EPQ7, EPQ13, EPQ39
G1b*	*E.melliodora* +/- *E. blakelyi* +/- *E. youmanii* +/- *E. prava* + *E. bridgesiana* +/- *E. crebra* woodland and open forest on granite slopes and weathered granite plains.	ES2, ES4, ES15, ES17, ET26, EPQ5, EQ18, EQ20, EQ26, EQ27, EQ35, EQ36, EQ38, EQ39, EPQ1, EPQ9, EPQ14, EPQ16, EPQ17, EPQ19, EPQ24, EPQ31, EPQ32, EPQ35, EPQ36, EPQ37
G1c	*E. youmanii, E. andrewsii* woodland and open forest on granite hillslopes.	ERS4, EPQ3, EPQ6, EPQ18, EPQ23, EPQ28, EPQ29, EPQ30
G1d*	Woodland and open forest with dominant *E. youmanii, Callitris endlicherii, Angophora subvelutina* on granite knolls.	EPQ7, EPQ3, EPQ6, ES17, EQ21, EQ22, EQ31, EQ34, EPQ15, EPQ33, EWS43, EWS45
G1f	*E. conica* + *E. melliodora* + *E. blakelyi* woodland on deeply weathered granite plains and slopes.	EPQ26, EPQ39, EPQ40, EPQ41, EPQ42.
G1g	*E. callignosa* + *E. melliodora* woodland on deeply weathered granite plains and slopes.	STQ21, STQ21a, STQ23, STQ24, STQ122
Shrubland and Sedgeland Communities		
A2a*	Closed shrubland, shrubland and sedgeland mosaic with emergent trees. Fluvial sediments and associated rock pavements of the main flood channel and associated overflow of the Severn River.	ES1, ES9 EQ3,EQ32, EQ33, EPQ25
A2b*	Swampy grasslands of riverine flood channel overflows.	EQ4
Rock Pavement Communities		
R1*	In-stream granite boulder deposits associated with major fluvial systems (Severn River).	ES24, ES10
R2*	Granite rock pavements associated with dry eucalypt forest.	EQ12, ES10, EQ19, EQ32a, EWS46
R3*	Granite rock pavement associated with fluvial systems.	EQ29
Cleared Land		
Cl	Includes all cleared areas, including exotic grasslands, urban areas, and agricultural areas of fruit orchards and small crops	none

* Indicates vegetation community recorded inside the dam inundation area.


WARWICK SHIRE
Pozieres
Thulimbah
The Summit
Amiens
Applethorpe
STANTHORPE
Severnlea
Glen Aplin
Ballandean
NEW SOUTH WALES
Overview
SHIRE OF STANTHORPE
Legend
Full Supply Level 734.5m AHD
Full Supply Level 738m AHD
Stalling Lane Bypass
Creeks
Construction Site Facilities
Vegetation Communities
A1a
A1ax
A1e
A1ex
A2a
ARS
G1b
G1c
G1cx
G1d
GRS
PI
R1
R2
R3
RS
W
CI
N
W
E
S
0 100 200 400 600 800
Metres
Scale - 1:20,000 (at A4)
Projection: Map Grid of Australia Zone 56
EMU SWAMP DAM EIS
Emu Swamp Dam Site
Figure 9.4
Vegetation Communities in the Inundation Area and the Stalling Lane Access
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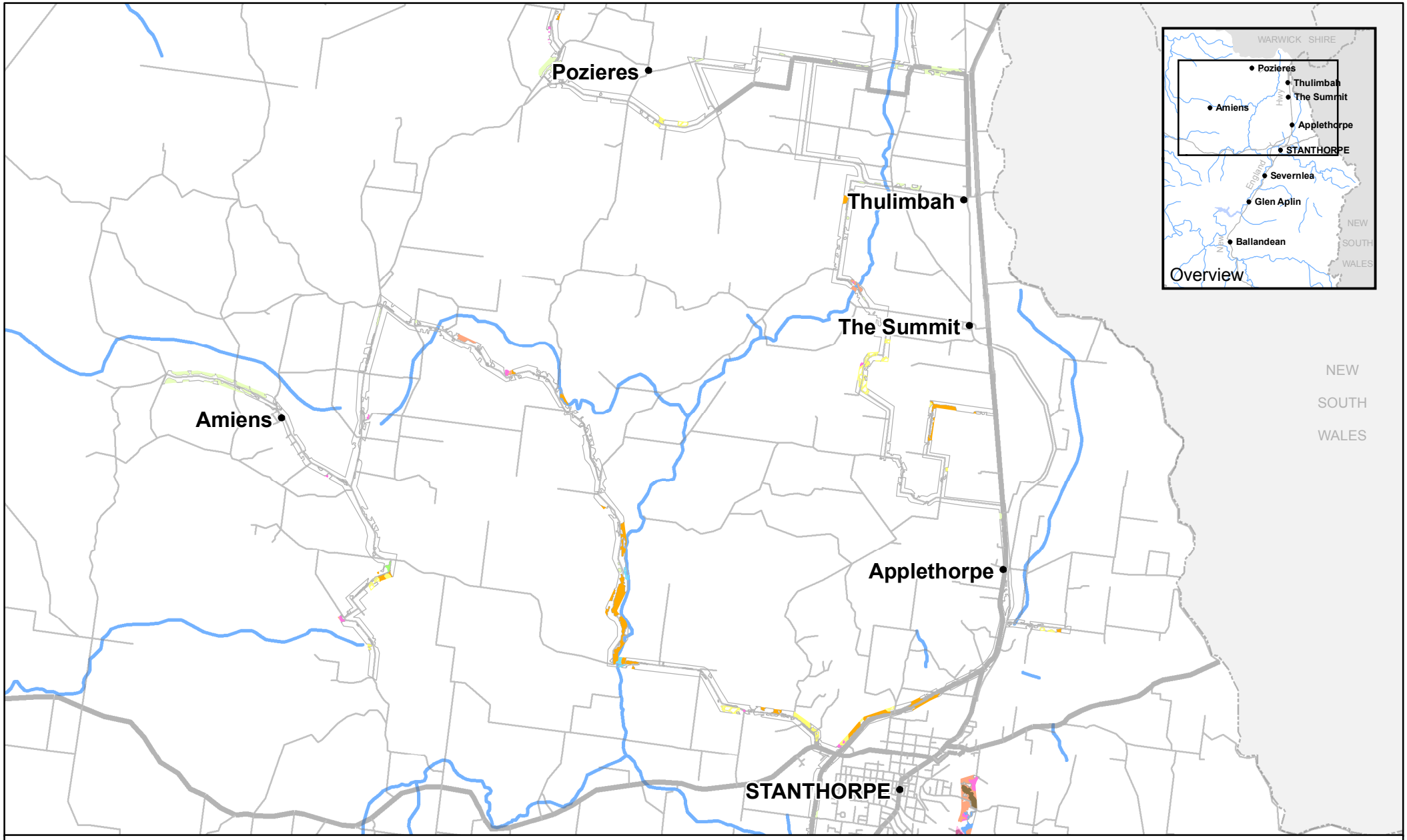

SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Creeks

Vegetation Communities

A1a	A1ax	A1e	A1ex	A2a	ARS	G1b	G1c
G1cx	G1d	GRS	PI	R1	R2	R3	RS
W	CI						

N W E S

0 0.5 1 2 3 4

Kilometers

Scale - 1:100,000(at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-5

Vegetation Communities in the Urban Pipeline and Irrigation Pipeline (North)

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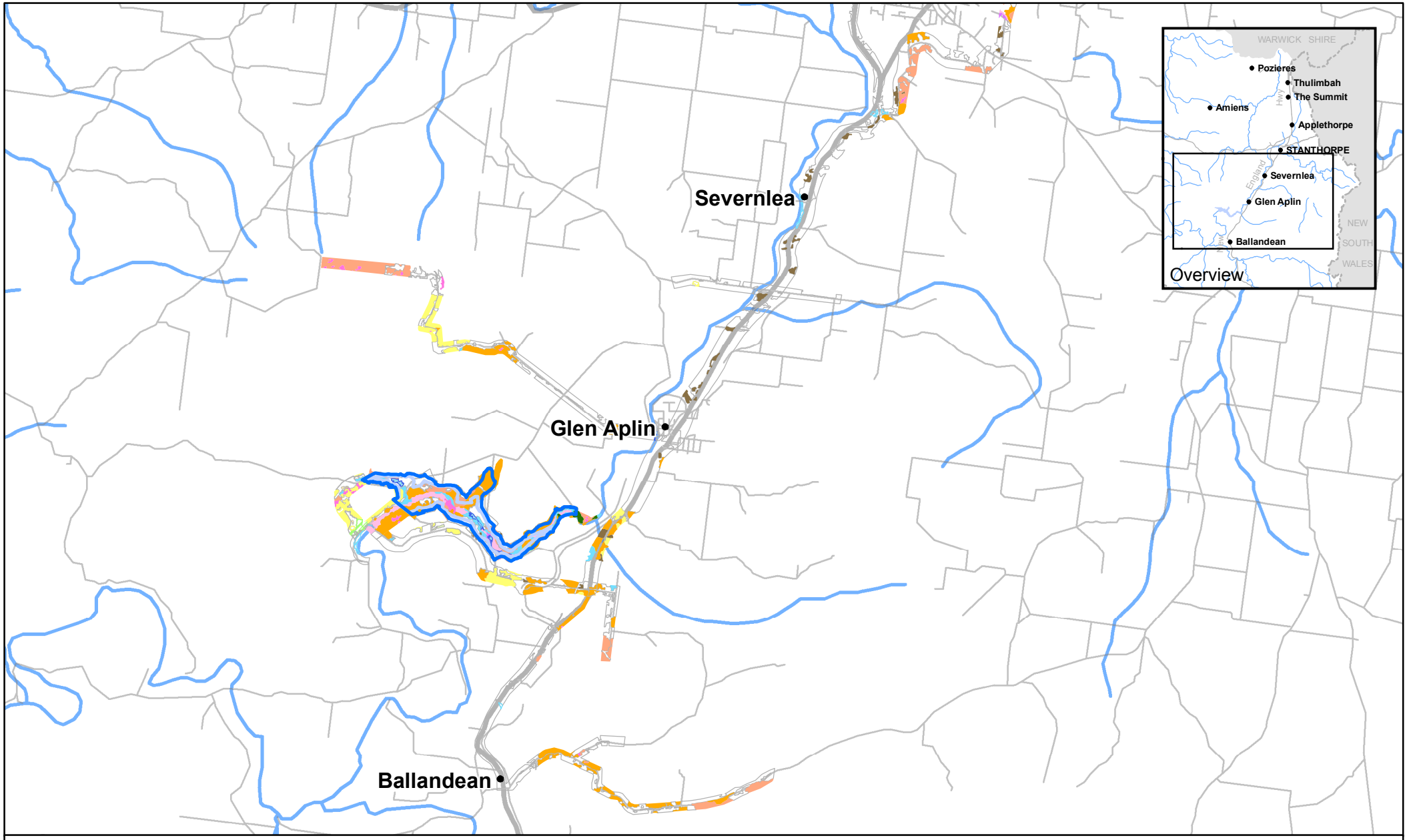

SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Creeks

Vegetation Communities

A1a	ARS	GRS	RS		
A1ax	G1b	PI	W		
A1e	G1c	R1	CI		
A1ex	G1cx	R2			
A2a	G1d	R3			

N W E S

0 0.5 1 2 3 4

Kilometers

Scale - 1:100,000(at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-6

Vegetation Communities in the Urban Pipeline and Irrigation Pipeline (South)

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Regional Ecosystems

Vegetation communities have been classified into REs based on landform associations, structural types and floristic assemblages. A total of six REs were identified in the Project area (**Table 9-6**) together with their Vegetation Management status under the VM Act. A distribution map of the REs in the inundation area and Stalling Lane Access is shown in **Figure 9-7**, with the northern section of the Urban Pipeline and Irrigation Pipeline shown in **Figure 9-8** and the southern section in **Figure 9-9**.

- **Table 9-6 Identified REs in the project area**

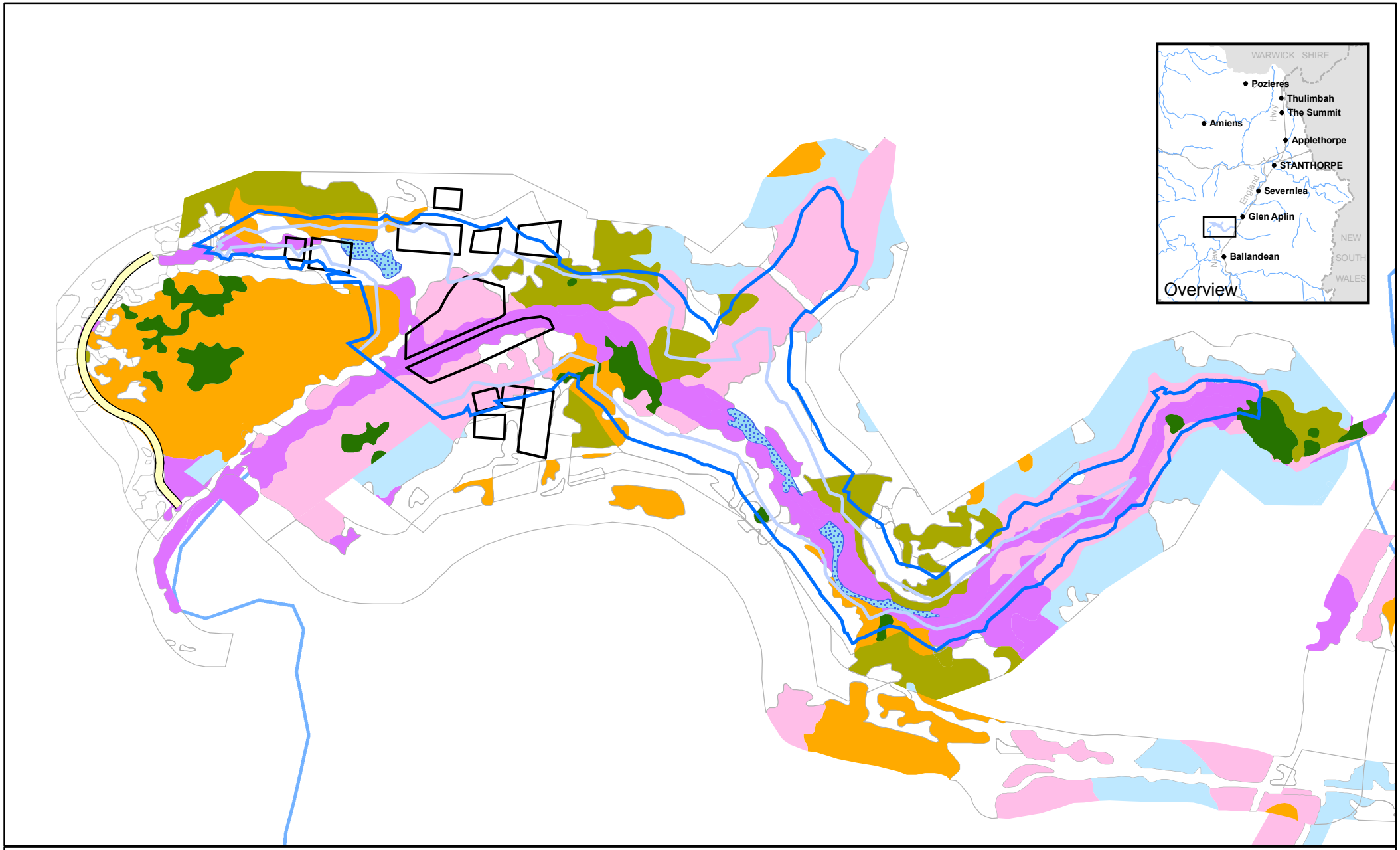
Regional Ecosystem	Conservation Status^	Component Vegetation Communities	Regional Ecosystem Description	Field Reference Sites
Alluvial plains, including fluvial deposits in riverine flood channels and associated exposed granite pavements.				
13.3.1*	CE (Aust) in part E (Qld)	A1a, A1ax, A1e, R3	*Eucalyptus blakelyi* woodland on alluvial plains	ES5, ES6, ES8,EQ25, EQ28 EPQ2, EPQ8, EPQ34
13.3.1x1**	E (Qld)	A2a, A2ax	13.3.1x1 riparian shrubland on braided stream channels +/- emergent trees such as *E. blakelyi, E. bridgesiana* or *Angophora floribunda*.	ES1, ES9
Granitoid lithologies including rhyolites and granites				
13.12.2	NOC	G1h	*E. andrewsii, E. youmanii* woodland on igneous rocks	EQ7, ES6, EPQ3, EPQ6, EPQ18, EPQ23, EPQ28, ES17, EQ21, EQ22, EQ31, EQ34, EPQ15, EPQ33
13.12.5*	NOC	G1c, G1d	*E. youmanii* on igneous rocks	EQ7, ES6, EPQ3, EPQ6, EPQ18, EPQ23, EPQ28, EPQ29, EPQ30, ES17, EQ21, EQ22, EQ31, EQ34, EPQ15, EPQ33, EWS43, EWS44
13.12.6*	OC	R1, R2	Shrubland on igneous rocks	ERS5, ES10, ES24, EWS46, EQ19, EQ29
13.12.8*	E (Aust) in part E (Qld)	G1b, G1f	*E. melliodora* and/or *E. moluccana/ E. macrocarpa* and/or *E. conica* woodland on igneous rocks	ES2, ES4, ES15, ES17, ET26, EPQ5, EQ18, EQ20, EQ26, EQ27, EQ35, EQ36, EQ38, EQ39, EPQ1, EPQ9, EPQ14, EPQ16, EPQ17, EPQ19, EPQ24, EPQ31, EPQ32, EPQ35, EPQ36, EPQ37, EPQ26, EPQ39, EPQ40, EPQ41, EPQ42, EWQ42.
13.12.9	E (Aust) E (Qld)	G1e	*E. blakelyi* and/or *E. calignosa* woodland to open forest on igneous rocks	EPQ7, EPQ13, EPQ39, STQ21, STQ21a, STQ23, STQ24, STQ122

Truncated descriptions as per the Regional Ecosystem Description Database (REDD) (Queensland Herbarium 2005).

* Indicates RE occurring within inundation area.

** Indicates a structural formation of RE 12.3.1 and is a new inclusion into REDD (Version 5.1, June, 2007). This community occurs in the dam inundation area.

^ Conservation Status of communities under the EPBC Act (Australia), CE = Critically Endangered and VM Act (Qld). E = Endangered, OC = Of Concern and NOC = not of Concern



SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Creeks
- Stalling Lane Access
- Construction Site Facilities

Regional Ecosystems

- 13.12.8
- 13.12.2
- 13.12.5
- 13.12.6
- 13.12.9
- 13.3.1
- Non-remnant
- Waterbody/Waterhole

N W E S

0 100 200 400 600 800

Metres

Scale - 1:20,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Emu Swamp Dam Site

Figure 9-7

Regional Ecosystems on the Inundation Area and the Stalling Lane Access (3D Review)

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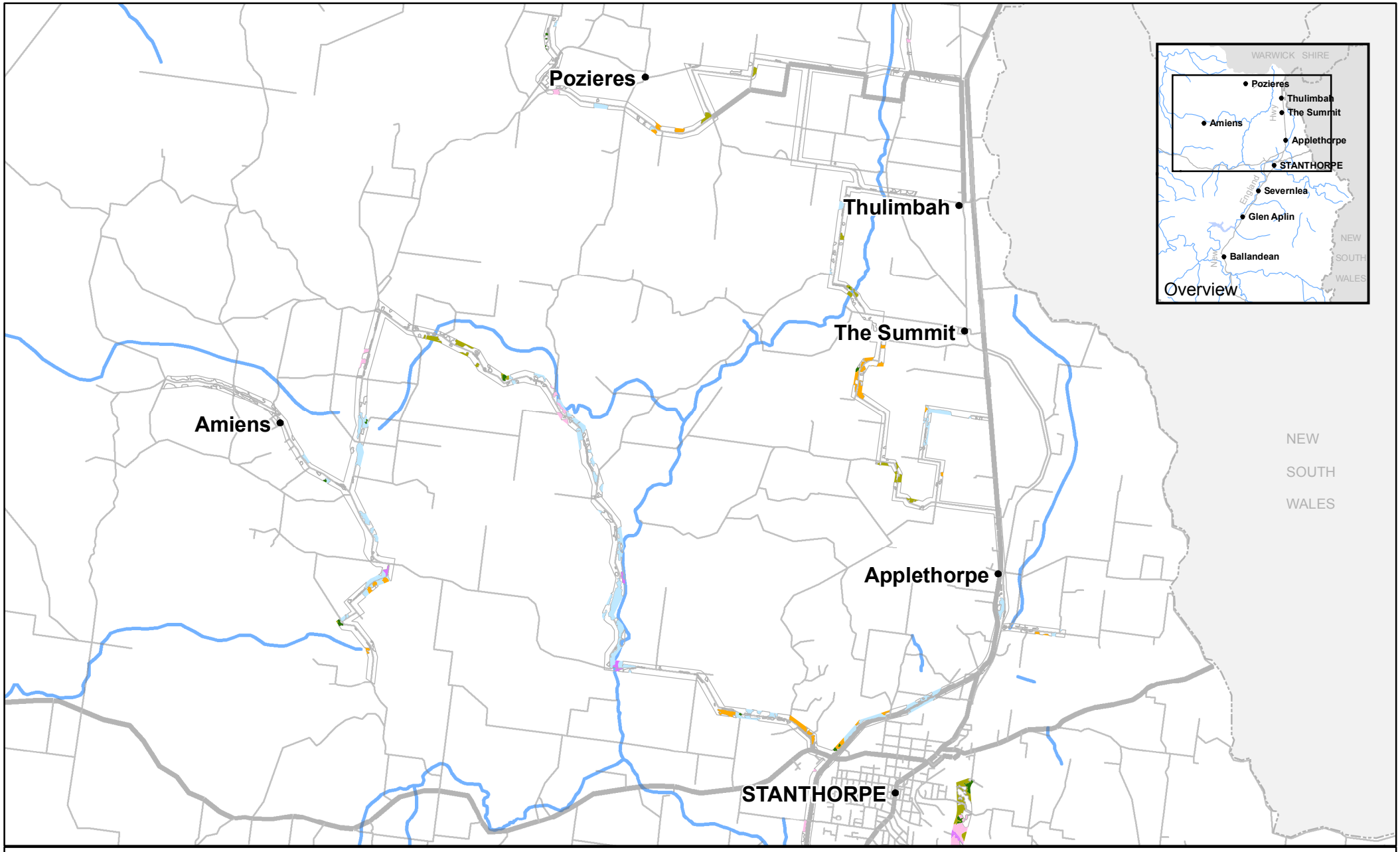

SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Creeks

Regional Ecosystems

- 13.12.8
- 13.12.2
- 13.12.5
- 13.12.6
- 13.12.9
- 13.3.1
- Non-remnant
- Waterbody/Waterhole

N W E S

0 0.5 1 2 3 4

Kilometers

Scale - 1:100,000(at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-8

Regional Ecosystems on the Urban Pipeline and Irrigation Pipeline (North)

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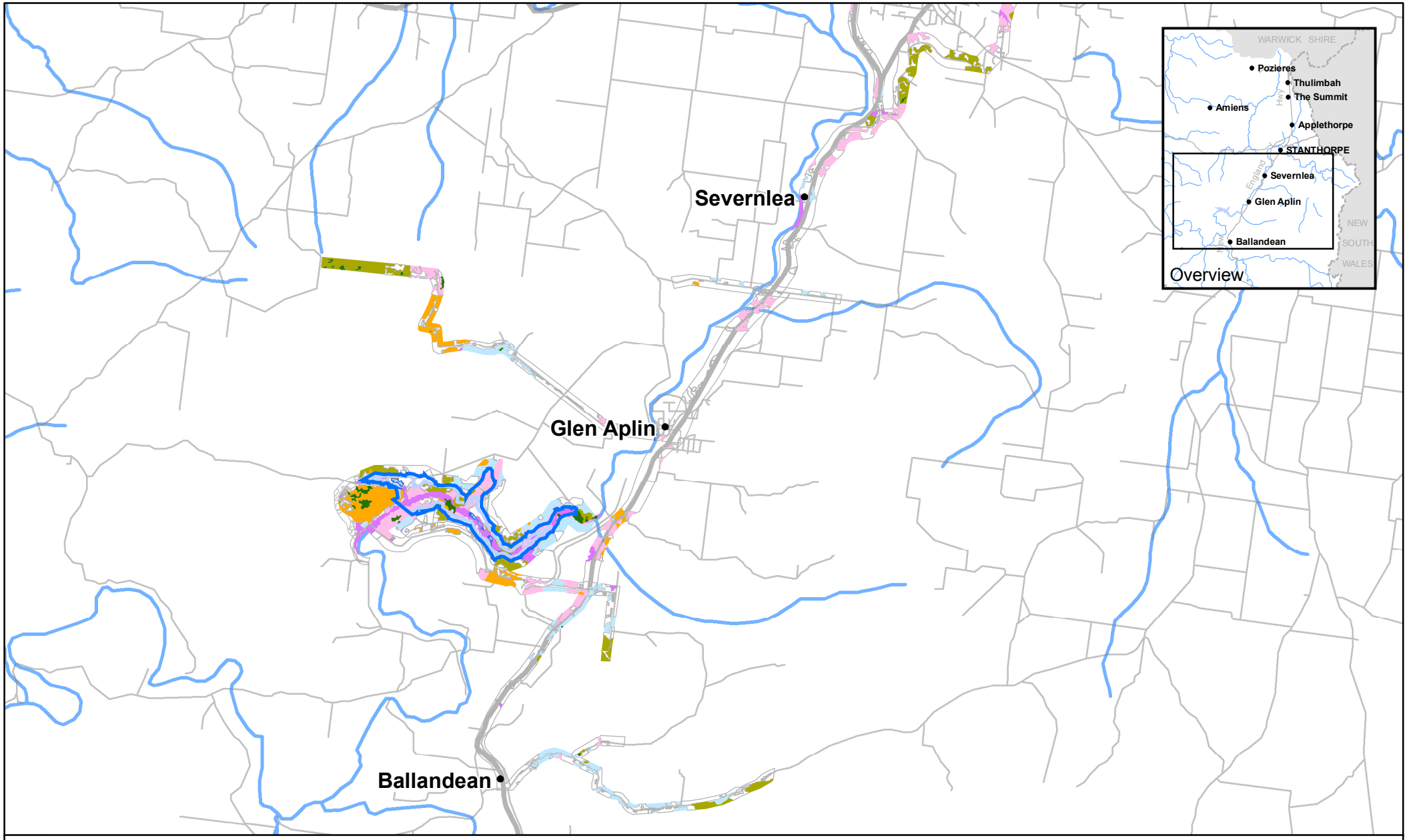

SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Creeks

Regional Ecosystems

- 13.12.8
- 13.12.2
- 13.12.5
- 13.12.6
- 13.12.9
- 13.3.1
- Non-remnant
- Waterbody/Waterhole

N W E S

0 0.5 1 2 3 4

Kilometers

Scale - 1:100,000(at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-9

Regional Ecosystems on the Urban Pipeline and Irrigation Pipeline (South)

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Non-remnant Vegetation Communities

Non-remnant communities are those that do not meet the minimum height requirements or canopy cover requirements as prescribed under the VM Act. Non-remnant classifications are indicated in **Table 9-7** with spatial distribution provided in previous figures.

Table 9-7 Non-remnant Vegetation Community Classifications

Non-Remnant Classification	Non-Remnant Community	Description
Grs	Secondary eucalypt communities	Restricted to minor pockets along roadsides and several minor areas of historical disturbance amongst woodland communities within the inundation area. The majority of these communities comprise species similar to their parent woodland types, with a far greater proportion of *Acacia* species in the canopy. With a general canopy height below 10 m, their status as non-remnant conforms to VM Act legislative definitions.
Gre*	Dominant Exotic Species – non plantation	Only a minor area of this non-remnant classification is mapped on the pipeline easement. The community manifests in the landscape as a degraded wetland dominated by the scrambling Rose Bramble (*Rubus albicandicans*) This classification does not include remnant communities with a dominant exotic groundcover.
Pl	Plantation (usually *Pinus*)	This classification includes all plantation communities within the study area, including *Pinus* plantations marginal to the inundation area on Fletcher Road, and several well established *Pinus* Plantations on roadsides in the northern section of the INW.
Cl	Cleared areas including horticultural area	This classification includes all cleared areas, including exotic grasslands, urban areas, and agricultural areas of fruit orchards and small crops. No formal survey sites were located in these areas but species were recorded from observations made during roadside searches for EVR species.

* Found on pipeline easement only.

Flora Species

A total of 295 species of vascular plants were recorded within the dam inundation area incorporating results from the Stalling Lane Access (refer to the Supporting Technical Document (3D Environmental 2007)). This includes all records from the baseline survey and inclusion of relevant HERBRECS records. Seventy-five families and 180 genera are represented. Threatened species totalled 51, representing 17% of the total flora. It should be noted that the survey of the Irrigation Pipeline survey focused on the identification of significant flora and as such, a comprehensive list of all flora species on the corridor was not compiled.

The survey of the dam inundation area recorded 5 of the 51 species of EVR taxa potentially occurring in the study area (**Table 9-8**). The location of these specimens is shown in **Figure 9-10**. The survey of the proposed Stalling Lane Access recorded two out of the 51 species of EVR taxa potentially occurring in the study area (**Table 9-9**). Both of these species are listed as Vulnerable under the EPBC Act and the NC Act. A third species is known to occur in this area from a HERBRECS database record.

Table 9-8 Baseline survey records of Threatened Flora (Inundation Area).

Species	Conservation Status	Site [1]	Map Unit [2]	RE
Acacia latisepala	Rare (NC Act)	19	R2	13.12.6
		29	R3	13.12.6
		33	A2a	13.3.1
Melaleuca flavovirens	Rare (NC Act)	1	A2a	13.3.1
		misc	R1	13.3.1x
		EWQ47	G1c	13.12.2
		EWQ48	R1	13.12.6
		misc	A2a	13.3.1
		misc	A2a	13.3.1
		misc	A2a	13.3.1
Melaleuca williamsii	Vulnerable (EPBC Act) Vulnerable (NC Act)	EWQ46	R1	13.3.1x
		EWQ48	R1	13.12.6
		1	A2a	13.3.1
		9	A2a	13.3.1
		HERBRECS	HERBRECS	13.3.1
		1	A2a	13.3.1
		24	R1	13.12.6
		28	A1a	13.3.1
		33	A2a	13.3.1
		36	G1b	13.12.8
		misc	R1	13.12.6
		misc	R1	13.12.6
		misc	A2a	13.3.1
Rulingia hermaniifolia	Rare (NC Act)	29	R3	13.12.6
Thelionema grande	Rare (NC Act)	29	R3	13.12.6
		misc	R1	13.3.1x
		EWQ48	R1	13.12.6
		misc	R1	13.12.6
		32a	A2a	13.3.1

[1] For species identified during the flora survey the survey site number or “Traverse”. Species known from database are also included and identified as “HERBRECS”

[2] The vegetation community flora species located in as per **Table 9-5** and **Table 9-7**

Table 9-9 Baseline survey records of Threatened Flora (Stalling Lane Access)

Species	Conservation Status	Site [1]	Map Unit [2]	RE
Acacia pubiflora (population of 15 individuals)	Vulnerable (EPBC Act) Vulnerable (NC Act)	HERBRECS	R2	13.12.6
Melaleuca williamsii (3 individuals)	Vulnerable (EPBC Act) Vulnerable (NC Act)	Traverse	A1ax	13.3.1
Melaleuca williamsii	Vulnerable (EPBC Act) Vulnerable (NC Act)	Traverse	A1ax	13.3.1

[1] For species identified during the flora survey the survey site number or “Traverse”. Species known from database are also included and identified as “HERBRECS”

[2] The vegetation community flora species located in as per **Table 9-5** and **Table 9-7**.

The survey of the Urban Pipeline recorded 3 out the possible 51 potential EVR species with one of these being listed as Vulnerable under the EPBC Act, 1999. An additional species, *Eucalyptus mckieana*, listed as Vulnerable (EPBC Act) was added on account of a HERBRECS collection approximately 150 m from the Urban Pipeline route on Fletcher Road, although was not recorded during the survey.

The survey of the Irrigation Pipeline recorded 3 out of the 51 species of EVR taxa potentially occurring in the study area. Of these, two are listed as Vulnerable under the EPBC Act and the NC Act and one species is listed as Rare under the NC Act.

Threatened flora collections for the Urban Pipeline and Irrigation Pipeline are provided **Table 9-10** and **Table 9-11** respectively. The spatial distribution of these survey records on the respective pipeline corridors is shown in **Figure 9-11** and **Figure 9-12**.

- **Table 9-10 Baseline survery records of Threatened Flora (Urban Pipeline)**

Species	Conservation Status	Site [1]	Map Unit [2]	RE
Acacia latisepala	Rare (NC Act)	EPQ37	Cl	Non Remnant
		EPQ34	G1b	13.12.8
		EPQ3	Cl	NR
Eucalyptus mckieana	Vulnerable (EPBC Act)	HERBRECS	G1c	13.12.2
Mirbelia confertiflora	Rare (NC Act)	EPQ31	G1b	13.12.8
Melaleuca williamsii	Vulnerable (EPBC Act)	EPQ34	G1b	13.12.8
	Vulnerable (NC Act)	EPQ25	G1f	13.12.8
		EPQ38	Cl	NR
		EPQ14	G1b	13.12.8

[1] For species identified during the flora survey the survey site number or “Traverse”. Species known from database are also included and identified as “HERBRECS”

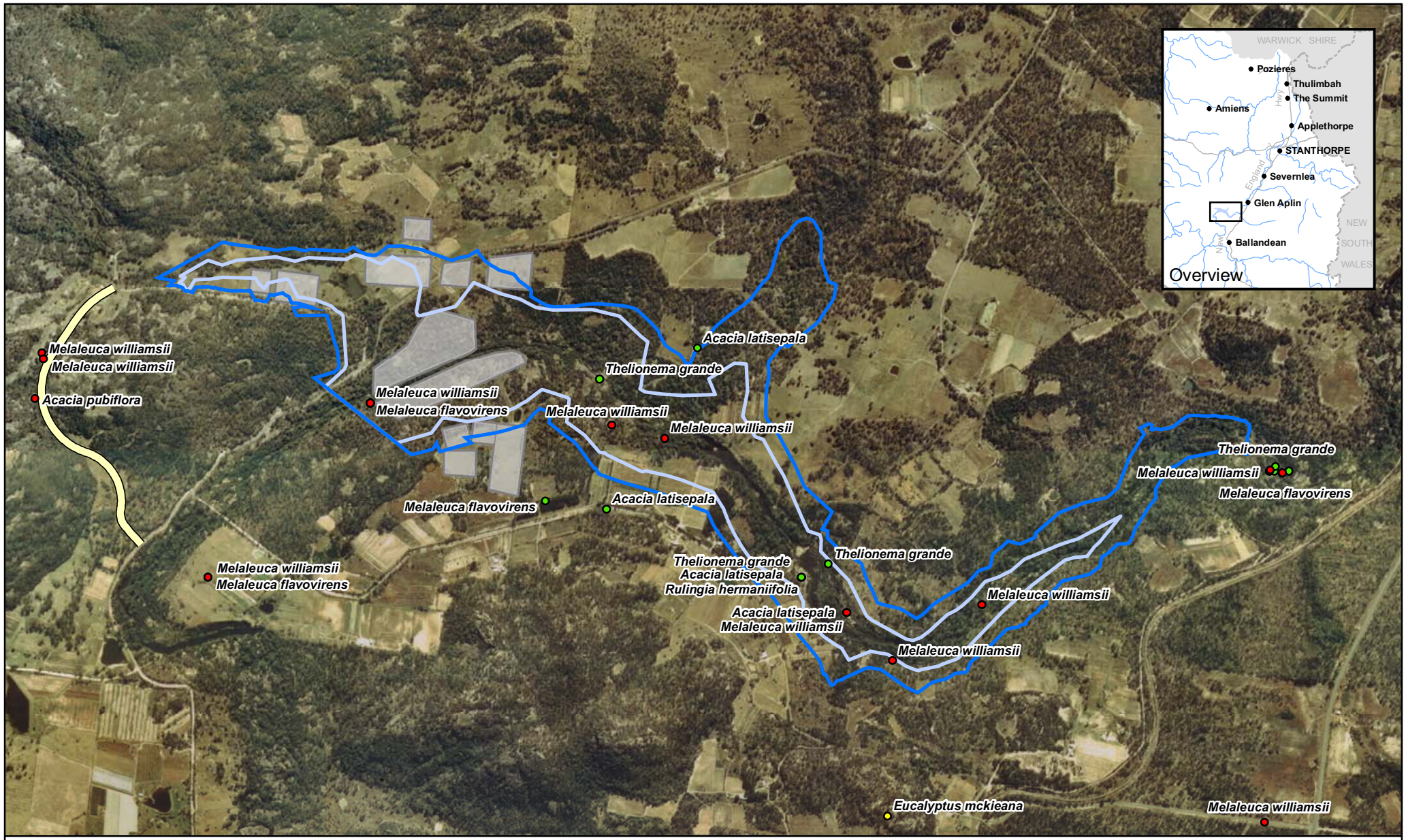
[2] The vegetation community flora species located in as per **Table 9-5** and **Table 9-7**.

- **Table 9-11 Baseline survey records of Threatened Flora (Irrigation Pipeline)**

Species	Conservation Status	Site [1]	Map Unit [2]	RE
Acacia latisepala	Rare (NC Act)	Traverse	Cl	Non Remnant
		Traverse	Cl	Non Remnant
		Traverse	Cl	Non Remnant
		Traverse	Cl	Non Remnant
		Traverse	Cl	Non Remnant
		Traverse	Cl	Non Remnant
		Traverse	G1g	RE13.12.9
		Traverse	Grs	Non Remnant
Grevillea scortechinii subsp. *scortechinii*	Vulnerable (EPBC Act)	Traverse	Cl	Non Remnant
	Vulnerable (NC Act)	Traverse	Cl	Non Remnant
		Traverse	Cl	Non Remnant
Melaleuca williamsii	Vulnerable (EPBC Act)	Traverse.	G2ax	13.3.1x1
	Vulnerable (NC Act)	Traverse	Cl	Non Remnant
		Traverse	Cl	Non Remnant

[1] For species identified during the flora survey the survey site number or “Traverse”. Species known from database are also included and identified as “HERBRECS”

[2] The vegetation community flora species located in as per **Table 9-5** and **Table 9-7**.



Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Construction Site Facilities
- Stalling Lane Access

EVR Records

- Vulnerable EPBC - NCA
- Vulnerable EPBC
- Rare - NCA

N W E S

0 100 200 400 600 800

Metres

Scale - 1:20,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Emu Swamp Dam Site

Figure 9-10

EVR Records in the Inundation Area

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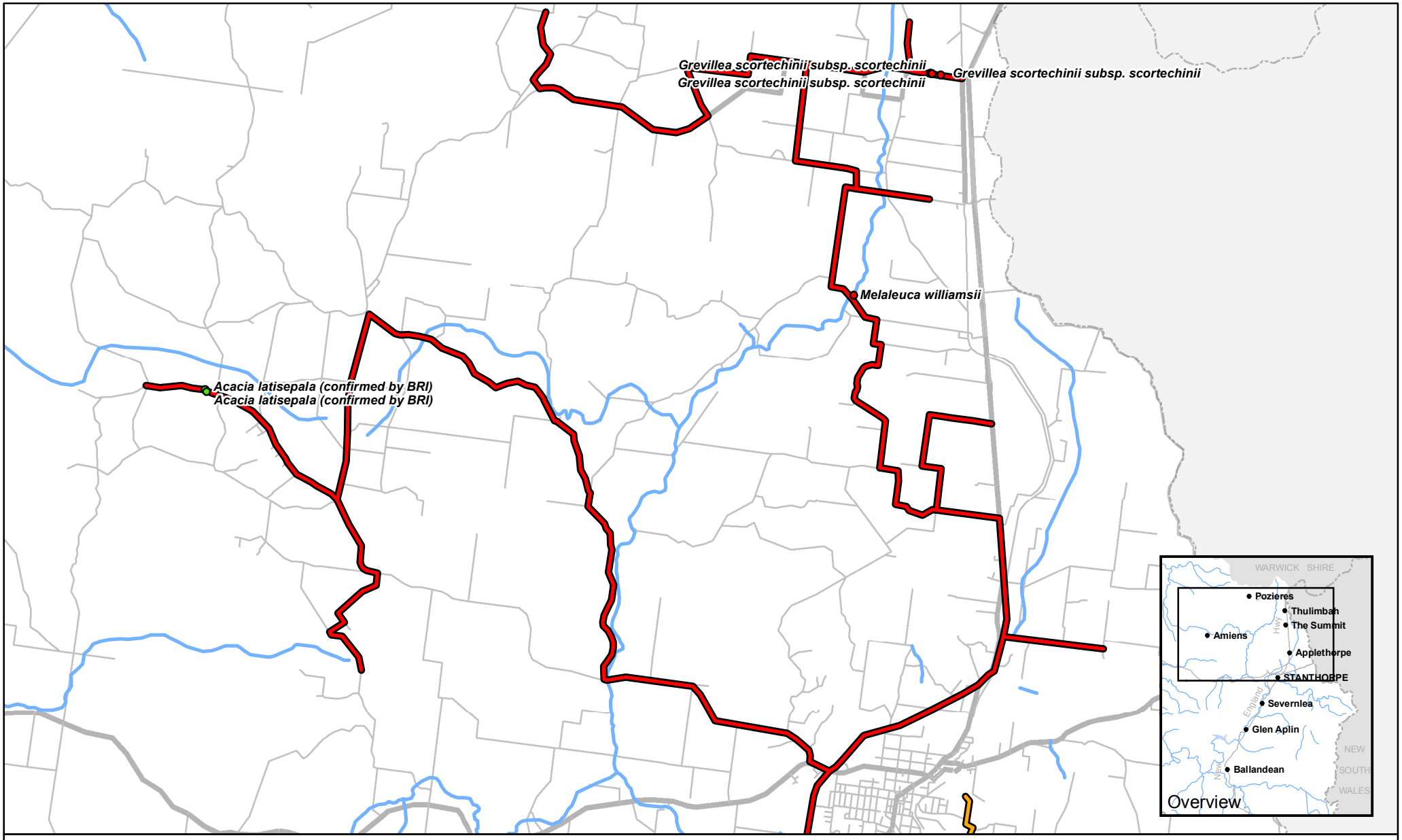

EMU SWAMP DAM EIS

Project Area

Figure 9-11 EVR Records in the Urban Pipeline and Irrigation Pipeline (North)

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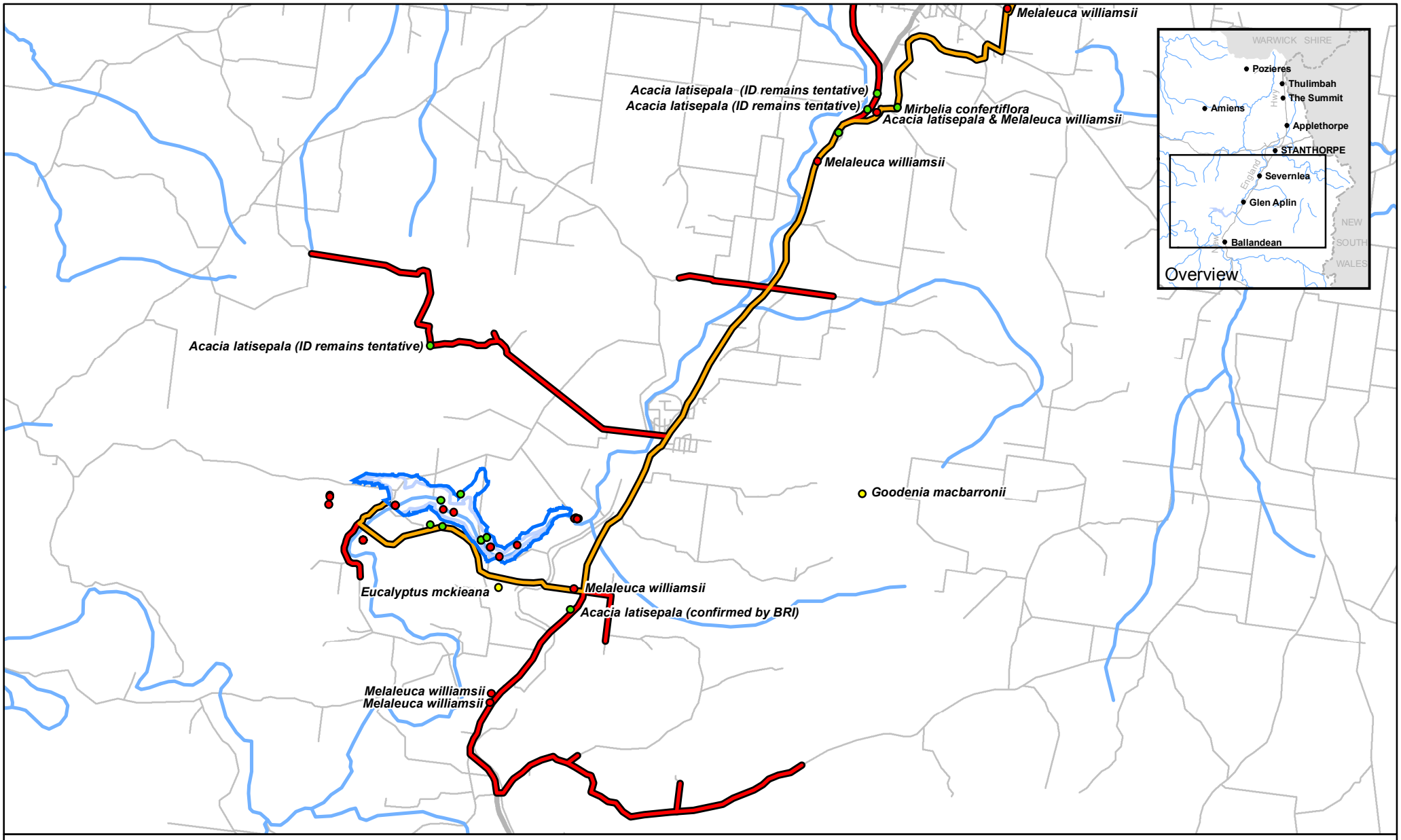

SHIRE OF STANTHORPE

Legend

- Urban Pipeline
- Irrigation Pipeline
- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD

EVR Records

- Vulnerable EPBC - NCA
- Vulnerable EPBC
- Rare - NCA

N W E S

0 0.5 1 2 3 4

Kilometers
Scale - 1:100,000 (at A4)
Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-12 EVR Records in the Urban Pipeline and Irrigation Pipeline (South)

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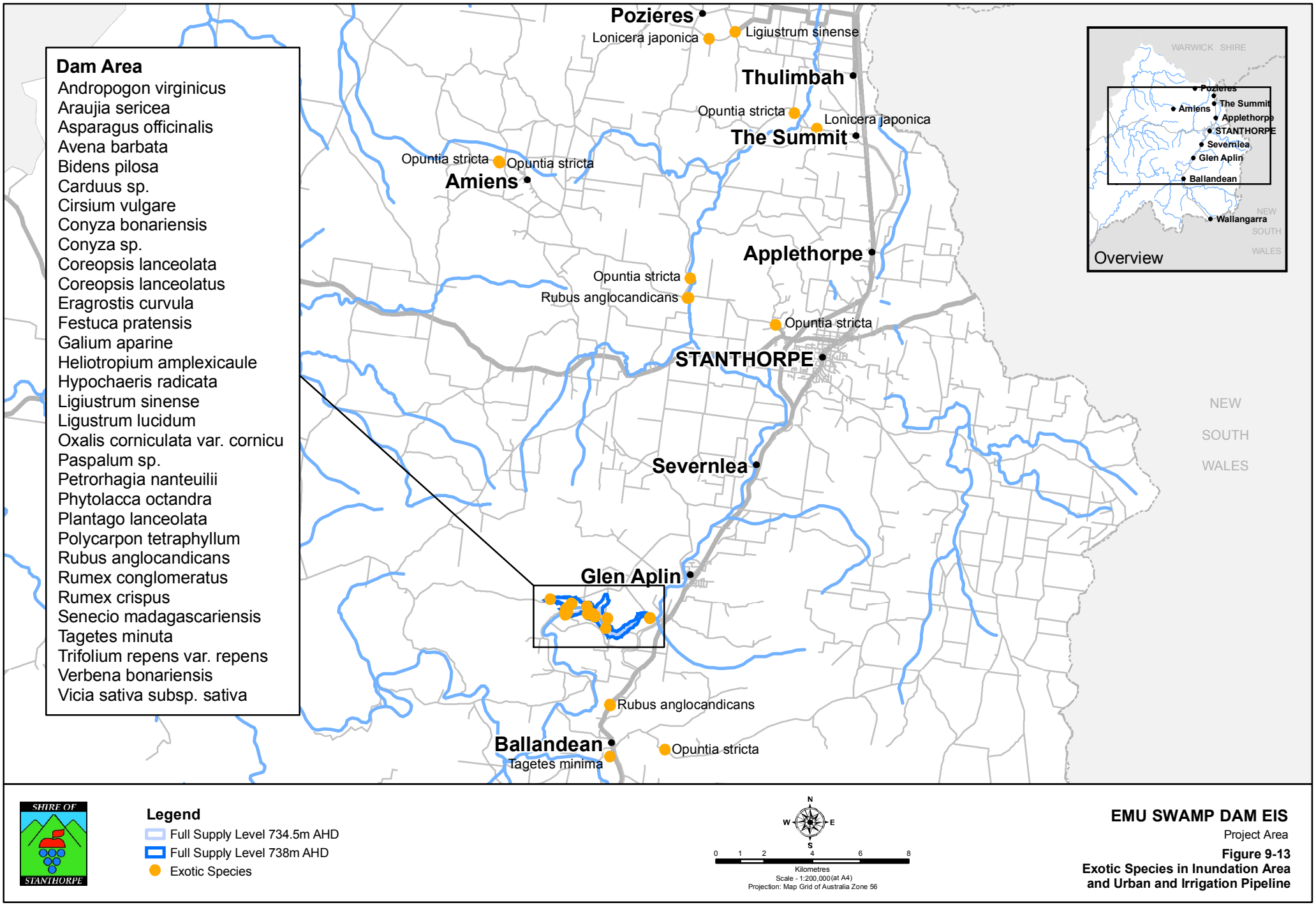
Exotic Flora

Six LP Act declared species and eight species identified in the Stanthorpe Shire Council Local Government Pest Management Plan (2005) were recorded in the irrigation corridor. Two species are listed as Weeds of National Significance. All exotic species recorded during the field survey are listed in **Table 9-12** and are included in the preliminary species list for the area (refer to the Supporting Technical Document (3D Environmental 2007). Weed species were recorded throughout the Project area as shown in **Table 9-12**.

- **Table 9-12 Exotic Species collected during the survey.**

Species	Common Name	Regional Ecosystem	Declaration Status	Weed of National Signifacance	SSC Status
Acetosella vulgaris	Sheep Sorrel	Non-remnant	Not declared		-
Andropogon virginicus	Whisky Grass	13.12.6, 13.3.1	Not declared		Low
Asparagus officinalis	Asparagus	13.3.1	Not declared		-
Avena sp.	An Oats Grass	13.3.1	Not declared		-
Bidens pilosa	Farmers Friend	13.12.6, 13.12.8, 13.3.1	Not declared		-
Bryophyllum sp	Mother of Millions	Non-remnant, 13.12.5, 13.12.8, 13.3.1	Class 2		Medium
Carduus sp.	A Thistle	13.3.1	Not declared		-
Chondrilla juncea	Skeleton Weed	Non-remnant	Not declared		-
Cirsium vulgare	Thistle	Non-remnant, 13.3.1	Not declared		-
Conyza bonariensis	Tall Fleabane	Non-remnant, 13.12.6, 13.12.8, 13.3.1	Not declared		-
Coreopsis lanceolata	Coreopsis	Non-remnant, 13.12.6, 13.12.8, 13.3.1	Not declared		-
Cortaderia selloana	Pampas Grass	Non-remnant	Not declared		Medium
Cosmos bipinnatus	Cosmos	Non-remnant, 13.3.1	Not declared		-
Cyperus flavescens		Non-remnant,	Not declared		-
Datura ferox	Fierce Thornapple	Non-remnant,	Not declared		-
Datura stramonium	Common Thornapple	Non-remnant,	Not declared		-
Digitaria sanguinalis	Summer Grass	Non-remnant,	Not declared		-
Echinochloa crus-galli	Barnyard Grass	Non-remnant,	Not declared		-
Eleusine indica	Crowsfoot Grass	Non-remnant,	Not declared		-
Eragrostis curvula	African Love Grass	Non-remnant, 13.3.1	Not declared		-
Erodium cicutarium	Common Storksbill	Non-remnant	Not declared		-
Heliotropium amplexicaule	Blue Heliotrope	Non-remnant, 13.3.1	Not declared		-
Hordeum glaucum	Northern Barley grass	Non-remnant	Not declared		-
Hypochoeris radicans	Flatweed	Non-remnant, 13.12.8, 13.3.1	Not declared		-
Ligustrum sinense	Small leaved Privet	Non-remnant, 13.3.1	Class 3		High
Ligustrum lucidum	Large leaved Privet	Non-remnant,	Class 3		High

Species	Common Name	Regional Ecosystem	Declaration Status	Weed of National Signifacance	SSC Status
		13.12.8			
Lonicera japonica	Japanese Honeysuckle	13.3.1	Not declared		-
Mentha piperata	A Peppermint	13.3.1	Not declared		-
Myriophyllum aquaticum	Parrots' Feather	13.3.1	Not declared		-
Oenothera glazioviana		Non-remnant	Not declared		-
Oenothera stricta subsp. stricta		Non-remnant	Not declared		-
Opuntia stricta	Prickly Pear	Non-remnant	Not declared		-
Oxalis corniculata var. corniculata	Oxalis	Non-remnant, 13.12.8, 13.3.1	Not declared		-
Paspalum urvillei	Vasey Grass	Non-remnant	Not declared		-
Petrorhagia nanteuilii		13.3.1	Not declared		-
Phytolacca octandra	Inkweed	Non-remnant, 13.3.1	Not declared		-
Plantago lanceolata	Plantain	Non-remnant, 13.3.1	Not declared		-
Rubus anglocandicans	Blackberry	Non-remnant, 13.3.1	Not declared		-
Rubus fruticosus agg.	Blackberry	Non-remnant, 13.3.1	Class 3	Yes	
Rumex conglomeratus	Clustered Dock	Non-remnant, 13.3.1	Not declared		-
Rumex crispus	Curled Dock	Non-remnant, 13.3.1	Not declared		-
Salix sp.	Willow	Non-remnant	Class 1	Yes	-
Senecio madagascariensis	Fireweed	Non-remnant, 13.3.1	Class 2		High
Tagetes minuta	Stinking Roger	Non-remnant, 13.3.1	Not declared		-
Trifolium repens var. repens	White Clover	Non-remnant, 13.3.1	Not declared		-
Urtica urens	Stinging Nettle	Non-remnant	Not declared		-
Verbena bonariensis	Purpletop	Non-remnant, 13.12.6, 13.12.8, 13.3.1	Not declared		-
Verbena incompta	Purpletop	Non	Not declared		-
Vulpia muralis		Non	Not declared		-


Dam Area
Andropogon virginicus
Araujia sericea
Asparagus officinalis
Avena barbata
Bidens pilosa
Carduus sp.
Cirsium vulgare
Conyza bonariensis
Conyza sp.
Coreopsis lanceolata
Coreopsis lanceolatus
Eragrostis curvula
Festuca pratensis
Galium aparine
Heliotropium amplexicaule
Hypochaeris radicata
Ligiustrum sinense
Ligustrum lucidum
Oxalis corniculata var. cornicu
Paspalum sp.
Petrorhagia nanteuilii
Phytolacca octandra
Plantago lanceolata
Polycarpon tetraphyllum
Rubus anglocandicans
Rumex conglomeratus
Rumex crispus
Senecio madagascariensis
Tagetes minuta
Trifolium repens var. repens
Verbena bonariensis
Vicia sativa subsp. sativa
Pozieres
Lonicera japonica
Ligiustrum sinense
Thulimbah
Opuntia stricta
Lonicera japonica
The Summit
Opuntia stricta
Opuntia stricta
Amiens
Applethorpe
Opuntia stricta
Rubus anglocandicans
Opuntia stricta
STANTHORPE
Severnlea
Glen Aplin
Rubus anglocandicans
Ballandean
Opuntia stricta
Tagetes minima
NEW
SOUTH
WALES
WARWICK SHIRE
Pozieres
The Summit
Amiens
Applethorpe
STANTHORPE
Severnlea
Glen Aplin
Ballandean
Wallangarra
NEW
SOUTH
WALES
Overview
SHIRE OF
STANTHORPE
Legend
Full Supply Level 734.5m AHD
Full Supply Level 738m AHD
Exotic Species
N
W
E
S
0 1 2 4 6 8
Kilometres
Scale - 1:200,000(at A4)
Projection: Map Grid of Australia Zone 56
EMU SWAMP DAM EIS
Project Area
Figure 9-13
Exotic Species in Inundation Area
and Urban and Irrigation Pipeline
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9.3.3.3 Conservation Status of Vegetation Communities

State Conservation Status

The conservation status of REs within the study area is represented in **Table 9-13**.

- **Table 9-13 Conservation status of REs in the Project area as per the VM Act**

Regional Ecosystem	Description
Endangered	
13.3.1	*Eucalyptus blakelyi* woodland on alluvial plains
13.12.8	*E. melliodora* and/or *E. moluccana* / *E. macrocarpa* and/or *E. conica* woodland on igneous rocks
13.12.9	*E. blakelyi* and/or *E. caliginosa* woodland to open forest on igneous rocks
Of Concern	
13.12.6	Shrubland on igneous rocks
Not of Concern	
13.12.2	*E. andrewsii, E. youmanii* woodland on igneous rocks
13.12.5	*E. youmanii* on igneous rocks

National Conservation Status

Vegetation communities with national status are classified in accordance with guidelines outlined in the DEWHA EPBC Policy Statement for White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands (DEH 2006). Vegetation communities form the basis for EPBC classification, and are used here to provide an indication of the spatial distribution of EPBC listed communities within the study area. The following vegetation communities are all listed as 'Critically endangered' under the EPBC Act; A1a, G1b, A1e and G1e. Their spatial distribution is indicated in **Figure 9-14** for the inundation area and Stalling Lane Access, and **Figure 9-15**, and **Figure 9-16** for the northern and southern portions of the Urban Pipeline and Irrigation Pipeline respectively.

SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Construction Site Facilities

Conservation Status (EPBC)

- Critically Endangered
- Waterbody/Waterhole
- NA

N W E S

0 100 200 400 600 800

Metres

Scale - 1:20,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Emu Swamp Dam Site

Figure 9-14 National Habitat Conservation Significance in the Inundation Area (EPBC, 1999)

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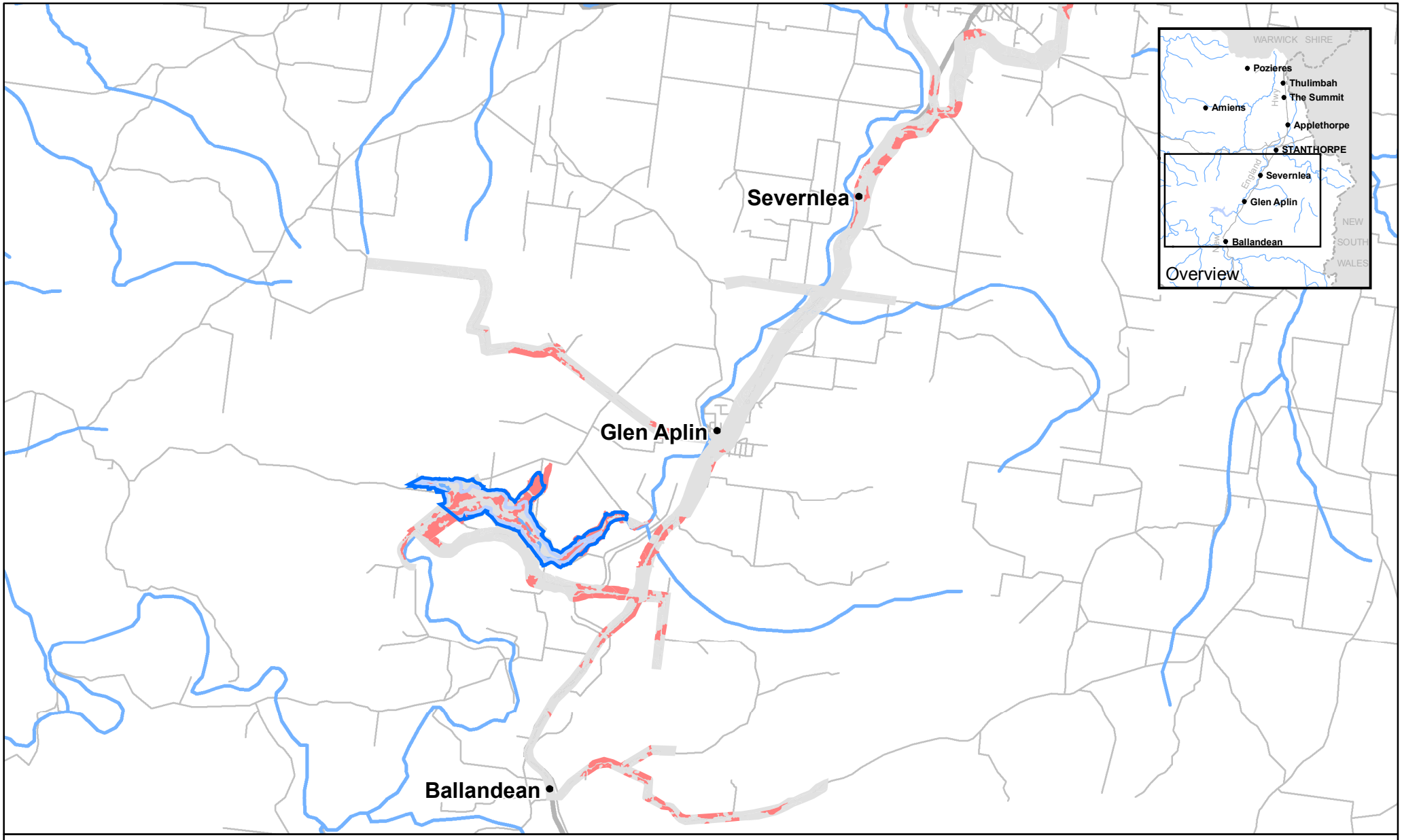

SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD

Conservation Status (EPBC)

- Critically Endangered
- Waterbody/Waterhole
- NA

N W E S

0 0.5 1 2 3 4

Kilometres

Scale - 1:100,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-15 Habitat Conservation Significance (EPBC, 1999) on Urban and Irrigation Pipeline (South)

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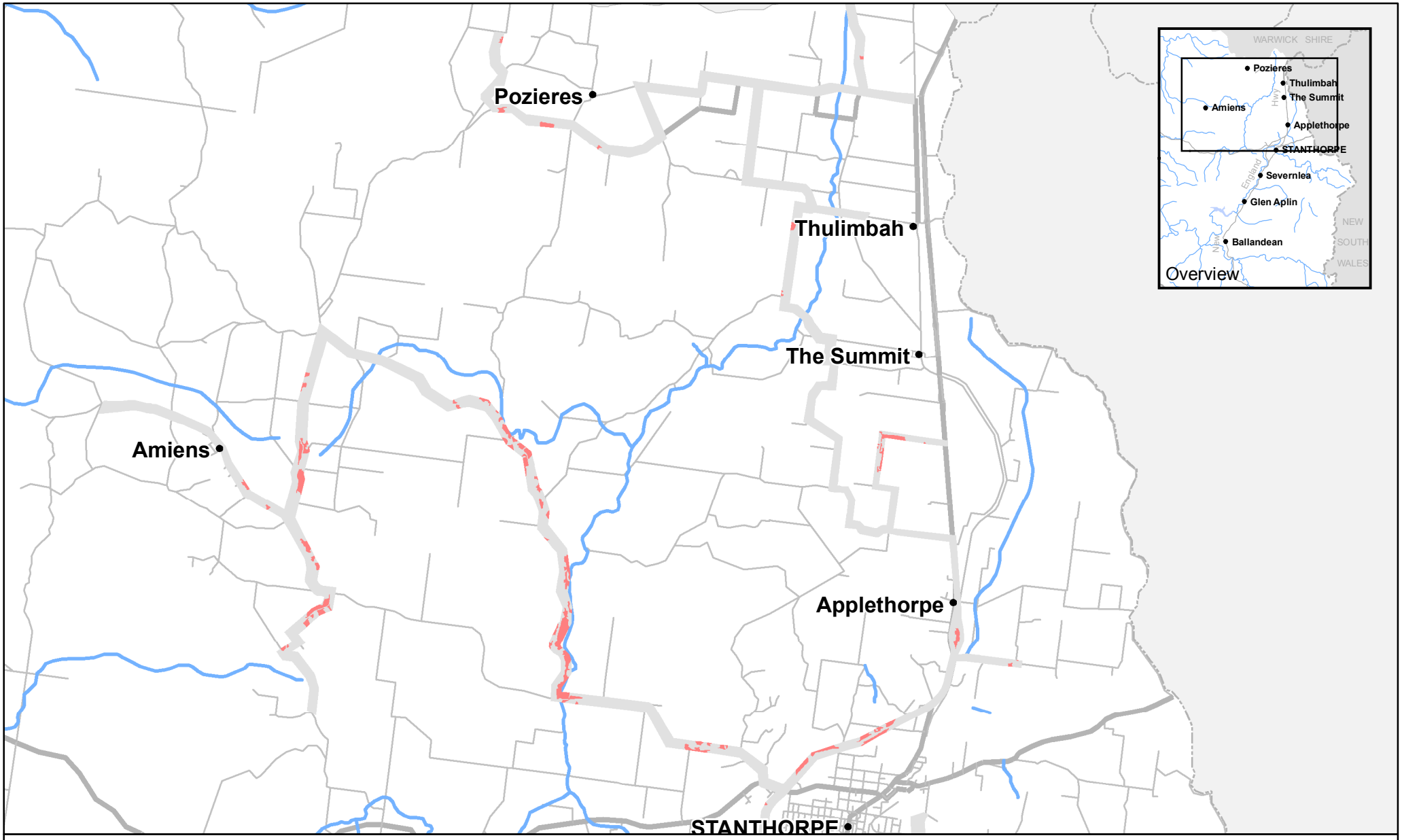

SHIRE OF STANTHORPE

Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Construction Site Facilities

Conservation Status (EPBC)

- Critically Endangered
- Waterbody/Waterhole
- NA

N W E S

0 0.5 1 2 3 4

Kilometres

Scale - 1:100,000(at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-16 Habitat Conservation Significance (EPBC, 1999) on Urban and Irrigation Pipeline (North)

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9.4 Terrestrial Fauna Existing Environment

9.4.1 Study Methodology

Biodiversity Assessment and Management (BAAM) were commissioned by SSC to provide an independent assessment of the terrestrial vertebrate fauna and associated habitat at the site for the proposed Emu Swamp Urban Water Project. The assessment examined the potential impact of the construction and operation of both Urban Water Supply Dam and Combined Urban and Irrigation Dam options and the construction of a town water supply pipeline and an irrigation pipeline. This section of the report summarises the findings of BAAM (2007). Further detail on the findings of the fauna survey is provided in the Supporting Technical Document – *Terrestrial Vertebrate Fauna Assessment Report – Emu Swamp Dam* (BAAM 2007).

The methodology adopted for the fauna investigations involved two distinct elements:

- a desktop review of background data and literature; and
- a summer field surveys in December 2006 and autumn/winter survey in May and July 2007.

A full description of survey methods and results is provided in the Supporting Technical Document (BAAM 2007).

9.4.2 Results

9.4.2.1 Desktop Review

Prior to the field survey, public databases were searched in order to provide background information regarding terrestrial vertebrate fauna species known from the region and local area. This included searches of the Commonwealth's EPBC Online Protected Matters Search Tool, the EPA's WildNet database, Birds Australia's bird database, and the Queensland Museum's fauna database for the Project area. The results from the database searches are presented in the Supporting Technical Document (BAAM 2007).

9.4.2.2 Field Survey

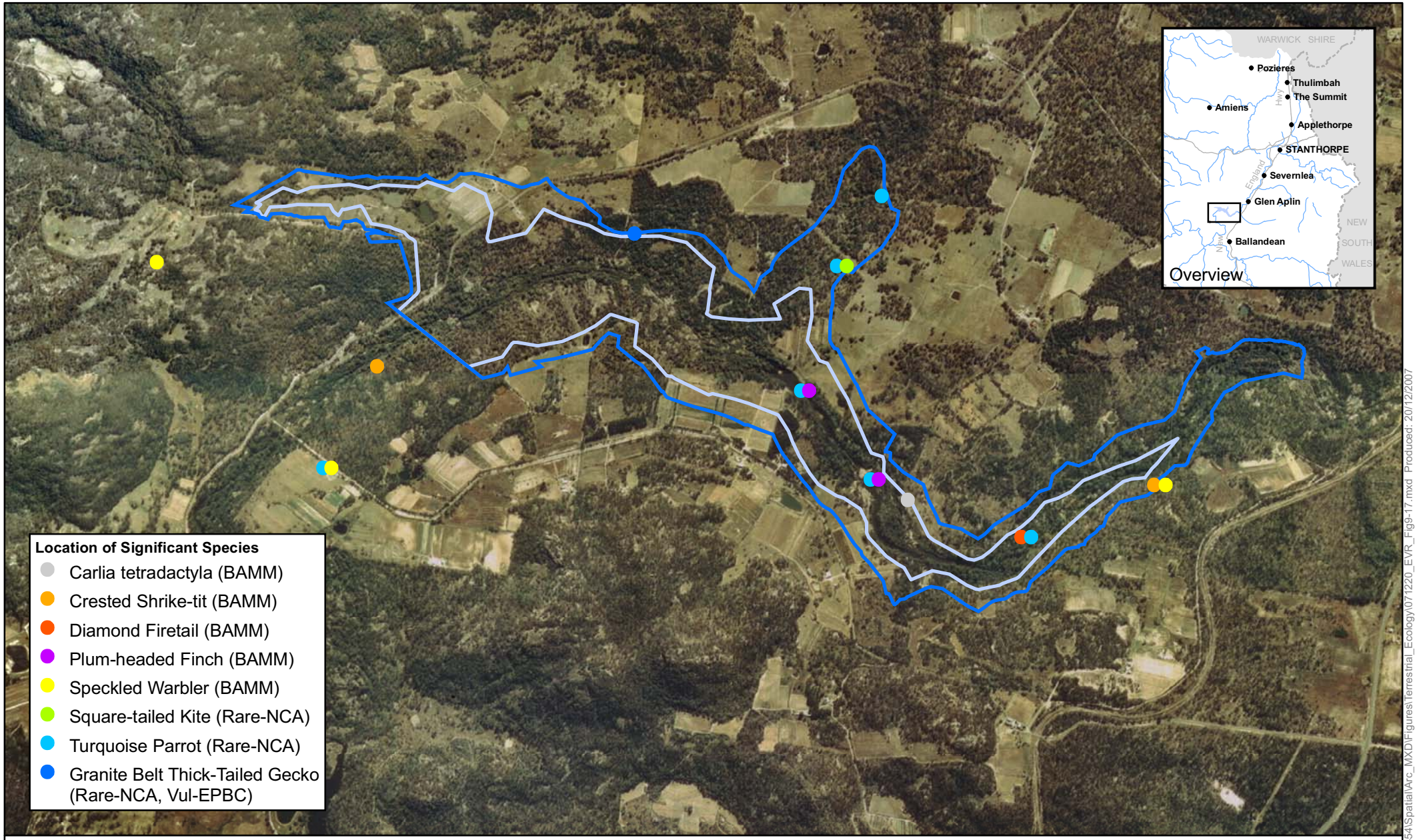
In total, 187 terrestrial vertebrate species were recorded in the Project area, including 35 species of mammals, 118 birds, 23 reptiles and 11 amphibians. The majority of the site's terrestrial vertebrate fauna is currently listed in Queensland's NC Act as 'Least Concern' wildlife (i.e. native animals that are not currently listed as 'Presumed Extinct, Endangered, Vulnerable or Rare', although still prescribed as protected wildlife). However, 14 species are recognised as being of special conservation significance under Commonwealth and/or State Government legislation.

Species of state or national conservation significance are discussed individually in the Supporting Technical Document (BAAM 2007). These discussions include individual management recommendations. Non-EVR priority species for the New England Tableland bioregion are discussed in the BAAM (2007) report. No management recommendations are provided for these species considered significant at the bioregion level.

9.4.2.3 Fauna of Special Conservation Significance

Fourteen species of special conservation significance were recorded in the Project area during the survey. The locations of recorded individuals within the inundation area and Stalling Lane Access are shown on **Figure 9-17.**

Twenty-three species of special conservation significance were not recorded on the Project area or nearby during the survey but are predicted to occur based on the results of the database searches (also see 'Comments' in **Table 9-14**.



SHIRE OF STANTHORPE

Legend

Full Supply Level 734.5m AHD

Full Supply Level 738m AHD

N W E S

0 100 200 400 600 800

Metres

Scale - 1:20,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Emu Swamp Dam Site

Figure 9-17

Location of EVR Fauna Records

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Table 9-14 Likelihood of occurrence - Fauna Species of Conservation Significance

Species	Common Name	Status	Source	Habitat	Likelihood of Occurrence
BIRDS					
Lophoictinia isura	Square-tailed Kite	R (NC Act)	FS	Occurs in a variety of habitat types including heathlands, woodlands, forests, rainforests, timbered watercourses, hills and gorges (Pizzey and Knight 1997). Most records are from woodlands and forests, particularly those on fertile soils with abundant small birds (Marchant and Higgins 1993).	Present. One individual (an immature) was observed in flight over a trapping site during the summer survey.
Neophema pulchella	Turquoise Parrot	R (NC Act)	FS	Occurs in eucalypt woodlands and open forests with grassy ground cover or a low shrub understorey. It is commonly found on forest edges, in clearings, remnant trees in farmland, orchards and golf courses (Higgins 1999; NPWS 2003)	Present. Singles and pairs were observed at a number of trap and target sites.
Accipiter novaehollandiae	Grey Goshawk	R (NC Act)	WildNet, BA	Occurs in temperate, sub-tropical and tropical rainforest, tall-open forests, woodlands, wooded gorges, dense timber along watercourses, and farmland, usually in the 760+ mm rainfall zone. Individuals can, however, sometimes be found in other habitats, probably young birds dispersing from natal territories (Olsen and Olsen 1985; Marchant and Higgins 1993).	Possible. There are a number of Birds Australia and WildNet records for this species in the study area, including records from Glen Aplin and Ballandean. It is likely to occur at low densities in suitable habitat throughout the study area. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V (NC Act)	WildNet	Occurs within a range of forests and woodlands, although, due to their dependence on she-oaks, they prefer habitats dominated by this tree type either in the canopy or middle stratum (Higgins 1999). In addition, the species is reliant on suitable large hollows in dead or senescent trees in which they can nest.	Unlikely. There are two WildNet records for this species in the general area. There are no details available for these records. WildNet records are not necessarily substantiated nor are the records vetted. There are no, or insufficient, food resources in the inundation area and surrounds for this species. It is not considered to be present. It is not expected to occur in the study area within the pipeline corridors or their immediate surrounds. Refer to the Supporting Technical Document (BAAM 2007).
Climacteris erythrops	Red-browed Treecreeper	R (NC Act)	BA	Occurs in tall eucalypt forests, mainly in hilly country and mountains where dry forests merge into wetter rainforest or wet sclerophyll gullies (Pizzey and Knight. 1997).	Unlikely. There are two Birds Australia records for the study area, both from Girraween National Park. The species is probably not present in the inundation area and immediate surrounds due to insufficient suitable habitat. It may occur within the area encompassing the water supply and irrigation pipelines. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.

Species	Common Name	Status	Source	Habitat	Likelihood of Occurrence
Cyclopsitta diophthalma coxeni	Coxen's Fig-Parrot	E (NC Act) E (EPBC Act)	WildNet	It lives in subtropical rainforest, dry rainforest, littoral rainforest, riparian corridors in woodland, open woodland, and agricultural and urban areas with fig trees (Garnett and Crowley 2000).	Unlikely. There are two WildNet records for this species in the general area. There are no details available for these records. WildNet records are not necessarily substantiated nor are the records vetted. There is no suitable habitat for this species in the study area. It is not considered to be present. Refer to the Supporting Technical Document (BAAM 2007).
Falco hypoleucos	Grey Falcon	R (NC Act)	BA	Found in semi-arid and arid woodlands, grasslands and wooded watercourses, typically in areas of less than 500 mm annual rainfall.	Unlikely. This species is a vagrant to the region. There are two recent Birds Australia records from west of Stanthorpe. It typically occurs in arid inland Australia. Individuals recorded in eastern Queensland are usually dispersing young birds. It is not considered to be present in the study area. Refer to the Supporting Technical Document (BAAM 2007).
Geophaps scripta scripta	Squatter Pigeon (southern)	V (NC Act) V (EPBC Act)	EPBC	Occurs in open dry sclerophyll woodland with grassy understorey, nearly always near permanent water. Birds may occasionally feed in sown grasslands and pastures.	Unlikely. There are no database records for the study site or its immediate surrounds. It is comparatively easy to observe when present and its occurrence is considered very doubtful. The species is likely to be locally extinct in the inundation area and immediate surrounds. It may still occur within the area encompassing the water supply and irrigation pipelines. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Lathamus discolor	Swift Parrot	E (NC Act) E (EPBC Act)	EPBC	Swift Parrots occur in woodlands, riparian vegetation and remnant patches of mature eucalypts in agricultural areas, though they prefer dry sclerophyll forest (Higgins 1999; NPWS 2003).	Possible. There are no database records for this species for the study area. The EPBC Online Protected Matters Search Tool states that this 'species or species habitat may occur within area'. It is considered likely that the species will occur at some future stage or has been overlooked previously. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Macronectes giganteus	Southern Giant-Petrel	E (NC Act) E (EPBC Act)	QM	A marine species.	Unlikely. This is a seabird. It occurs only as a vagrant. There is a single Queensland Museum record from northwest of Stanthorpe in 1970. There is no suitable habitat and the species is not expected to occur. Refer to the Supporting Technical Document (BAAM 2007).
Menura novaehollandiae	Superb Lyrebird	R (NC Act)	QM, WildNet, BA	Inhabit moist forest types, including rainforest and wet and dry sclerophyll forests. The species requires open forest floor with leaf litter and suitable moisture levels.	Unlikely. There are Birds Australia and EPA WildNet records for the study area, but the only known location is Girraween National Park. The species is probably not present in the inundation area and immediate surrounds due to insufficient suitable habitat. It may occur within the area encompassing the water supply and irrigation pipelines. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.

Species	Common Name	Status	Source	Habitat	Likelihood of Occurrence
Ninox strenua	Powerful Owl	V (NC Act)	WildNet	Occurs in mountain rainforests, gullies and forest margins, sparser hilly woodlands, coastal forests, woodlands, scrubs, exotic pine plantations and large trees in private/public gardens (Pizzey and Knight 1997). Powerful Owls are most likely observed at sites with mature dry forest, many live hollowbearing trees, diverse habitats within 2 km,and not much pure regrowth within 5 km (Loyn et al. 2001).	Unlikely. There is one WildNet record for the study area for which no details are available. WildNet records are not vetted and are often unsubstantiated. It is considered unlikely to roost or breed in the inundation area or immediate surrounds. It may occur within the area encompassing the water supply and irrigation pipelines. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Poephila cincta cincta	Black-throated Finch (southern)	V (NC Act) E (EPBC Act)	EPBC	Occur in dry open grassy woodlands and forests with seeding grasses and freestanding water. In south-eastern Queensland Black-throated Finches have been recorded from dry open forest on ridges, grassy hillsides and mountain flats (Higgins et al. 2006).	Unlikely. There are no database records for the study area. The EPBC Online Protected Matters Search Tool states that this 'species or species habitat likely to occur within area'. The species is now possibly extinct in New South Wales and there were only six Atlas of Australian Bird records in southern Queensland for the period 1977 to 1981 and none for the Atlas of Australian Birds 2 (1998 – present) (Higgins et al. 2006).This species is probably locally extinct and possibly regionally extinct. Refer to the Supporting Technical Document (BAAM 2007).
Rostratula australis	Australian Painted Snipe	V (NC Act)	EPBC	Occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. The species feeds on vegetation, seeds and invertebrates, including crustaceans and molluscs (Marchant and Higgins 1993).	Unlikely. There are no database records for this species in the study area. The EPBC Online Protected Matters Search Tool states that this 'species or species habitat may occur within area'. Currently the section of the Severn River within the inundation area provides very little habitat for this species. What potential habitat is present is due to the construction of weirs. The project is likely to create, rather than reduce, suitable habitat. There is no suitable habitat within the proposed pipeline corridor but the species could occur elsewhere in the study area. Refer to the Supporting Technical Document (BAAM 2007) life history and management details.
Xanthomyza phrygia	Regent Honeyeater	E (NC Act) E (EPBC Act)	WildNet, BA, EPBC	Although occasionally found in agricultural land with only partial tree cover or in city parks and gardens, the Regent Honeyeater occurs mainly in dry boxironbark eucalypt woodland and dry sclerophyll forest (Higgins et al. 2001).	Possible. There are two WildNet records for the study area, though no location details or dates are known. There is also one Birds Australia record from Sundown National Park. The species possibly occurs in the inundation area and immediate surrounds at times, though it is most likely to just move through the area due to a lack of favoured food trees. It is unlikely to regularly occur within the pipeline corridors but may occur regularly elsewhere in the study area. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.

Species	Common Name	Status	Source	Habitat	Likelihood of Occurrence
REPTILES					
Underwoodisaurus sphyrurus	Granite Belt Thick-tailed Gecko	V (EPBC Act) R (NC Act)	FS, EPBC	Occurs in rocky hills with dry open eucalypt forest or woodland, typically with boulders and exfoliating rock (NPWS 2003)	Present. One individual was recorded during a targeted search during the summer survey.
Acanthophis antarcticus	Common Death Adder	R (NC Act)	QM	Occurs in a wide variety of habitats from rainforest to shrublands and heathlands (Ehmann 1992; Wilson and Swan 2003)	Possible. There is a Queensland Museum specimen record from Stanthorpe and no EPA WildNet records for the region. The species is not considered to be present in the inundation area but may still occur within the area encompassing the water supply and irrigation pipelines. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Hoplocephalus stephensii	Stephen's Banded Snake	R (NC Act)	QM	Occurs in a variety of habitats including rainforest, wet sclerophyll forests and dry sclerophyll forests (Fitzgerald et al. 2002b).	Possible. There are two Queensland Museum records from Glen Aplin. Within the study area this species is most likely to shelter under exfoliating rock. There are no substantial areas of this habitat in the inundation area but the species may be present in small numbers. It is likely to occur within the area encompassing the water supply and irrigation pipelines. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
MAMMALS					
Chalinolobus dwyeri	Large-eared Pied Bat	V (EPBC Act) R (NC Act)	FS, EPBC	The Large-eared Pied Bat is rarely captured and consequently poorly known. Little is known of its roosting requirements, although it has been recorded roosting in disused mine tunnels, rock overhangs, caves and abundant Fairy Martin Hirundo ariel nests (Dwyer 1966; Eyre et al. 1997; Schulz 1998; Thompson 2002). The habitat requirements for the species are poorly understood. Most records from New South Wales are from dry and wet sclerophyll forest including Callitris forests, tall open eucalypt forests with a dry understorey, subalpine woodland, and sandstone outcrop country (Duncan et al. 1999). In south-eastern Queensland the species seems to be more associated with higher altitude moist forests and adjacent rainforest (Eyre et al. 1997).	Present. The Large-eared Pied Bat was recorded by Anabat at a trapping site during the summer survey. It was not listed for the area in either the EPA's WildNet or Queensland Museum's databases.

Species	Common Name	Status	Source	Habitat	Likelihood of Occurrence
Phascolarctos cinereus	Koala	SLC (NC Act) B (BAMM)	FS, WildNet	Koalas are found in areas with suitable food trees, from tall open forest to open woodland. The species also occurs in areas modified by humans such as residential developments and farmland and movement is not confined to vegetated corridors, as they also move across cleared rural land and through suburbs.	Present. A Koala was heard calling at a target site.
Tachyglossus aculeatus	Short-beaked Echidna	SLC (NC Act)	FS, WidNet	Occurs in almost all terrestrial habitats except for intensively managed farms. The species is active both by day and night and shelters in logs, crevices, burrows and leaf litter (Augee 2001; Menkhorst and Knight 2001).	Present. A road-killed individual was recorded on Cannon Creek Road along the proposed Irrigation Pipeline route.
Dasyurus maculatus maculatus	Spotted-Tail Quoll	V (NC Act) E (EPBC Act)	QM, EPBC	They shelter in rock caves and hollow logs or trees, with basking sites usually nearby (Menkhorst and Knight 2001).	Spotted by landholder. There is a Queensland Museum record from Ballandean and, despite the lack of WildNet records, the species almost certainly occurs in the inundation area and immediate surrounds, at least sporadically. It was reported as occurring by a landholder. Although the majority of the pipeline corridors is not suitable, this species may traverse the areas at times. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Nyctophilus timoriensis (southeastern mainland population)	Eastern (Greater) Long-eared Bat	LC (NC Act) V (EPBC Act)	EPBC	Occurs in dry forest and woodland, mallee, and other arid and semi-arid habitats. It roosts in tree hollows or under bark (NPWS 2003). It is a little known species that is rarely caught (Churchill 1998).	Possible. There are no database records for the study site or its immediate surrounds. The EPBC Online Protected Matters Search Tool states that the “species or species habitat may occur within area”. However, because this species is so little known it is difficult to assess the likelihood or otherwise of its possible occurrence in the study area. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Ornithorhynchus anatinus	Platypus	SLC (NC Act)	QM	Platypus are mainly solitary animals inhabiting freshwater streams, rivers, lakes and dams, and are tolerant of a wide range of conditions, but have a preference for steep, well vegetated banks for burrowing (Low 1995; Menkhorst and Knight 2004).	Possible. There is one Queensland Museum record from approximately 56 km northeast of Stanthorpe. There are no WildNet records. Much of the Severn River within the study area has a rocky substrate, which is unsuitable for the burrows required by this species. It is not expected to occur in the inundation area or within the water supply pipeline corridor. It may possibly occur within the irrigation pipeline corridor. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
Petrogale penicillata	Brush-tailed Rock-wallaby	V (NC Act) V (EPBC Act)	QM, EPBC	This species inhabits rock piles and cliff lines in vegetation ranging from rainforest to dry sclerophyll forests (Short and Milkovits 1990).	Possible. There is one Queensland Museum record from approximately 56 km northeast of Stanthorpe. There are no WildNet records. There is no suitable habitat within the inundation area or the pipeline corridors. The species may be present in the study area. Refer to the Supporting Technical Document (BAAM 2007) life history and management details.

Species	Common Name	Status	Source	Habitat	Likelihood of Occurrence
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	V (NC Act) V (EPBC Act)	EPBC	The Long-nosed Potoroo has been recorded in a variety of habitat types including disturbed subtropical and warm-temperature rainforests, tall open forests with a moist understorey, woodland with tussock grass, open forest with shrubby understorey, and heathlands.	Unlikely. There are no database records for the study area. The EPBC Online Protected Matters Search Tool states that the "species or species habitat may occur within area". It is not considered to be present due to a lack of suitable habitat. Refer to the Supporting Technical Document (BAAM 2007)
Pteropus poliocephalus	Grey-headed Flying-fox	V (EPBC Act)	EPBC	Commonly within dense vegetation close to water, primarily rainforest patches, stands of Melaleuca, mangroves or riparian vegetation.	Unlikely. There are no database records for the study area. The EPBC Online Protected Matters Search Tool states that the "species or species habitat may occur within area". It is not considered to be present. Refer to the Supporting Technical Document (BAAM 2007)
Vombatus ursinus	Common Wombat	R (NC Act)	QM	Occurs in forested, often mountainous areas in south-eastern Australia. In Queensland it only occurs in sclerophyll forest above 600 metres. The species requires temperate climate, soils suitable for burrowing and native grasses for food.	Possible. This species is seldom recorded in Queensland, even in nearby Girraween National Park. There was no evidence of the characteristic digging and tunnels and the species is considered to not be present in the inundation area or immediate surrounds. It may be present elsewhere in the study area. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details.
FROGS					
Adelotus brevis	Tusked Frog	V (NC Act)	QM	This species inhabits a variety of habitats including rainforest, wet sclerophyll, dry sclerophyll, woodland, vine forest and can even be found in low numbers in open grazing country (Eyre et al. 1997). They can be found in slow moving streams and dams, particularly around accumulated debris such as leaves and sticks. On land, they can be found under logs and in hollows/rock crevices beside streams and ponds (Meyer et al. 2001)	Possible. There are only two Queensland Museum records of this species in the study area, both from 1961. There are no EPA WildNet records. The species is not considered to be present in the inundation area but may still occur within the area encompassing the water supply and irrigation pipelines. Refer to the Supporting Technical Document (BAAM 2007) for life history and management details. Although a lack of records from the survey does not mean that this secretive species is not present in the study area, particularly as conditions at the time of the surveys were not conducive to heightened frog activity (either too dry and/or too cold), it is considered that the species is unlikely to occur in the inundation area. The distinctive call of this species usually indicates its presence.
Litoria subglandulosa	New England Tree Frog	V (NC Act)	QM	Associated with sub-alpine swamps and permanent streams and rivers in rainforest and wet and dry sclerophyll forest above 300 metres (Anstis 2002; NPWS 2003). It also occurs along streams in disturbed grazing land (Barker et al. 1995).	Unlikely. In the NET bioregion this species is known only from Girraween National Park. It is not expected to occur in the study area. Refer to the Supporting Technical Document (BAAM 2007) for life history details.
Key to Status: E – Endangered V – Vulnerable R – Rare SLC – Special Least Concern (Cultural Significance) B - non-EVR priority species in the New England Tableland Bioregion BAMM - Qld's Biodiversity and Mapping Methodology (BAMM) EPA 2002				Key to Source: EPBC – Environment Protection and Biodiversity Conservation Act Protected Matters database search records for the study area QM – records from the Queensland Museum database FS – recorded during the field surveys Wildnet – records from the EPA's Wildnet database BA – records from Birds Australia New Database	

9.4.2.4 Feral Terrestrial Vertebrate Fauna Species

The feral terrestrial vertebrate fauna species noted during the survey and from database searches are listed in **Table 9-15**. The locations of recorded feral species are shown in **Figure 9-18**. Locations of Pig (*Sus scrofa*) diggings identify only areas of substantial disturbance. Under the LP Act a Class 2 pest is one that is established in Queensland and has, or could have a substantial adverse economic, environmental, or social impact.

Provided that appropriate pest species management actions are employed no adverse ecological outcomes are expected from these species as a result of the proposed development.

- **Table 9-15 Feral terrestrial species recorded during survey or listed by database (DB) searches**

Zoological Name	Common Name	Recorded	DB	Pest Status*
BIRDS				
Acridotheres tristis	Common Myna		x	
Carduelis carduelis	European Goldfinch		x	
Columba livia	Rock Dove		x	
Passer domesticus	House Sparrow	x	x	
Streptopelia chinensis	Spotted Turtle-dove	x	x	
Sturnus vulgaris	Common Starling	x		
MAMMALS				
Canis lupus	Dog / Dingo#	x		Class 2/non-declared
Capra hircus	Goat		x	Class 2
Dama dama	Fallow Deer	x		Non-declared
Mus musculus	House Mouse	x		Non-declared
Oryctolagus cuniculus	Rabbit	x		Class 2
Rattus rattus	Black Rat		x	Non-declared
Sus scrofa	Pig	x		Class 2
Vulpes vulpes	Red Fox	x	x	Class 2

* Under the Queensland *Land Protection (Pest and Stock Route Management) Act 2002*.
# Recorded by scats and tracks; Class 2 pest if Dingo or Dog, non-declared animal if domestic dog.

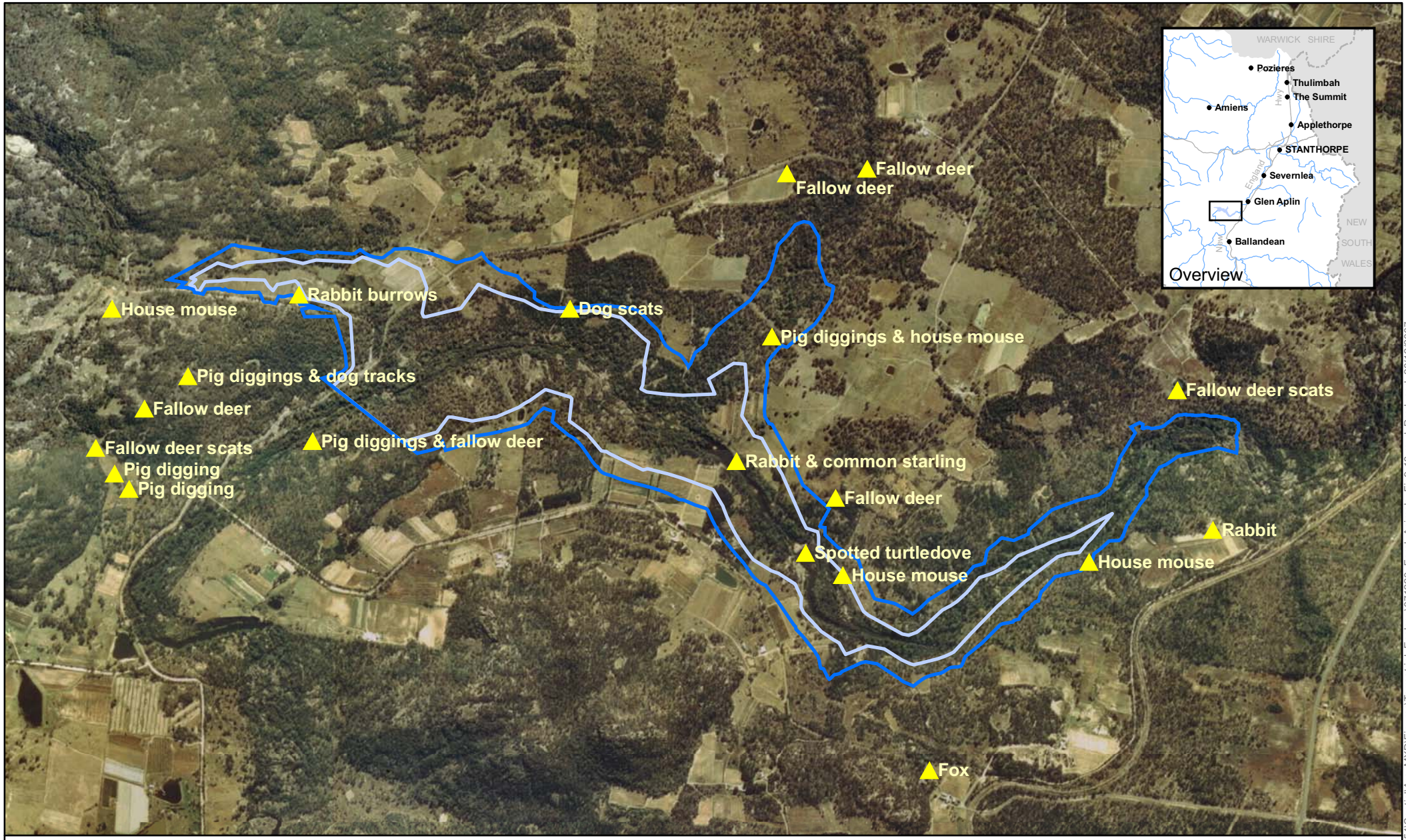
9.4.2.5 Movement Opportunities for Terrestrial Vertebrate Fauna

Regional Corridors

Figure 9-19 shows the EPA corridor mapping for the Project area and surrounds, indicating the location of the proposed dam within a regional wildlife corridor. This habitat is categorised as being of very high quality in terms of fauna movement (EPA 2007). It is contiguous with a major corridor to the west which links remnant vegetation to the south and (discontinuously) with areas in the north of the bioregion. The impoundment would not cause any significant disruption to this major corridor.

Local Corridors

The Severn River forms part of a typically narrow riparian corridor connected both to the major corridor to the west and to an area of remnant habitat in the southeast corner of the bioregion. This corridor also continues to the north-east but does not connect with any other mapped areas of remnant vegetation (**Figure 9-19**). The impoundment would cause some disruption to the Severn River corridor in terms of movement to the northeast, though linkage would not be broken entirely due to other remnant vegetation.



Legend

- Full Supply Level 734.5m AHD
- Full Supply Level 738m AHD
- Presence/Signs of Feral Species

N W E S

0 100 200 400 600 800

Metres

Scale - 1:20,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Emu Swamp Dam Site

Figure 9-18

Location of Feral Animals Recorded

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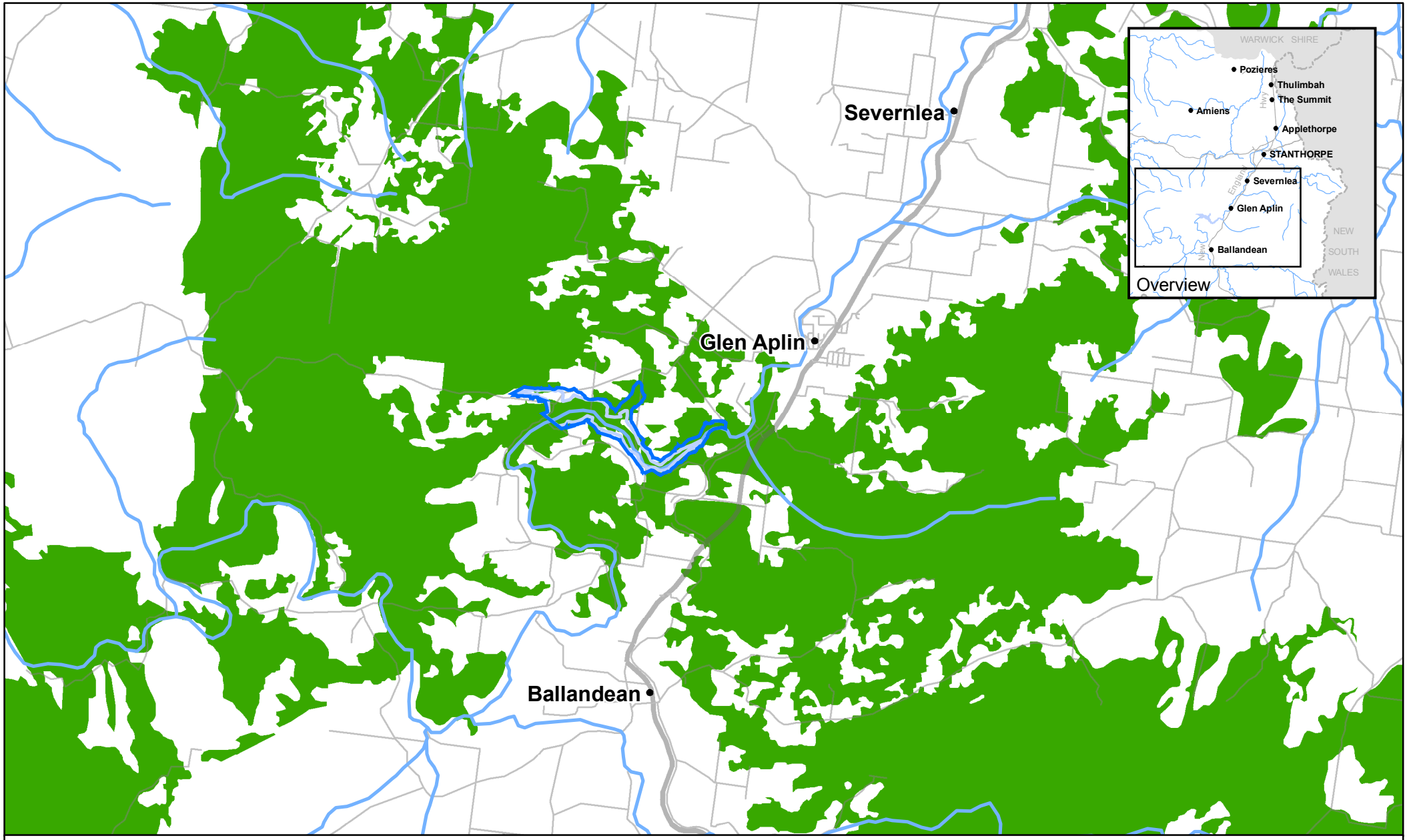

SHIRE OF STANTHORPE

Legend

- Full Supply Level 738m AHD
- Full Supply Level 734.5m AHD
- Creeks

J RATING

- HIGH
- VERY HIGH

N W E S

0 0.5 1 2 3 4

Kilometers

Scale - 1:100,000 (at A4)

Projection: Map Grid of Australia Zone 56

EMU SWAMP DAM EIS

Project Area

Figure 9-19
EPA Corridor Mapping

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The riparian vegetation to the northeast is mapped as being of very high or medium quality for fauna movement (EPA 2007). The mapping is likely to be based on remote sensing. The Severn River is generally highly disturbed and modified north of the inundation area, with no native riparian vegetation in some areas. Given that this riparian corridor is not actually connected to any substantial areas of remnant vegetation and will remain linked by non-riparian remnant vegetation any likely disruption to fauna movement as a result of inundation is considered to be minor.

9.5 Potential Impacts and Proposed Mitigation

9.5.1 Nature and Extent of Impacts

The impacts of the Project will occur in the short-term and over the long-term. The short-term construction impacts include:

- the loss of remnant and non-remnant vegetation communities and fauna habitat as a result of vegetation clearing for construction of the dam wall and associated infrastructure, and preparation of the inundation area;
- fragmentation and reduction of riparian vegetation along parts of the Severn River and associated tributaries affecting the movement of wildlife across and along the river;
- disturbance to fauna from construction activities, dust, noise and vibration;
- traffic related wildlife mortality on haul routes; and
- spread of weeds into cleared and disturbed areas.

The long-term operational impacts include:

- the flooding of remnant and non-remnant vegetation communities and habitat within areas to be inundated up to the Full Supply Level (FSL);
- infrequent and temporary inundation of remnant vegetation and habitat during flood events;
- gradual changes in flora composition immediately above the FSL;
- change in the flow and flooding regime downstream of the dam resulting in changes in the distribution of riparian vegetation along the banks of the Severn River;
- potential for increased proliferation of exotic species, including weeds and pests;
- traffic related wildlife mortality on Stalling Lane Access; and
- increased visitation to the dam by fauna species that prefer dam and lagoon conditions.

The assessment of impacts on terrestrial flora and fauna is based on the key features of the Project, which comprise:

- dam construction site works, including site offices, plants, storage/stockpile areas, haul routes, and excavation areas;
- construction of the Stalling Lane Access;
- the dam wall footprint;
- permanent inundation of the area up to the FSL;
- temporary inundation of the area up to the flood levels; and
- construction of Urban and Irrigation Pipeline.

9.5.2 Impacts on Flora and Proposed Mitigation

Impacts to terrestrial flora will occur during activities associated with the proposed Emu Swamp Dam Project, including construction, inundation and operation of the Dam area and construction of associated infrastructure. These impacts may be direct, or residual. Direct impacts are usually immediate and may be associated with physical disturbance such as road clearing, whilst residual impacts may take many years to manifest in the affected environments. Sufficient and relevant information is required to determine the extent of such impacts on terrestrial flora and biodiversity values. Probable and potential impacts associated with dam construction and associated infrastructure are discussed briefly below.

9.5.2.1 Direct Impact

Loss of Vegetation of National, State, Bioregional and Catchment Significance

This includes the loss of 'Endangered' and 'Of concern' REs (as per the VM Act), and locally significant vegetation communities. Habitat loss will occur as a direct result of inundation/impoundment, or through road re-alignment required to correct a route displacement, and pipeline construction. For the inundation area, opportunities for direct mitigation are minimal, and remediation and offset areas must be considered. The total area of REs of state significance (VM Act) to be impacted by the Urban Water Supply Dam (Inundation Area 1) and the Combined Urban and Irrigation Dam (Inundation Area 2) are presented in **Table 9-16** and **Table 9-17** respectively. The area of impact includes the dam inundation area, Stalling Lane Access (based on a road corridor buffered 10 m either side of the proposed road centreline) and pipeline corridors for the Urban Pipeline and Irrigation Pipeline (based on a 5 m maximum disturbance width). Impacts to vegetation communities of national significance (EPBC Act) on individual project components, including total impacts, are given in **Table 9-18** and **Table 9-19**.

- **Table 9-16 Total impacts of project to regional ecosystems of state significance (VM) for the Urban Water Supply Project**

RE	Inundation Area 2 (ha)	Urban Pipeline (ha)	Stalling Lane Access (ha)	Total Area of Impact (ha)
Endangered REs				
13.3.1	17.4	0	0.5	**17.9**
13.3.1x1	16.8	0	0	**16.8**
13.12.8	23.1	1.2	0	**23.3**
13.12.9	0	0	0	**0**
Of Concern REs				
13.12.6	3.1	0	0.12	**3.2**

- **Table 9-17 Total impacts of project to regional ecosystems of state significance (VM) for the Combined Urban and Irrigation Project**

RE	Inundation Area 1 (ha)	Urban and Irrigation Pipeline (ha)	Stalling Lane Access (ha)	Total Area of Impact (ha)
Endangered REs				
13.3.1	25.9	0	0.5	**26.4**
13.3.1x1	20.6	0	0	**20.6**
13.12.8	52.9	1.2	0	**54.1**
13.12.9	0	0.4	0	**0.4**
Of Concern REs				
13.12.6	6.2	0	0.12	**6.32**

- **Table 9-18 Total impacts of project to vegetation communities of national significance (EPBC) for the Urban Water Supply Project**

RE	Inundation Area 2 (ha)	Urban Pipeline (ha)	Stalling Lane Access (ha)	Total Area of Impact (ha)
Critically Endangered Vegetation Community				
A1a	16.9	0	0.15	**17.1**
A1e	0.5	0	0.38	**0.9**
G1b	23.1	0	0	**23.1**
G1e	0	0	0	**0**
Total Area Impacted				**41.1**

- **Table 9-19 Total impacts of project to vegetation communities of national significance (EPBC) for the Combined Urban and Irrigation Project**

RE	Inundation Area 1 (ha)	Urban and Irrigation Pipeline (ha)	Stalling Lane Access (ha)	Total Area of Impact (ha)
Critically Endangered Vegetation Community				
A1a	22.8	0	0.15	**23.0**
A1e	3.1	0	0.38	**3.5**
G1b	52.9	1.08	0	**54.0**
G1e	0	0.05	0	**0.1**
Total Area Impacted				**80.6**

Loss of Essential Habitat for Terrestrial Flora Species

Essential habitat for state significant taxa are indicated in the EPA RE mapping which provides spatial information on known areas of habitat. Habitat suitability maps for state significant taxa and nationally significant taxa collected during the field survey within the inundation area are provided in the Supporting Technical Document (3D Environmental 2007). Predictive habitat analysis for state significant taxa and nationally significant taxa within the inundation area are also presented in the Supporting Technical Document. These figures identify the potential habitat for EVR species that were not recorded in the baseline survey yet have a high potential to occur based on analysis of available literature. It should be stressed that habitat suitability maps are generated for the inundation area only. The inundation area is the only portion of the Project where avoidance is not a feasible mitigation strategy.

A summary of potential impacts on individual EVR flora species in the Project area including the inundation area and all proposed infrastructure is provided in **Table 9-20**. Only those species considered to occur within the study area are included in this table. The full list is provided in the Supporting Technical Document (3D Environmental 2007). It should be noted that several populations of *Melaleuca williamsii* in highly degraded vegetation on roadsides have not been considered in this analysis and non-remnant vegetation may host a range of significant species with an unpredictable distribution.

Dam Inundation Area

Direct impacts of inundation/impoundment associated with the proposed Emu Swamp Dam will include the loss of essential habitat, and impacts on populations of:

- one national (EPBC Act) species - *Melaleuca williamsii* (syn. *Callistemon pungens*);
- five state (NC Act) species - *Acacia latisepala, Thelionema grande, Rulingia hermaniifolia, Melaleuca flavovirens* and *M. williamsii*;
- forty-seven regionally and locally significant flora species.

The greatest impacts are on the essential habitats of *Melaleuca williamsii, M. flavovirens* and *M.* sp. (Severn River). In the Project area, these species are restricted to the riparian zone of the Severn River in REs 13.3.1 and 13.12.6. Inundation is likely to impact on the viability of these taxa. The population of *Melaleuca williamsii* within the inundation area represents one of the largest known stands on the Stanthorpe Plateau in comparison to those reported by Donatiu (2006).

Populations of *Acacia pubiflora, Boronia granitica, Homoranthus montanus, Kunzea bracteolata* and *Bertya glandulosa* are known from the Stalling Lane Public Reserve 171 Lot 39/BNT 1522. These records are outside the inundation area however loss of suitable habitat may occur. They were not located during the baseline survey in the inundation area. Based on habitat requirements identified in the available literature, they are considered to have the potential to occur in REs 13.12.2 and 13.12.5, with results from this survey indicate likely occurrence in suitable areas of RE 13.12.6.

A population of *Diuris parvipetala* is known to occur to the north of the inundation area. Based on its preferred habitat of RE 13.3.1, 13.12.5 and 13.12.9 (Donatiu 2006), this terrestrial orchid has the potential to occur within the area of proposed impact. No populations were detected during the baseline survey. The taxa is difficult to detect in the field outside of the September-December flowering time period.

Stalling Lane Access

Water Reserve 171 - Stalling Lane is reported to support populations of threatened flora species including *Boronia granitica* and *Homoranthus montanus,* although verified collections of these species have only been made on rocky hillslopes to the north of Stalling Lane. The proposed Stalling Lane Access will pass to the immediate west of this lot and impact a range of habitats similar to those occurring in the Stalling Lane Reserve.

Two EVR species were recorded on the Stalling Lane Access being *Acacia pubifolia* (Vulnerable) and *Melaleuca williamsii* (Vulnerable). Fifteen individuals of *Acacia pubifolia* within a 1,000 m^2 search area were recorded in RE 13.12.6, mostly adjacent to the proposed alignment. Impact to essential habitat and populations of this species associated with proposed Stalling Lane Access are expected. Two shrubs of *Melaleuca williamsii* were recorded in RE 13.3.1 (A1ax), approximately 20-30 m west of the proposed alignment. The degree of impact to essential habitat and populations of this species is dependant on sensitive road design and effective pre and post construction mitigation and management measures.

A significant population of *Acacia pubifolia* was recorded on the corridor for the proposed Stalling Lane Access in RE 13.12.6. Due to the intensity of the site survey and lack of any confirmed records, impacts on *Boronia granitica, Homoranthus montanus, Kunzea bracteolata* and *Bertya glandulosa* are likely to be minimal. Impacts to known populations of *Acacia pubifolia* on the Stalling Lane Access will be dependant on the final road design, and the effectiveness of mitigation measures to prevent habitat loss and degradation.

Urban Pipeline

Herbarium records of *Acacia pubiflora* and *Homoranthus montanus* situated along Fletcher Road were not located during the baseline survey despite targeted searches. The roadside habitat was heavily disturbed and subject to fire several months before the survey. These, and other roadside records including *Melaleuca williamsii* (three individuals on the southern margin of Fletcher Road 0.5 km from the junction of the New England Highway, and one record from the rocky creek-line south of Mt Marlay) and *Acacia latisepala* (two records from New England Highway 4 km south of Stanthorpe) represent constraints to the proposed pipeline alignment. Further constraints are posed by a single record of *Mirbelia confertiflora* (Rare) in remnant roadside vegetation and HERBRECS records of the *Eucalyptus mckieana* (Vulnerable EPBC Act). The latter species is restricted in Queensland to the Fletcher Road area and known from roadside tall woodland with *Eucalyptus bridgesiana* (RE 13.12.2) about 400 m west of Rumbalara Railway crossing on Fletcher Lane . The HERBRECS database refers to the species being 'locally common' however it was not identified during the survey on account of lack of fertile material.

Opportunities to avoid these species must be considered. It should be noted, that three of the *Melalueca williamsii* records were from highly disturbed non-remnant vegetation and long-term viability of the species in these communities is questionable.

Irrigation Pipeline

Four confirmed populations of *Acacia latisepala* were recorded for the Irrigation Pipeline network. The identity of an additional four records awaits clarification from the Queensland Herbarium. Approximately 123 individuals were recorded within the four confirmed populations with three populations occurring in disturbed non-remnant vegetation in the road reserve.

Grevillea scortechinii subsp. *scortechinii* (defined Vulnerable in both EPBC Act and NC Act) is endemic to the Stanthorpe Plateau and confined to several small populations between Stanthorpe and Dalveen where it is known from the Cottonvale and Applethorpe districts mainly in cleared road and railway verges (Donatiu 2006, Galbraith & Sparshott 2003). It is represented in Queensland by 11 herbarium collections, the majority of which are from the Pozieres Rd location (EPA HERBRECS Extract 2006). It is not known to be conserved in any protected areas (Galbraith & Sparshott 2003). The majority of the known populations are in areas of heavily disturbed roadside subject to a range of threatening processes such as edge effects, weed intrusions, inappropriate management, and too frequent fire (Donatiu 2006). Subsequently high importance value is assigned to populations which inhabit relatively intact forest (Donatiu 2006) although non-remnant vegetation may retain significant importance.

A large population was recorded on Pozieres Road in the north of the Project area. The population consists of approximately 50 individuals (over a linear distance of approximately 100 m) of low almost prostate 0.25-0.5 m shrubs. Plants are situated on the northern side of the road in a narrow verge of disturbed regrowth located between the road drain and a Pinus plantation. One plant was observed on the southern side of the road on the immediate road margin in *Imperata cylindrica* with regenerating shrubs of *Daveisia* sp. adjoining an apple orchard windbreak. The population is highly vulnerable to any form of roadside disturbance.

Melaleuca williamsii (syn. *Callistemon pungens*) was recorded in three locations along the Irrigation Pipeline. Two populations are in disturbed non-remnant vegetation and one in remnant RE 13.3.1 woodland of *E. blakelyi*.

The endangered *Boronia repanda* is known from a number of HERBRECS records on Pfunders Road and Poziers Road within proposed pipeline corridor in disturbed roadside vegetation with the vulnerable *Grevillea scortechinii* subsp. s*corthechinii*. *B. repanda* is endemic to the Stanthorpe Plateau restricted to scattered populations around Cottonvale, Thulimbah, Amiens and Passchendaele and a recently located record to the east of Stanthorpe on the border with New South Wales (Donatiu 2006). It occurs in REs (13.12.2 and 13.12.6) and is not known to be conserved in national parks (Donatiu 2006). Donatiu (2006) notes the population on Pozieres Road on Shire roadside & private freehold consisting of 50 -100 individuals. Major impact to essential habitat and populations of this species is possible and dependant of additional survey, sensitive design and pre and post construction mitigation and management measures.

A summary of threatened species occurrences, habitat suitability, and impacts in relation to the inundation area, Urban Pipeline corridor, Stalling Lane Access and Irrigation Pipeline is provided in **Table 9-20** below. Only those species considered to occur within the Project area are included in this table.

Table 9-20 Summary of Occurrence, Habitat Suitability and Impact Assessment of EVR and EPBC threatened flora

Species Name	Status		Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
	NC Act	EPBC						
Acacia latisepala (no common name)	R	Not listed	Known from Girraween NP in Eucalyptus, Callitris woodlands on granite boulder slopes & pavements RE 13.12.2. Conserved in Girraween and Bald Rock NP (Hunter et al 1998) and from Torirngton area in NSW (Hunter et al 1998). HEREBRECS records from Amiens & Bapaume districts.	Suitable habitat in 13.12.2; Not previously recorded; Survey records in RE 13.3.1 and 13.12.6; Essential habitat-known (H) Occurs in low densities generally on granitic hill slopes.	Suitable habitat in 13.12.2; Not previously recorded; No survey records; Essential habitat-possible (H). Occurs in low densities generally on granitic hill slopes.	Suitable habitat in 13.12.2; Known from 2 records in roadside vegetation on New England Highway within TWS corridor; No survey records; Essential habitat-possible (M).	Suitable habitat in 13.12.2; Previously recorded; Survey records (4 confirmed populations with four additional records requiring confirmation); Essential habitat known (H).	Low. Minor impact to habitat and populations is expected through loss of individuals from clearing of pipeline easement, machinery movement, and stockpiling of soil. Dependant on sensitive design and pre and post construction mitigation and management measures. Known to regenerate after fire and will colonise disturbed situations.
Acacia pubifolia (no common name)	V	V	Potential habitat in 13.12.2 & 13.12.5. Known from Ballandean, Wybera, Wallangarra and Fletcher districts. Known from remnant vegetation near Stalling Lane and non-remnant roadside vegetation along Fletcher Road.	Suitable habitat; Previously recorded immediately to west of dam impact area; No survey record; General habitat possible (M).	Suitable habitat; Not previously recorded; Recorded on survey with 13 individuals within a 1 000 m^2 search area in RE 13.12.6; Essential habitat known (H).	Suitable habitat; Previously recorded by 1 HERBRECS record from Fletcher Road within pipeline corridor; No survey record; General habitat known (M).	Sup-optimal habitat; Not previously recorded with closest record approx. 2 km west of end of Sector 13; No survey records; Absence suspected (H).	High. Impact to essential habitat and populations of this species associated with proposed Stalling Lane Access expected. Species Management Plan and pre-construction survey recommended.
Babingtonia granitica (no common name)	E	V	Known from heath 13.12.6 where it occurs in shallow peaty soils formed in the crevices of granite outcrops dominated by heath (Bean 1997 in Donatui 2006). Three known populations at Ballandean, Doctors Ck near Lyra, & Girraween NP	Suitable habitat; Not previously recorded; No survey record; Essential habitat-possible (L).	Suitable habitat; Known from a HERBRECS record to the north of Stalling Lane (13.12.5/13.12.6) No survey record;	Sup-optimal habitat; Not previously recorded; No survey records; Absence	Sup-optimal habitat; Not previously recorded; No survey records; Absence	None expected

Species Name	Status NC Act	Status EPBC	Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
			(Donatui 2006).		Essential habitat-possible (L).	suspected (H).	suspected (H).	
Bertya glandulosa (no common name)	R	Not listed	Known from Wybera, Wallangarra and Stalling Lane. Suitable habitat in open woodland to woodland of Eucalyptus spp. and Callitris sp.; shrubland on rocky hillsides with exposed rock pavements RE 13.3.2, 13.12.6.	Suitable habitat; Not previously recorded; No survey record; Essential habitat-possible (L).	Suitable habitat; Known to occur immediately to the north of the proposedStalling Lane Access (13.12.6); No survey record; Essential habitat-possible (L).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	None expected
Boronia granitica (Granite Boronia)	E	E	Known from Girraween NP, Amiens area (Harslett Rd, Mt Hutton Rd & Sonego Rds), near The Summit and Paschendale districts in regional ecosystems 13.12.2-13.12.6 in shrubby woodland, open forest and heath (Donatui 2006). In NSW from Torrington, Severn River Nature Reserve, the Barbs near Pindari Dam, Kings Plains National Park and Howell (Hunter et al 1998).	Suitable habitat; Not previously recorded; No survey record; Absence suspected (H).	Suitable habitat; Previously recorded immediately to the north of the proposedStalling Lane Access; No survey record; Essential Habitat-Possible (H).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	None expected
Boronia repanda (Repand Boronia)	E	E	Endemic to Stanthorpe Plateau with known national distribution restricted to scattered populations around Cottonvale, Thulimbah, Amiens and Passchendaele and a recently located record to the east of Stanthorpe on the border w ith New South Wales (Donatui 2006). Occurs in regional ecosystems	Suitable habitat; Not previously recorded; No survey record; Absence suspected (H).	Suitable habitat; Not previously recorded; No survey record; Absence suspected (H).	Suitable habitat; Not previously recorded; No survey record; Absence suspected (H).	Suitable habitat; Previously recorded from a number of HERBRECS records on Pfunders Road (Sector 1) and Poziers Road (Sector 2) within proposed pipeline	High. Major direct and residual impact to essential habitat and populations of this species is possible as a result of Irrigation Pipeline. Impact assessment dependant on additional survey to inform sensitive design and pre and post construction mitigation and

Species Name	Status NC Act	Status EPBC	Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
			13.12.2-13.12.6 in shrubby woodland, open forest and heath (Donatui 2006) & in non-remnant.				corridor in disturbed roadside vegetation with the vulnerable *Grevillea scortechinii* subsp. *scorthechinii*; No survey records; Essential habitat possible (H).	management measures.
Diuris parvipetala (no common name)	R	Not listed	Known from grassland areas near granite outcrops and has been observed in association with *Stylidium graminifolium, Chrysocephalum apiculatum* and *Themeda triandra* (Donatui 2006). Endemic to eastern Australia, with a know n national distribut ion of seven disjunct populations extending from southern Queensland to an outlier northwest of Glen Innes in New South Wales (Copeland 2004 in Donatui 2006). In Qld potential habitat in RE 13.3.1, 13.12.2, 13.12.9, and 13.12.5.	Suitable habitat RE 13.3.1, 13.12.2, 13.12.5, 13.12.9; Previously recorded to the north of dam impact area; No survey records; Essential habitat possible (M).	Sub-optimal habitat; Not previously recorded; No survey records; Essential habitat possible (M);	Sub-optimal habitat; Not previously recorded; No survey records; Essential habitat possible (M);	Suitable habitat; 2 HERBRECS records located in vicinity of New England Highway in Sector 8; No survey records however seasonal survey in flowering period (Sept-Nov) not carried; Essential habitat possible.	Medium. Surveys in flowering season should be considered.
Eucalyptus mckieana (McKie's Stringybark)	Not listed	V	Main distribution is in NSW where it is geographically restricted to the drier western side of the New England Tablelands of NSW, from Torrington to Bendemeer (DECC 2007) and between Inverell and Guyra in the	Suitable habitat; Not previously recorded in inundation area however known to be restricted to Fletcher area;	Suitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Suitable habitat; Previously recorded in in Fletcher Road area in RE 13.12.2 400m W of Rhumbalara Railway crossing	Suitable habitat; Not previously recorded; No survey records; General habitat known (M).	Low. Potential impacts associated with Urban Pipeline corridor in proximity of Rumbalara Railway crossing on Fletcher Lane. Further surveys recommended for town supply water supply

Species Name	Status NC Act	Status EPBC	Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
			Retreat, Tenterden, Gilgai areas and recorded in Kings Plain National Park (Hunter *et al* 1998). Qld populations represents northern limit of geographical distribution where it restricted to a few collections in the Fletcher area in RE 13.12.2.	No survey records; General habitat known (M).		of Fletcher Lane. Qld population poorly known and restricted to Fletcher area; No survey records; General habitat known (H).		line clearance.
Grevillea scortechinii subsp. *scortechinii* (NSW subsp. referred to as 'Backwater Grevillea')	V	V	In Qld endemic to Stanthorpe Plateau, known from several populations between Stanthorpe and Dalveen in non-remnant roadsides with potential habitat in REs 13.3.1, 13.12.1, 13.12.2, 13.12.6, 13.12.8, 13.12.9. (Donatiu 2006).	Suitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Suitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Suitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Suitable habitat; Known populations on margins of Pozieres Road and Pfunders Rd; Survey records Pozieres Rd; Essential habitat known (H).	High. Major direct and residual impact to essential habitat and populations of this species is possible in Sector 2 and dependant of sensitive design and pre and post construction mitigation and management measures.
Goodenia macbarronii (Narrow Goodenia)	Not listed	V	Known from the western slopes of the Great Dividing Range in NSW, south from the Guyra and Inverell districts and also in north-eastern Victoria and the Darling Downs in Queensland (DECC 2007). Recorded from Stalling Lane on rock pavements of 13.12.6 (Donatiu 2006).	Suitable habitat; Known from vicinity of dam impact area (Fletcher area on pavement seepage slopes) with potential to occur on R2 rock pavements (RE 13.12.6) and those associated with R1 (13.3.1) along the Severn River. No survey records; Essential habitat possible (M).	Suitable habitat; Known from R2 rock pavements (RE 13.12.6) ; No survey records; Essential habitat possible (M).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (M).	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (M).	Moderate. Potential for impacts associated with dam.
Homoranthu	V	V	Known from Stanthorpe	Suitable habitat;	Suitable habitat;	Sub-optimal	Sub-optimal	None expected

Species Name	Status NC Act	Status EPBC	Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
s montanus (Mountain Mouse Bush)			Plateau from Mt Jibbinbar (Sundown) and Stalling Lane (Fletcher) in REs 13.11.1, 13.12.5, 13.12.6 (Donatiu 2006).	Previously recorded to north of inundation area; No survey records; Essential habitat possible (RE 13.12.5, 13.12.6) (L).	Previously recorded to north of Stalling Lane; No survey records; Essential habitat possible (RE 13.12.5, 13.12.6) (L).	habitat; Previously recorded on Fletcher Rd roadside; No survey records (area recovering from burn at time of survey); Absence suspected (H).	habitat; Not previously recorded; No survey records; Absence suspected (H).	
Kunzea bracteolata (no common name)	R	Not listed	Known from Giraween NP with record from Stalling Lane in shrubland on granite slopes and pavements RE 13.12.6. Extends southwards into NSW to Guy Fawkes River (Hunter et al. 1998)	Potentially suitable habitat; Previously recorded to west of inundation area; No survey records; Essential habitat possible (13.12.6), (M).	Potentially suitable habitat; Previously recorded to north of Stalling Lane; No survey records; Absence suspected (M).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	None expected
Melaleuca flavovirens (syn. *Callistemon flavovirens*) (no common name)	R	Not listed	Known from Girraween NP, Wallangara, Stalling Lane (Fletcher). Habitat in RE 13.3.1x and 13.12.6. In NSW from Gibraltar Range SF, Boonoo Boonoo NP, Guy Fawkes NP and Mann River Nature Reserve (Hunter et al. 1998).	Known habitat; Previously recorded in close proximity to inundation area (downstream from proposed dam wall); Survey recorded numerous populations known within riparian situations of Severn River in 13.3.1, 13.3.1x; Essential habitat	Unsuitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Unsuitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Unsuitable habitat; Not previously recorded; No survey records; Absence suspected (H).	High. Direct impacts expected in inundation area and residual impacts possible downstream.

Species Name	Status NC Act	Status EPBC	Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
				known (H).				
Melaleuca williamsii (syn. *Callistemon pungens*) (no common name)	V	V	Known from Qld in Girraween NP, Severn River Fletcher, in Stanthorpe area and extending to NSW from Oxley Wild Rivers NP near Armidale, Howell, Mount Balala, Guyra, Mann River Nature Reserve and New England National Park. (Hunter et al. 1998). Donatiu (2006) refers to habitat in RE 13.3.4-13.3.5 in riparian areas along rocky watercourses or sandy creek beds.	Known habitat; Previously recorded in close proximity to inundation area (downstream from proposed dam wall). Donatiu (2006) reports estimations of over 150 individual plants west of Ballandean; Survey recorded numerous populations known within riparian situations of Severn River in 13.3.1x and in 13.3.1, with scattered occurrences in 13.12.6 on margins of 13.3.1x. Surveys suggest populations of >1000; Essential habitat known (H).	Suitable habitat; Previously recorded in close proximity; Survey recorded single population of 4 individuals in RE 13.3.1 (A1ax) on drainage line; Essential habitat known (H).	Sup-optimal habitat; Not previously recorded; Survey records in non-remnant; Essential habitat known (H).	Sup-optimal habitat; Not previously recorded; 3 populations recorded on survey; Essential habitat known (H) in 13.3.1 and non-remnant.	High. Significant impact to essential habitat and populations of this species is expected as a result of inundation. Stalling Lane Access population located approximately 20-30 m west of the proposed alignment. Impacts to 3 populations on Irrigation Pipeline is possible however dependant on sensitive design and pre and post construction mitigation and management measures.
Mirbelia confertiflora (no common name)	R	Not listed	Occurs on low heaths of granite pavements RE 13.12.6. HERBRECS data indicates its occurrence from 2 locations in Stanthorpe area at Giraween NP and Jollys Falls near the Summit. Not common in NSW in dry sclerophyll forest and heath on granite, and confined to Gibraltar Ra. N.P. and Boonoo	Suitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	Suitable habitat; Not previously recorded; Single survey records; Essential habitat known (H) (13.12.8)	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	Low. Opportunities to avoid single individual by sensitive siting of pipeline supply line.

Species Name	Status NC Act	Status EPBC	Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
			Boonoo N.P. (Harden 2002) although Hunter et al. (1998) record it from Eagle Creek, Warra SF and adjacent private properties and Parlour Mountains.					
Phebalium glandulosum subsp. *glandulosum* (no common name)	V	V	Known from 3 disjunct populations extending from Stanthorpe south Glen Innes (Donatui 2006). Population of 20 individuals known from Paschendale area (Donatiu 2006). In NSW known from heath amongst granite outcrops in the Torrington district (Harden 2002).	Suitable habitat; Previously recorded to north/west of inundation area in elevated granitic hills; No survey records; Essential habitat possible (L).	Suitable habitat; Previously recorded to north of Stalling Lane in elevated granitic hills; No survey records; Essential habitat possible (M).	Unsuitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Unsuitable habitat; Not previously recorded; No survey records; Absence suspected (H).	None expected
Pterostylis longicurva (A Greenhood)	R	Not listed	2 HERBRECS records from private property in Glen Aplin area and otherwise from Girraween NP among granite rocks in light open forest (Stanley and Ross 1989). Potential habitat in RE 13.3.1, 13.12.9. Harden (2002) refers to habitat on shady slopes in sclerophyll forests of inland ranges with a distribution north from Coonabarabran district.	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Low. 2 HERBRECS records from private property in Glen Aplin area indicate rarity of this species in study area. Not recorded for survey however a difficult species to detect away from flowering time which, from HERBRECS specimen data, appears to be March-May.
Pterostylis woollsii (Long-Tailed Greenhood)	R	Not listed	Potential habitat in RE 13.3.1, 13.12.9. Known as a widespread but disjunct terrestrial orchid from NSW north coast, central tablelands, north west slopes and central western slopes south to Victoria among rocks on ridges and slopes and among	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Low. 2 HERBRECS records from private property in Glen Aplin area indicate rarity of this species in Project area. Known to be a widespread but disjunct taxa (Harden 2002). Not recorded for survey however a difficult

Species Name	Status NC Act	Status EPBC	Occurrence & Distribution	Inundation Area	Stalling Lane Access	Urban Pipeline	Irrigation Pipeline	Potential for Impacts
			grass in sclerophyll forest (Harden 2002).					species to detect away from flowering time
Rulingia hermanniifolia (no common name)	R	Not listed	Known from Stanthorpe area in Girraween, Fletcher, Lyra, Wybera districts in eucalyptus woodlands, open forests RE 13.12.2 and heathlands on pavements 13.12.6. disjunct population in NSW from sandstone substrates where it is confined to coastal areas from Broken Bay to Botany Bay, also south to Jervis Bay, and along the Shoalhaven R (Harden 2002).	Suitable habitat; Not previously recorded; Survey recorded 1 population of 5-10 individuals on exposed rock pavement; Essential habitat known (H) 13.3.1x, and possible for 13.12.6.	Suitable habitat; Not previously recorded; No survey records; Essential habitat possible (L).	Sub optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	Sub optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	High. Direct impacts associated with inundation area likely.
Thelionema grande (no common name)	R	Not listed	Girraween, Amiens, Wybera and Thulimbah areas in RE 13.12.6 associated with rock pavements. Also known from Mt Barney/Mt Maroon and in NSW from northern tablelands and north west slopes north from Boonoo Boonoo, Bald Rock, Gibraltar Range and Werrikimbe National Parks, Boonoo State Forest, Torrington, Bolivia Hill and Howell on sandy soils around granite outcrops, at altitudes above 800 m (Harden 2002, Hunter et al. 1998).	Suitable habitat; Survey recorded with 4 populations of 50-100 individuals on exposed rock pavements associated with 13.3.1x and 13.12.6 Essential habitat known (H) 13.3.1x, 13.12.6.	Sub-optimal habitat; Not previously recorded; No survey records; Absence suspected (H).	Unsuitable habitat; Not previously recorded; No survey records; Absence suspected (H).	Unsuitable habitat; Not previously recorded; No survey records; Absence suspected (H).	High. Direct impacts associated with inundation area likely.

9.5.2.2 Residual Impacts

The residual impacts of the Project can be summarised as follows:

- potential impacts on vegetation downstream from the impoundment;
- changes in soil moisture regime/stream hydrology;
- creation of a niche for weed infestation; and
- habitat degradation due to proliferation of exotic vertebrates.

The potential downstream impacts on vegetation resulting from a reduction in flow conditions immediately downstream of the proposed dam are presented in **Table 9-21**.

- **Table 9-21 Summary of Potential Downstream Impacts**

Affect on Hydrological Regime	Affect on Fluvial/ Hydrological Process	Potential Impact on Riparian Vegetation	Potential Impact on Sensitive Species/ Communities
Reduction in overall downstream flow volume	Overall reduction in groundwater levels near channel; Changes to sedimentary deposition including a decrease in bedload size; Reduction in the frequency of disturbance to river bed; Gradual narrowing of river channels through influx of fine sediment.	Species diversity may decrease through a simplification/homogenisation of bedform and microhabitat.	Loss of habitat for EVR species including *Acacia latisepala*, *Melaleuca williamsii*, *Melaleuca flavovirens*, *Rulingia hermaniifolia*, *Thelionema grande*; Loss of habitat for significant species *Mirbelia confertiflora*, and *Melaleuca* sp. (Severn River); Potential dieback of deep rooted species including *Eucalyptus* spp. associated with the immediate riparian zone
Impediment to downstream sediment transport	Armouring of flood channel immediately downstream from impoundment through channel scour; Reduction in bedload size and erosion of coarse fluvial deposits.	Erosion/undercutting of stream banks and alluvial deposits immediately downstream from impoundment wall and resultant loss of associated riparian vegetation.	Loss of habitat for EVR species including *Acacia latisepala*, *Melaleuca williamsii*, *Melaleuca flavovirens*, *Rulingia hermaniifolia*, *Thelionema grande*; Loss of habitat for regionally significant species notably *Melaleuca* sp. (Severn River); Loss of habitat trees through erosion of stream banks; Creation of unvegetated niches with potential for exotic weed invasion.
Decrease in seasonal flow variability	Simplification of fluvial processes and reduction possible reduction in bedform complexity.	Species diversity may decrease through simplification/ homogenisation of bedform & microhabitat; Increasing seasonal predictability of flow may favour invasion of exotic species of natives; Potential for creation of a niche for exotic species invasion.	Loss of habitat for EVR species including *Acacia latisepala*, *Melaleuca williamsii*, *Melaleuca flavovirens*, *Rulingia hermaniifolia*, *Thelionema grande*; Loss of habitat for regionally significant species notably *Melaleuca* sp. (Severn River); Loss of native species diversity.

There is already significant development of the Severn River with a reported 26 barriers from the confluence of Quart Pot Creek and the Broadwater to Nundubbermere Falls in Sundown National Park. The proposed Emu Swamp Dam represents a large physical barrier.

The flow statistics in **Section 7** of the EIS for both the Urban Water Supply Dam and the Combined Urban and Irrigation Dam highlight the following characteristics of the flow regime of the Severn River:

- the Urban Water Supply Dam will have no impact on flow regime upstream of the proposed dam;
- impacts from the dam are localised to between the proposed dam and the confluence of Accommodation Creek;
- the dam has minimal impact on the flow regime downstream of Accommodation Creek; and
- the dam has negligible impact on the flow regime for Sundown National Park.

The impacts on the flow regime and terrestrial flora will be greatest immediately downstream of the proposed dam. The potential for impacts on vegetation communities will reduce with distance downstream and are unlikely to extend beyond Mungall's Weir. It is unlikely there will be any impacts on vegetation communities and species downstream of Accommodation Creek, including Sundown National Park.

9.5.2.3 Cumulative Impacts

Assessment of the cumulative impacts associated with clearing and construction activities are taken into account in the assessment of EVR species under Commonwealth, State and Local Government legislation.

9.5.2.4 Impact Mitigation

The following recommendations are made for the mitigation of direct impacts to significant vegetation communities and species incurred during dam inundation, road, and pipeline construction. The management of residual impacts is dealt with in the subsequent section.

Management of Direct Impacts

Dam Inundation Area

There is limited scope for the avoidance of impacts to terrestrial flora within the proposed inundation area. Mitigation measures proposed relate the establishment of compensatory habitat through a number of inter-related mechanisms being:

- a suitable vegetation management offset strategy developed to meet the regulatory requirements of Queensland's *Policy for Vegetation Management Offsets* DNRW (2007)*;*
- creation of adequate and suitable compensatory habitat for EVR species affected by inundation;
- conservation of habitat for EVR species though establishment of binding conservation agreements; and
- a specific Species Management Plan for individual EVR flora species affected by inundation will be prepared.

The SSC will enter into a deed of agreement with the DNRW to provide vegetation offset strategy within 12 months of lodging the vegetation clearing application. DNRW allow 12 months to develop an offset agreement for those Projects that are considered critical public infrastructure.

The offset strategy will form the basis of the compensatory habitat strategy for the Project and will seek to comply with the performance criteria set out in the DNRW *Policy for Vegetation Management Offsets 2007*. The compensatory habitat strategy is likely to involve a combination of the following options:

- securing advanced regrowth (near remnant) vegetation within and outside the Shire which is representative of the RE s and essential habitat to be cleared for the Project. The properties will be either be purchased by SSC

or secured via registered covenant. In both cases the properties would be actively managed until such time as they reach remnant status;

- securing RE s of equivalent conservation status to those to be cleared for the Project within and outside Stanthorpe Shire and managing these areas until such time as they meet remnant status;
- strategic purchase of key land parcels which have been identified as key linkages or habitats for EVR taxa at the local, sub-regional or regional scale; and
- revegetation and rehabilitation of existing cleared areas of land within the Project area, with a view to reinstating pre-clearing vegetation types.

Stalling Lane Access

Avoidance of any areas of significant vegetation or known populations of EVR species is fundamental to the mitigation strategy, although a range of measures can be considered as detailed in the section below.

- detailed design of the road alignment considering identified significant terrestrial flora values is required;
- following finalisation of the preferred alignment, significant terrestrial flora values that can not be avoided will be surveyed accurately on the ground. Where individual species can be avoided and retained, then suitable buffers will be erected around each species or population to avoid incidental damage by factors such as machinery movement, soil dumping, windrowed vegetation, and by potential sediment/erosion events. These following measures are to be addressed in individual species management plans;
- in cases where direct impact to significant species is unavoidable these species must be tagged for possible translocation and under the guidance of a translocation plan; and
- individual habitat trees will be retained and protected from damage through the use of tree girdles and/or temporary barriers.

Urban Pipeline and Irrigation Pipeline

Avoidance of areas of significant vegetation or known populations of EVR species is fundamental to the mitigation strategy. Mitigation measures include:

- the finalisation of the alignment will consider the location of significant terrestrial flora values and avoidance of these areas through route adjustment will be pursued;
- prior to road construction, detailed on ground survey to accurately locate boundaries of significant vegetation communities and tagging of individual EVR species will be undertaken; and
- individual habitat trees will be retained and protected, where possible, from damage through the use of tree girdles and or temporary barriers.

Management of Residual Impacts

Dam Inundation Area

A number of potential residual impacts associated with dam construction are identified in **Section 9.5.2.2.** Of these, the management of weeds is most readily addressed. Several specific measures will be considered as a means to mitigate for, and measure the residual impacts of dam construction. These include:

- establishing a buffer area to maintain ecological connectivity around the proposed dam inundation area. The buffer area will be at least 200 m in width and will reconnect patches of remnant vegetation. 3D Environmental (refer to **Appendix F**) have assessed and developed management plans for the revegetation of cleared areas within the buffer;
- development of a specific Weed Management Plan (WMP) for areas within the buffer area surrounding the dam. This will focus on control of major invasive weed species identified in **Table 9-12** and will incorporate planning for long-term control of weeds in habitats essential to a range of EVR species, as well as within the

broader mosaic of vegetation communities in the dam vicinity. The WMP will be completed in accordance with the *Land Protection (Pest and Stock Route) Management Act 2002*;

- monitoring of downstream of the proposed dam and at suitable reference sites (yet to be identified) to detect any residual impacts that changes in hydrological regime may have on significant species. Particularly relevant are the impacts that any changes to hydrological regime may have on populations of *Melaleuca williamsii, M. flavovirens,* and the regionally significant *M.* sp. (Severn River) downstream from the dam wall. If monitoring downstream shows that the Project is having an impact, SSC will investigate the feasibility of the following proposed mitigation measures:
  - changing the flow regime of the environmental flows; or
  - installation of dissipaters downstream of the dam to minimise the effects of erosion.
- Vegetation Management Offsets (VMO) planning will consider the establishment (or restoration) of habitat connectivity in fragmented vegetation on the impoundment margins. This will not only facilitate wildlife movement, but act as a buffer to exotic species invasion.

Stalling Lane Access

Indirect impacts may relate to degradation of habitat through exotic species invasion, sedimentation and erosion. This may impact the long-term viability of EVR species populations and habitat integrity. Procedures identified to minimise residual impacts are summarised below.

- Exotic Species Invasion - An WMP must be developed which includes details of procedures to prevent the spread of weeds into adjacent habitats with high integrity, potentially threatening the long term viability of populations of EVR species. This might include procedures to minimize ground disturbance in vegetation communities adjacent to areas of direct impact. A WMP which ranks priority weed species provides strategies for control, and identifies management action must be prepared prior to construction.
- Sedimentation and Erosion Control - In severe cases, sedimentation has the potential to smother native flora species, particularly sensitive ground covers, and prevent regeneration of native species. This may facilitate invasion of exotic species into previously undisturbed vegetation communities resulting in a long-term cycle of habitat degradation. In a catastrophic form, slope failure resulting of landform disturbance has potential to fragment habitats and corridors, as well as severely impact flora habitat values. Preventative measures which must be considered in an SMP include:
  - the installation of filter/sediment fences, filter drains, filter strips, grass outlet sediment traps and sediment basin traps around all culverts, drains, soil stockpiles and all other areas which may have the potential to erode or be effected by sedimentation;
  - erosion control devices such as catch drains, slope drains, diversion drains and energy dissipaters in conjunction with sediment traps installed to divert stormwater around the construction site;
  - stabilising by sterile grassing or another approved method materials stockpiled for long periods;
  - stabilising of disturbed areas such as drains and batters;
  - minimising as far as practicable the area of land which is bare of vegetation at any one time;
  - planning the stages of various works to minimise erosion; and
  - shallow diversion channels to prevent, as far as practicable, large amounts of stormwater from entering the construction site.

Urban Pipeline and Irrigation Pipeline

Issues relating to indirect impacts on the Urban and Irrigation Pipeline are similar to those on the Stalling Lane Access site although due to the considerable length of the route and degraded nature of the landscape, will be much more difficult to manage and identify. The major concern is the spread of exotic species into vegetation communities with high structural integrity. This may occur on the distal areas of Mt Stirling Road (Irrigation Pipeline), and on the slopes of Mt Marlay (Urban Pipeline) where the proposed pipeline easements are unformed, passing though intact remnant vegetation. Specific WMP's for these areas will be prepared. The pre-construction

eradication of exotic species on roadside margins may help control the spread of these species into intact vegetation communities.

Residual impacts to EVR species caused by roadside disturbance are difficult to predict as survey records indicate that degraded non-remnant vegetation can host a range of significant species. These are often scattered throughout the landscape in a random distribution. Whilst attention can be directed to the management of direct impacts in degraded landscapes, the requirements for management of residual impacts in these areas are much more difficult to gauge, and the outcomes less predictable.

9.5.3 Impacts on Fauna and Proposed Mitigation

9.5.3.1 Introduction

This section sets out the impact mechanisms predicted to affect terrestrial fauna in the study area, with reference to those species of special conservation significance.

- impacts common to all proposed components of the project will be discussed initially;
- impacts specific to particular components of the project will be discussed in the section relating to that component;
- planned and recommended mitigation measures are set out in **Section 9.5.3.9**; and
- residual impacts are discussed in **Section 9.5.3.10**.

During the construction phase, clearing is required for the following infrastructure:

- inundation area of Emu Swamp Dam;
- RCC wall construction;
- construction of Stalling Lane Access;
- Urban Pipeline; and
- Irrigation Pipeline.

9.5.3.2 Common Impacts

Clearing of native vegetation results in a reduction of the overall amount of habitat and populations of flora and fauna, isolation of habitats and populations, changes to remaining vegetation that cause the loss of food and shelter resources for fauna, and exposure to introduced species that are either competitors or predators (Bennett et al 2000).

Removal of vegetation will result in direct loss of plant species, and mortality of certain fauna present at the time of clearing. There will also be indirect impacts such as the loss of large, live and dead, trees suitable for nesting.

Secondary impacts are associated with:

- soil exposure, and subsequent erosion and sedimentation, which may expose tree roots, smother vegetation, and potentially alter downstream aquatic habitats;
- increases in desiccation, light penetration, wind-throw, herbivory, weed invasion, nest predation, and parasitism for adjacent flora and fauna (Murcia 1995);
- reptiles and small mammals, becoming trapped in any trenches or other excavations that remain open for any period of time. This may lead to mortality either by exposure, starvation, thirst or predation by other species;
- an increase in traffic, particularly heavy vehicles during the construction phase could contribute to increased animal/vehicle collisions on local roads.
- construction vehicles have the potential to introduce and/or spread weed species in disturbed soil; and
- fuels and chemical spills from storage areas, and oils from heavy machinery can enter the environment, affecting habitats where the spill occurs, and potential causing more widespread impact if contaminants reach waterways.

9.5.3.3 Cumulative Impacts

Assessment of the cumulative impacts associated with clearing and construction activities are taken into account in the assessment of EVR species under Commonwealth, State and Local Government legislation.

9.5.3.4 Inundation Area

Construction Activities

Construction of the dam wall and associated infrastructure components require the following activities:

- establishment of a plant, equipment and workforce work areas;
- drilling, blasting and excavation of rock and other material;
- disposal of rock and other material from excavations; and
- on-site power supply.

Dam Operation

The operation of the dam will have both short and long-term, and positive and negative, impacts on terrestrial vertebrate fauna.

Impacts associated with inundation are:

- creation of a large waterbody deep enough to provide a range of habitats and food resources for a variety of waterbirds, including some species listed as Migratory (EPBC Act);
- changing water levels that will affect soil moisture levels;
- changing water levels that will affect shoreline vegetation composition and survival, including potential colonisation by terrestrial weed species;
- fluctuations in downstream flow that may alter riparian vegetation and stream-dependent vertebrate fauna;
- alterations to downstream water quantity and quality and changes in the time and extent of flood events;
- creation of edge effects along the borders of the inundation area; and
- creation of a water barrier to the dispersal of terrestrial non-volant (non-flying) fauna through the local landscape.

9.5.3.5 Stalling Lane Access

Subsequent to clearing, the construction of the Stalling Lane Access will require:

- use of heavy machinery and vehicles;
- soil excavation;
- rock blasting;
- quarrying and transportation of materials;
- installation of drains and culverts;
- compaction of the roadway and roadside areas; and
- production and laying of bitumen.

The road width is expected to be about 8 m with a construction impact width generally of 15 m but expanding up to 30 m in areas that require substantial earthmoving.

The proposed realignment traverses a small area of intact eucalypt and *Callitris* dominated woodland with substantial areas of rock, a creekline with some intact riparian vegetation and substantial areas of highly modified land.

The small woodland area does provide some habitat suitable for the conservation significant Granite Belt Thick-tailed Gecko and Stephen's Banded Snake. The majority of the section requiring clearing however, i.e. from the western end of Stalling Lane to link with Emu Swamp Road, is highly disturbed. Much of this area has been converted to pasture and is dominated by regrowth or weed species. The realignment route doesn't increase the amount of intact habitat that is disturbed compared to the current road alignment.

Once constructed, the Stalling Lane Access is not anticipated to attract more traffic than currently occurs along the existing alignment. However, in several locations small areas of habitat will persist between the road and the dam edges. This may cause fauna to come into contact with the road more often than occurs currently, thereby increasing opportunities for vehicle strike.

The proposed road will pass by an area of large boulders within woodland on the western side. This area was targeted for Spotted-tailed Quolls with cage traps during the autumn field survey and, despite no evidence of their presence, it does appear suitable habitat for the species. If the species is present the road may increase the likelihood of death by vehicle strike.

Habitat adjacent to the road will be altered both physically and chemically. Changes to the physical environment affect soil density and water content, temperature, light penetration, dust, surface waters, runoff patterns and sedimentation. Chemical changes include the addition of heavy metals, salts, ozone and nutrients to roadside habitats. These conditions are often favourable for the growth of weed species that may thrive and spread into adjacent habitat from roadside locations.

Roads also function as movement corridors for exotic species, which act as competitors or predators for native species (Trombulak and Frissell 2000). However the proposed realignment is unlikely to increase access for exotic species locally.

9.5.3.6 Urban Pipeline Route

An urban delivery pipeline approximately 23 km in length is proposed to be built from the Emu Swamp Dam site to Mt Marlay Water Treatment Plant at Stanthorpe. The pipeline is to be located within a roadside corridor along Fletcher Road and the New England Highway.

The internal diameter of the water supply pipe will vary from 293 to 486 mm. The trench required to bury the pipe should be less than 1 m wide, however the area disturbed by machinery is anticipated to be 4-5 metres. Where substantial areas of rock occur the pipeline may be above ground. Vegetation will be allowed to regenerate along the edges of the trench once the pipe is installed.

The water supply pipeline corridor is generally highly disturbed, though there are patches of habitat suitable for a variety of fauna species.

Fletcher Road typically has a cleared road reserve and for much of its length the pipeline can be installed on either side with little impact on terrestrial fauna other than the general impacts listed hereunder. There are, however, a number of locations along Fletcher Road that do require consideration. These are discussed at length in the Supporting Technical Document (BAAM 2007).

In addition to possible mortality due to trenching work or increased road traffic potential impacts to fauna and associated habitats during the construction phase for the Urban Pipeline include:

- temporary displacement of fauna from within the construction corridor;
- freshly exposed soils and stockpiling may attract foraging species such as birds, rodents and reptiles. These species may be exposed to an increased risk of physical harm because of heavy vehicle movements;
- there is potential for refuge and breeding ground destruction as rocks and fallen timbers are relocated for ground dwelling animals, and shelters such as underground hollows and burrows are excavated displacing fauna such as snakes and lizards;

- there may be temporary or permanent loss of food source and protection resources associated with clearing of vegetation. Clearing may limit food foraging habitat, especially for nectarivores, and decrease linkages between intact habitats;
- improper management of weed species post construction during regeneration may provide a resource to fauna species not previously occurring within the corridor. It is important to note that some heavy woody weed infestations may provide important structural habitat for small bird and mammal species; and
- wastes at the work site during construction such as food scraps, may encourage undesirable pest fauna species to the area by providing a food source.

Generally, impacts on significant fauna and habitat values could occur through potential habitat loss and weed infestation as well as temporary disruption to local movements. Expected longer term impacts are listed for those conservation significant species known from the study area in **Table 9-23.**

9.5.3.7 Irrigation Pipeline Route

The proposed irrigation pipeline route is within approximately 124 km of road reserve in Stanthorpe Shire. The majority of this road reserve contains either a bitumen or dirt road but some sections; Teale Road/Church Road and Stabiles Road are undeveloped for vehicle access.

The Irrigation Pipeline will vary in internal diameter from 34 mm along Horans Gorge Road to 325 mm along the New England Highway north from Whiskey Gully Road. At this stage it is understood that the pipeline will be buried wherever possible and that vegetation will be allowed to regenerate above the buried pipe. The expected disturbance for <200 mm pipe is 3 metres. The expected disturbance for >200 mm pipe is 4-5 metres.

Much of the area has been cleared for cultivation and grazing and the road reserve is often vegetated only by grasses, both native and exotic. Where some native vegetation has been retained, or occurs as regrowth, it is often set back sufficiently far from the road surface that installation of the pipeline should not require any disturbance.

In addition to possible mortality due to trenching work or increased road traffic (as discussed above) potential impacts to fauna and associated habitats during the construction phase for the Irrigation Pipeline are the same as for the Urban Pipeline though the area of disturbance is often of less width and there are less impacts expected.

9.5.3.8 Impact Assessment

Impact Assessment Methodology

Table 9-22, **Table 9-23** and **Table 9-24**, set out each significant terrestrial vertebrate species present, or considered likely to be present, in the inundation area and surrounds (including the Stalling Lane Access) and the Urban and Irrigation Pipeline corridors, summarise the impact mechanisms and their potential effects on each species, provide appropriate mitigation measures (referencing sections which provide more detailed information for mitigation measures), and show the assessed residual impact. Impacts and mitigation measures are not discussed from the operational phase of the Urban and Irrigation Pipelines as once the pipelines are in place there are no substantive impacts anticipated.

Impacts may be negative, neutral or positive. All impacts listed in the tables should be considered as negative, unless otherwise stated.

The suggested mitigation measures are the basis for discussion and may change following that interaction. Those species that are considered very unlikely to occur within the Project area are excluded from the following tables (**Table 9-22**, **Table 9-23** and **Table 9-24**). The complete tables are provided in the Supporting Technical Document (BAAM 2007).

Table 9-22 Emu Swamp Dam and Stalling Lane Access Construction Impact Assessment

Species	NC Act Status	EPBC Status	Source of Impact	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
Granite Belt Thick-tailed Gecko *Underwoodisaurus sphyrurus* (species present)	R	V	Inundation area	**Direct impact** – loss of habitat due to inundation and clearing. **Indirect impact** – dispersal of feral predator species into adjacent areas possibly supporting the species.	Certain	Moderate	Offset required or restoration of comparable habitat in local area. Fauna spotter/catcher during clearing.	Minor
			Stalling Lane Access	**Direct impact** – loss of habitat due to inundation and clearing.	Possible	Moderate	Offset required or restoration of comparable habitat in local area. Fauna spotter/catcher during clearing.	Minor
Fork-tailed Swift *Apus pacificus* (species not recorded, likely to occur sporadically in summer)	LC	M	Inundation area Stalling Lane Access	No impact				
Great Egret *Ardea alba* (species not recorded, likely to occur sporadically)	LC	M	Inundation area	**Direct impact** – replacement of existing wetland habitat by impoundment.	Certain	Minor	Revegetation of dam edges and exclusion of livestock.	Minor (positive impact)
Latham's Snipe *Gallinago hardwickii* (species not recorded, possible rare summer visitor or passage migrant)	LC	M	Inundation area	**Direct impact** – replacement of existing wetland habitat by impoundment.	Certain	Minor	Revegetation of dam edges and exclusion of livestock. Feral predator control (management plan)	Minor (positive impact)
White-bellied Sea-eagle *Haliaeetus leucogaster* (species not recorded, possible rare visitor)	LC	M	Inundation area	**Direct impact** – replacement of existing wetland habitat by impoundment.	Certain	Minor	Retention of large dead trees where possible to provide roosting habitat for birds. Revegetation of dam edges and exclusion of livestock.	Minor (positive impact)

Species	NC Act Status	EPBC Status	Source of Impact	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
White-throated Needletail *Hirundapus caudacutus* (species not recorded, predicted to occur in summer)	LC	M	Inundation area Stalling Lane Access	No impact				
Square-tailed Kite *Lophoictinia isura* (species present)	R		Inundation area Stalling Lane Access	**Direct impact** – loss of habitat for breeding and foraging due to inundation and clearing of habitat.	Certain	Moderate	Offset required or restoration of comparable habitat in local area.	Minor
Rainbow Bee-eater *Merops ornatus* (species not recorded, predicted to occur)	LC	M	Inundation area Stalling Lane Access	**Indirect impact** – loss of prey species due to clearing and inundation.	Probable	Minor	None recommended	Minor
Turquoise Parrot *Neophema pulchella* (species present)	R		Inundation area Stalling Lane Access	**Direct impact** – loss of breeding and foraging habitat due to inundation and clearing	Certain	Moderate	Offset required or restoration of comparable habitat in local area.	Minor
Rufous Fantail *Rhipidura rufifrons* (species not recorded, possible rare visitor or passage migrant)	LC	M	Inundation area Stalling Lane Access	**Direct impact** – loss of riparian habitat suitable for foraging, resting during migration.	Unlikely	Minor	None recommended	Minor
Large-eared Pied Bat *Chalinolobus dwyeri* (species present)	R	V	Inundation area Stalling Lane Access	**Indirect impact** – Loss of prey species by clearing and inundation of foraging habitat.	Certain	Moderate	Offset required or restoration of comparable habitat in local area.	Minor
Spotted-Tail Quoll (SE mainland) *Dasyurus maculatus maculatus* (species not recorded, predicted to occur in small numbers)	V	E	Inundation area Stalling Lane Access	**Direct impact** – loss of habitat due to inundation and clearing. Mortality by vehicle strike. **Indirect impact** – Dispersal of both prey and feral predator species into adjacent areas more likely to support this species.	Probable	Moderate	Offset required or restoration of comparable habitat in local area. Feral predator control (management plan). Signage on roads and speed limits for construction vehicles.	Minor

Species	NC Act Status	EPBC Status	Source of Impact	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
Koala *Phascogale cinereus* (species present)	SLC		Inundation area Stalling Lane Access	**Direct impact** – Loss of habitat by clearing and inundation. Predation by feral predators when fleeing disturbance. Mortality by vehicle strike.	Certain	Moderate	Offset required or restoration of comparable habitat in local area. Fauna spotter/catcher during clearing. Signage on roads and speed limits for construction vehicles.	Minor
Short-beaked Echidna *Tachyglossus aculeata* (species not recorded, predicted to occur)	SLC		Inundation area Stalling Lane Access	**Direct impact** – Loss of habitat and prey species by inundation, clearing and earthworks. Mortality by vehicle strike.	Probable	Moderate	Offset required or restoration of comparable habitat in local area. Fauna spotter/catcher during clearing. Signage on roads and speed limits for construction vehicles.	Minor

NC Act Status: E = Endangered, V = Vulnerable, R = Rare, SLC = Special Least Concern (Cultural Significance).

EPBC Status: E = Endangered, V = Vulnerable, M = Migratory.

Table 9-23 Urban and Irrigation Pipeline Construction Impact Assessment

Species	NCA Status	EPBC Status	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
Granite Belt Thick-tailed Gecko *Underwoodisaurus sphyrurus* (low likelihood of occurrence within pipeline corridors)	R	V	**Direct impact** – loss of habitat by clearing.	Unlikely	Minor	Fauna spotter/catcher during clearing. Revegetation and regeneration of pipeline corridors.	Minor
Grey Goshawk *Accipiter novaehollandiae* (low likelihood of occurrence within pipeline corridors)	R		**Direct impact** – loss of habitat by clearing.	Unlikely	Minor	Revegetation and regeneration of pipeline corridors.	Minor
Fork-tailed Swift *Apus pacificus* (likely to occur sporadically in summer)	LC	M	No impact				
Great Egret *Ardea alba* (likely to occur in suitable areas)	LC	M	**Direct impact** – disturbance to habitat. **Indirect impact** – sedimentation and pollution of downstream habitat.	Probable	Minor	Revegetation and rehabilitation of any waterbodies and watercourses disturbed during construction.	Minor
Latham's Snipe *Gallinago hardwickii* (possible summer visitor or passage migrant)	LC	M	**Direct impact** – disturbance to habitat. **Indirect impact** – sedimentation and pollution of downstream habitat.	Unlikely	Minor	Revegetation and rehabilitation of any waterbodies and watercourses disturbed during construction.	Minor
White-bellied Sea-eagle *Haliaeetus leucogaster* (low likelihood of occurrence within the pipeline corridors)	LC	M	No impact				
White-throated Needletail *Hirundapus caudacutus* (very likely to occur in summer)	LC	M	No impact				
Rainbow Bee-eater *Merops ornatus*	LC	M	No impact				

Species	NCA Status	EPBC Status	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
(predicted to occur)							
Turquoise Parrot *Neophema pulchella* (likely to occur)	R		**Direct impact** – loss of habitat by clearing.	Certain	Moderate	Revegetation and regeneration of pipeline corridors.	Minor
Rufous Fantail *Rhipidura rufifrons* (unlikely visitor or passage migrant)	LC	M	**Direct impact** – loss of habitat by clearing.	Unlikely	Minor	Revegetation and regeneration of pipeline corridors.	Minor
Regent Honeyeater *Xanthomyza phrygia* (low likelihood of occurrence within the pipeline corridors)	E	E	**Direct impact** – loss of habitat by clearing.	Unlikely	Minor	Revegetation and regeneration of pipeline corridors.	Minor
Spotted-Tail Quoll (SE mainland) *Dasyurus maculatus maculatus* (low likelihood of occurrence within the pipeline corridors)	V	E	**Direct impact** – loss of habitat by clearing.	Unlikely	Minor	Revegetation and regeneration of pipeline corridors.	Minor
Eastern (Greater) Long-eared Bat *Nyctophilus timoriensis* (southeastern mainland population) (uncertain likelihood of occurrence within the pipeline corridors)	LC	V	**Direct impact** – loss of habitat by clearing.	Unknown (probably very unlikely)	Minor	Revegetation and regeneration of pipeline corridors.	Minor
Koala *Phascogale cinereus* (predicted to occur in low numbers)	SLC		**Direct impact** – loss of habitat by clearing. Mortality by vehicle strike.	Probable	Minor	Revegetation and regeneration of pipeline corridors. Fauna spotter/catcher during clearing. Speed limits for construction vehicles.	Minor
Short-beaked Echidna *Tachyglossus aculeata* (predicted to occur)	SLC		**Direct impact** – loss of habitat by clearing. Mortality by vehicle strike.	Probable	Minor	Revegetation and regeneration of pipeline corridors. Fauna spotter/catcher during clearing. Speed limits for construction vehicles.	Minor

NC Act Status: E = Endangered, V = Vulnerable, R = Rare, SLC = Special Least Concern (Cultural Significance).

EPBC Status: E = Endangered, V = Vulnerable, M = Migratory.

Table 9-24 Emu Swamp Dam and Stalling Lane Access Operation Impact Assessment

Species	NCA Status	EPBC Status	Source of Impact	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
Granite Belt Thick-tailed Gecko *Underwoodisaurus sphyrurus* (species present)	R	V	Inundation area Stalling Lane Access	No impact				
Grey Goshawk *Accipiter novaehollandiae* (species not recorded, low likelihood of occurrence)	R		Inundation area Stalling Lane Access	No impact				
Fork-tailed Swift *Apus pacificus* (species not recorded, likely to occur sporadically in summer)	LC	M	Inundation area Stalling Lane Access	No impact				
Great Egret *Ardea alba* (species not recorded, likely to occur sporadically)	LC	M	Inundation area	**Direct impact** – provision of permanent waterbody. **Indirect impact** – Possible introduction or invasion of waterbody by competitive exotic fish, affecting avail-ability of invertebrate prey.	**Direct** Certain **Indirect** Possible	Moderate	Revegetation of dam edges and exclusion of livestock prevent destruction of aquatic plants and muddying of water. Control of fish species inputs into dam by anglers and angling associations	Minor (overall positive impact)
			Stalling Lane Access	No impact				

Species	NCA Status	EPBC Status	Source of Impact	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
Latham's Snipe *Gallinago hardwickii* (species not recorded, possible rare summer visitor or passage migrant)	LC	M	Inundation area	**Direct impact** – provision of permanent waterbody. **Indirect impact** – Possible introduction or invasion of waterbody by competitive exotic fish, affecting avail-ability of invertebrate prey.	**Direct** Possible **Indirect** Possible	Moderate	Revegetation of dam edges and exclusion of livestock prevent destruction of aquatic plants and muddying of water. Control of fish species inputs into dam by anglers and angling associations.	Minor (overall positive impact)
			Stalling Lane Access	No impact				
White-bellied Sea-eagle *Haliaeetus leucogaster* (species not recorded, possible rare visitor)	LC	M	Inundation area	**Direct impact** – provision of permanent waterbody for food resources and breeding. **Indirect impact** – Possible introduction or invasion of waterbody by competitive exotic fish, providing additional food resources.	**Direct** Possible **Indirect** Possible	Moderate	Retention of large trees, including within impoundment for nesting and roosting. Control of fish species inputs into dam by anglers and angling associations.	Minor (overall positive impact)
			Stalling Lane Access	No impact				
White-throated Needletail *Hirundapus caudacutus* (species not recorded, predicted to occur in summer)	LC	M	Inundation area Stalling Lane Access	No impact				
Swift Parrot *Lathamus discolor* (species not recorded, possible rare winter visitor)	E	E	Inundation area Stalling Lane Access	No impact				
Square-tailed Kite *Lophoictinia isura* (species present)	R		Inundation area Stalling Lane Access	No impact				

Species	NCA Status	EPBC Status	Source of Impact	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
Rainbow Bee-eater *Merops ornatus* (species not recorded, predicted to occur)	LC	M	Inundation area Stalling Lane Access	No impact				
Black-faced Monarch *Monarcha melanopsis* (species not recorded, possible rare visitor or passage migrant)	LC	M	Inundation area Stalling Lane Access	No impact				
Turquoise Parrot *Neophema pulchella* (species present)	R		Inundation area Stalling Lane Access	No impact				
Rufous Fantail *Rhipidura rufifrons* (species not recorded, possible rare visitor or passage migrant)	LC	M	Inundation area Stalling Lane Access	No impact				
Large-eared Pied Bat *Chalinolobus dwyeri* (species present)	R	V	Inundation area Stalling Lane Access	No impact				
Spotted-Tail Quoll (SE mainland) *Dasyurus maculatus maculatus* (species not recorded, predicted to occur locally in small numbers)	V	E	Inundation area	**Indirect impact** – Inundation represents a constraint to regional movement and dispersal.	Probable	Moderate	Maintenance of local movement corridors by habitat offset or restoration of appropriate area in local area.	Minor
			Stalling Lane Access	**Direct impact** – mortality by vehicle strike.	Possible	Minor	Signage on roads.	Minor
Koala *Phascogale cinereus* (species present)	SLC		Inundation area	**Indirect impact** – Inundation represents a constraint to regional movement and dispersal.	Probable	Moderate	Maintenance of local movement corridors by habitat offset or restoration of appropriate area in local area.	Minor

Species	NCA Status	EPBC Status	Source of Impact	Impact Type	Likelihood	Preliminary Impact Assessment	Mitigation & Compensatory Measures	Residual Impact Assessment
			Stalling Lane Access	**Direct impact** – mortality by vehicle strike.	Possible	Minor	Signage on roads.	Minor
Short-beaked Echidna *Tachyglossus aculeata* (species not recorded, predicted to occur)	SLC		Inundation area	**Indirect impact** – Inundation represents a constraint to regional movement and dispersal.	Probable	Moderate	Maintenance of local movement corridors by habitat offset or restoration of appropriate area in local area.	Minor
			Stalling Lane Access	**Direct impact** – mortality by vehicle strike.	Possible	Minor	Signage on roads.	Minor

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9.5.3.9 Impact Mitigation

Implementation of the following mitigation and compensatory measures as identified in **Table 9-22**, **Table 9-23** and **Table 9-24** as necessary to reduce identified terrestrial fauna impacts to levels that will not cause permanent harm to significant fauna populations:

- develop and implement a Construction Management Plan and confine construction impacts to the inundation and road footprint areas;
- fauna spotter and fauna catchers/carers present during clearing operations;
- for affected species – offset through habitat restoration and enhancement of comparable ecosystems in the local area;
- for disruption of regional wildlife corridor - habitat rehabilitation and restoration to enhance regional wildlife corridor;
- include seeds or seedlings of local provenance species in habitat rehabilitation and restoration in the local area;
- for hollow-dependent species, and those dependent on hollow-dependent prey, provide nest boxes in the surrounding habitat to replace those lost;
- develop and implement a Weed Management Plan;
- monitor impacts on the riparian habitat downstream of the dam wall and take remedial action as appropriate to maintain ecological function;
- develop and implement an Animal Pest Species Management Plan in accordance with Stanthorpe Shire Council's Pest Management Plan 2005 - 2009;
- revegetation of dam edges, ensuring exclusion of cattle and control of feral predators;
- ensure environmental flows are maintained downstream of dam wall;
- control of fish species inputs into dam by anglers and angling associations; and
- retention, where possible, of large, dead trees in inundation area.

9.5.3.10 Residual Impacts

Once appropriate mitigation measures and management plans are implemented, the scale and duration of the construction and operational phase impacts of the dam project on terrestrial ecosystems are predicted to be predominantly minor. Critical to this outcome is restoration, enhancement or offset of appropriate habitat.

The presence of the dam will represent a permanent water source that will attract species adapted to lakes and impoundments. The edge effects from the inundation area will present a continual management challenge, primarily with regard to the control of weeds. Control of access by cattle to dam edges will increase habitat values for native species where cattle are excluded.

Riparian vegetation communities downstream of the dam wall will be affected by alterations in stream morphology and available water, requiring monitoring and the implementation of management actions where required to ensure that the vegetation retains its current ecological function within the local landscape.

The potential change in downstream vegetation communities may reduce habitat for aquatic and riparian fauna species. The potential for downstream impacts on species of conservation significance likely to use the habitat downstream of the dam is presented in **Table 9-25**.

Table 9-25 Potential for Downstream Impacts on Riparian and Aquatic Species of Conservation Significance

Fauna Species	Potential for Impact
Tusked Frog	only 2 QM records from 1961, unlikely to occur and the dam may provide habitat in any case
Painted Snipe	no actual database records, included as it came up under the EPBC Protected Matters search
Powerful Owl	may roost in riparian vegetation but only 1 WildNet record and the species has a home range of up to 1,000 ha.
Platypus	1 record from 56 km northeast of Stanthorpe, probably not in the Severn River
Black-faced Monarch	Use riparian habitats for movement but very few records for study area and possible loss of downstream riparian habitat will not preclude movement as the area most suitable as a corridor is west of the inundation area.
Rufous Fantail	Use riparian habitats for movement but very few records for study area and possible loss of downstream riparian habitat will not preclude movement as the area most suitable as a corridor is west of the inundation area.
Great Egret	Very minor impacts downstream (if any for the eagle) and any would be more than offset by the creation of habitat by the inundation itself.
White-bellied Sea-Eagle	Very minor impacts downstream (if any for the eagle) and any would be more than offset by the creation of habitat by the inundation itself.
Latham's Snipe	Probably doesn't occur on the Severn and the dam edges may provide suitable habitat as an alternative in any case