CONTENTS

TABLES

FIGURES

11. TERRESTRIAL FAUNA

11.1. Description of environmental values

This section addresses Section 3.3.3.1 of the ToR, describing the terrestrial fauna present or likely to be present at any time during the year in the areas potentially affected by the Project.

11.1.1. Regulatory framework

The key fauna conservation legislation relevant to the Project is described below.

11.1.1.1. Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas. The EPBC Act provides protection for matters of National Environmental Significance (MNES).

The Project was made a controlled action on 30 July, 2008 (referral number: 2008/4313). The controlling provisions relevant to terrestrial fauna are:

- Listed threatened species; and
- Listed migratory species.

The EPBC Act identifies and lists species as threatened. It also provides protection for Migratory species, including those listed under International Agreements such as the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA) or the Convention on the Conservation of Migratory Species of Wild Animals (i.e. the Bonn Convention).

Other matters that are protected by the EPBC Act include places listed on the Register of the National Estate. Three registered sites are within or adjacent to the study area:

- Brigalow Invertebrate Site is located within the road reserve along the Leichhardt Highway approximately 4 km north of Taroom. It is an excellent example of a remnant Brigalow community on fertile soil and provides known habitat for threatened species including the Golden-tailed Gecko (*Strophurus taenicauda*) and the Imperial Hairstreak Butterfly (*Jalmenus evagoras eubulus*);
- Boggomosses Area No. 1 (located near the intersection of Spring Creek Road and Glebe Weir Road); and
- Boggomosses Area No. 2 (located in Nathan Gorge).

These sites are shown on Figure 9-1.

11.1.1.2. Queensland legislation

The *Nature Conservation Act 1992* (Qld) (NC Act) provides for the conservation and management of Queensland's native flora and fauna. The Act prohibits the taking or destruction, without authorisation, of listed fauna species.

The *Nature Conservation (Wildlife) Regulation 2006* (NC Regulation) lists the fauna considered extinct in the wild, endangered, vulnerable, 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 *Nature Conservation (Koala) Conservation Plan 2006* provides for the conservation of the Koala (*Phascolarctos cinereus*) in Queensland and includes provisions for the assessment and management of Koalas during development approval processes and the implementation of projects. Differentiated levels of provisions apply to the three Koala districts that have been mapped across Queensland. The Project is located with Koala District C. This district includes areas where Koalas are found, are listed as least concern wildlife under the NC Regulation and where there is less perceived threat to their survival than in Districts A and B.

The *Land Protection (Stock and Pest Route Management) Act 2002* and the *Land Protection (Pest and Stock Route Management) Regulation 2003* provides for management of animal pests in Queensland. Landholders have an obligation to control Class 1 and 2 Declared Pests that are known to occur on their property. The Queensland Department of Employment, Economic Development and Innovation (DEEDI) provides pest management advice, which provides direction and control strategies to prevent the spread of pest animals.

11.1.2. Methodology

11.1.2.1. Nomenclature and species conservation status

The current naming conventions for fauna have been identified from the *CSIRO list of Australian vertebrates: a reference with conservation status* second edition (Clayton *et al.,* 2006). The current conservation status of fauna refers to species listed under the NC Regulation and the EPBC Act. Species that have a conservation status of critically endangered, endangered, vulnerable or near threatened are commonly referred to as 'threatened' throughout this report. Species regarded as regionally significant are classed as non-EVR priority taxa under the Brigalow Belt South Biodiversity Planning Assessment.

The conservation status of all fauna species occurring in Australian territory has been listed against IUCN categories and documented within a series of Action Plans specific to each taxon. The Action Plans consulted included Tyler (1997) for frogs, Cogger *et al.* (1993) for reptiles, Garnett and Crowley (2000) for birds, Maxwell *et al.* (1996) for monotremes and marsupials and Duncan *et al.* (1999) for bats. Fauna identified as otherwise threatened within the relevant Action Plan are referred to as significant species throughout this report.

In addition, a number of Recovery Plans have been prepared for threatened species at the State and National levels. The following Recovery Plans have been prepared and are relevant to this study:

- National Recovery Plan for the Boggomoss Snail (Stanisic, 2008);
- Draft National Recovery Plan for the Grassland Earless Dragon (Robertson and Cooper, 2000); and
- Queensland Brigalow Belt Reptile Recovery Plan 2008-2012 (Richardson, 2006) – draft recovery plan not currently approved.

During the field survey, the following texts were referred to for the identification of fauna to species level (where possible): Cogger (1996) and Barker *et al.* (1995) for frogs; Cogger (1996), Wilson (2005) and Wilson and Swan (2008) for reptiles; Pizzey and Knight (2007) for birds; van Dyck and Strahan (2008) for mammals; and Churchill (1998) for bats.

11.1.2.2. Dam study area and pipeline corridor

This section presents the methods used to assess the faunal characteristics of the water storage and pipeline corridor and describes the results of these assessments.

The location of the water storage is shown in Chapter 2, which also shows the pipeline route from Nathan Dam to Dalby (Section 2.4). The dam study area included sites both within the water storage and up to 7 kilometres (km) in surrounding landscape (within the Southern Brigalow Belt bioregion). The pipeline corridor included sites along and adjacent to the pipeline construction easement.

Major vegetation types of the Southern Brigalow Belt bioregion include Blue Grass (*Dichanthium* spp.) grasslands, Poplar Box (*Eucalyptus populnea*) and Brigalow (*Acacia harpophylla*) woodlands on plains and gentle terrain with more fertile soils. Patches of vine thicket occur in areas with suitable fire regimes. Less fertile areas with sandy or stony soils support shrublands and woodland with eucalypts, casuarinas and *Callitris* (Thackway & Cresswell, 1995).

The dam study area is bounded by:

- Leichhardt Highway to the east;
- Glebe Weir Road and Spring Creek Road to the north;
- a point 5 km downstream of the dam wall site on the Dawson River; and
- Cracow Road to the south (including inundated areas along Cockatoo Creek and other tributaries).

11.1.2.3. Desktop review

Literature review

Several reports were reviewed as part of this assessment. Crossman and Reimer (1986) completed the first wide scale inventory of fauna within Taroom Shire between 1977 and 1979. Several other fauna surveys have been conducted recently in response to a previous proposal to dam the Dawson River downstream of Taroom. These reports were reviewed with particular reference to any species not identified by Crossman and Reimer (1986) and to aid in the selection of sites for this survey. The main documents reviewed were:

- Crossman and Reimer (1986) Mammals, birds, reptiles and amphibians of the Taroom Shire, central Queensland;
- Duivenvoorden (1995) Biological and Ecological Data (excluding fisheries and turtles) on the Dawson River System with Particular Reference to the Proposed Nathan Dam;
- Ison Environmental Planners (1996) Dawson River Dam Study: Flora and Fauna Assessment;
- Ingram and Stanisic (1997) Dawson River Project Impact Assessment Study: Boggomosses (Mound Springs) and Other Spring-fed Areas;
- Hyder Environmental (1997) Impact Assessment Study for Proposed Dawson Dam; and

- Venz, Mathieson and Schulz [EPA] (2002) Fauna of the Lower Dawson River Floodplain: An Assessment of Fauna Downstream of the Proposed Nathan Dam.

The Surat Basin Railway is a proposed railway corridor running from Wandoan to Banana, via Cracow. The Nathan pipeline is near the southern portion of this railway corridor. The terrestrial fauna report (Connell Hatch, 2008) completed for the Surat Basin Railway EIS was reviewed to gain an appreciation of the fauna values of this section of the pipeline.

Database searches and significant species records

The desktop analysis involved interrogation of fauna databases and other information sources of species records. In describing the terrestrial fauna assemblage of the study area the following databases were used:

- Birds Australia (BirdData) database;
- the Queensland Department of Environment and Resource Management (DERM) Wildlife Online database; and
- EPBC Act Protected Matters Search Tool.

The following coordinates were used to define a rectangular search area for database interrogations:

- 25°32'16" S, 149°58'5" E;
- 25°39'29" S, 149°58'5" E;
- 25°39'29" S, 149°44'38" E; and
- 25°32'16" S, 149°44'38" E.

The rectangular search area is approximately 29 km by 44.5 km and encompasses an area of 129,050 hectares (ha). In comparison, the dam is proposed to inundate approximately 13,508 ha.

Several point searches were conducted (including a radius of 5 km) along the alignment of the pipeline centred on any areas containing a high cover of remnant vegetation. The results of these searches were then combined with the results of the database searches for the dam study area to identify any species unique to the Project corridor.

The coordinates for each point search and nearest place name are listed below:

- 26° 25'43"S; 150° 03'20"E – Gurulmundi;
- 26° 35'47"S; 150° 09'47"E – between Dalwogan and Miles;
- 26° 39'55"S; 150° 16'47"E – west of Columboola; and
- 26° 42'21" S; 150° 32'30"E – Baking Board, west of Chinchilla.

Existing mapping and spatial information

To provide a consistent approach to assessing biodiversity values at the landscape scale, DERM has developed the Biodiversity Assessment and Mapping Methodology (BAMM). The BAMM uses vegetation coverage data provided by the Queensland Herbarium (remnant vegetation mapping) and from DERM's Statewide Landcover and Trees Study (SLATS) combined with records of rare and threatened flora and fauna. The BAMM is used to prepare Biodiversity

Planning Assessments (BPA) across Queensland. The BPA utilises a panel of experts to refine the 'first cut' mapping produced from the BPA by assessing the specific flora, fauna and landscape values for the particular region. Note that remnant vegetation is defined by the Queensland Herbarium as vegetation that contains the characteristics that are within the specified range of the undisturbed state of that community, i.e. canopy cover and canopy height.

The Project is located within the Brigalow Belt South (BBS) bioregion. The BPA for this region was updated in September 2008 (Version 1.3;DERM, 2008). A series of reports by the panel of experts support the BPA and provide background information related to the decisions made when compiling the BPA. The following reports were reviewed as part of this terrestrial fauna assessment:

- BBS Fauna Expert Panel Report (EPA, 2002a) provides a list of fauna species that are considered to be non-EVR Priority Taxa by the EPA's fauna expert panel. These species are considered to be a priority for conservation within the BBS bioregion, but are not listed as rare or threatened under state or Commonwealth legislation. These species are included in this report as regionally significant species within the BBS bioregion; and
- BBS Landscape Expert Panel report (EPA, 2002b) was reviewed to determine areas of high conservation significance and identified bioregional wildlife corridors occurring within or adjacent to the Project area.

The DERM Essential Habitat mapping for the Project area was also reviewed. The Essential Habitat mapping is based on records of threatened species in conjunction with remnant vegetation mapping of vegetation communities that are known to support a specific taxa.

11.1.2.4. Field survey

Dam and surrounds

To supplement the existing (desktop) information, a summer/autumn survey of the dam study area was completed by four terrestrial ecologists between 10 and 21 March, 2008. Winter surveys were completed between 28 July and 1 August 2008. Total survey effort was approximately 480 hours during summer/autumn and 240 hours during winter, for an overall effort of 720 hours. There have been no developments in the study area since the surveys. There was a major flood event in January 2011, however, habitat and fauna in riparian and floodplain areas have demonstrated resilience to past flooding events. Therefore the baseline fauna surveys remain representative of today's environment.

A total of 14 comprehensive survey sites were established within the study area (Figure 11-1). These included four sites where dedicated searches and passive observations were conducted and ten sites where mammal traps were used. Of these ten sites, pitfall traps were erected at six sites. In addition, four major road transects were surveyed for vertebrate fauna; Cracow Road, Glebe Weir Road, Glebe Road and the Leichhardt Highway. Transects provided incidental data for reptiles, amphibians and mammals.

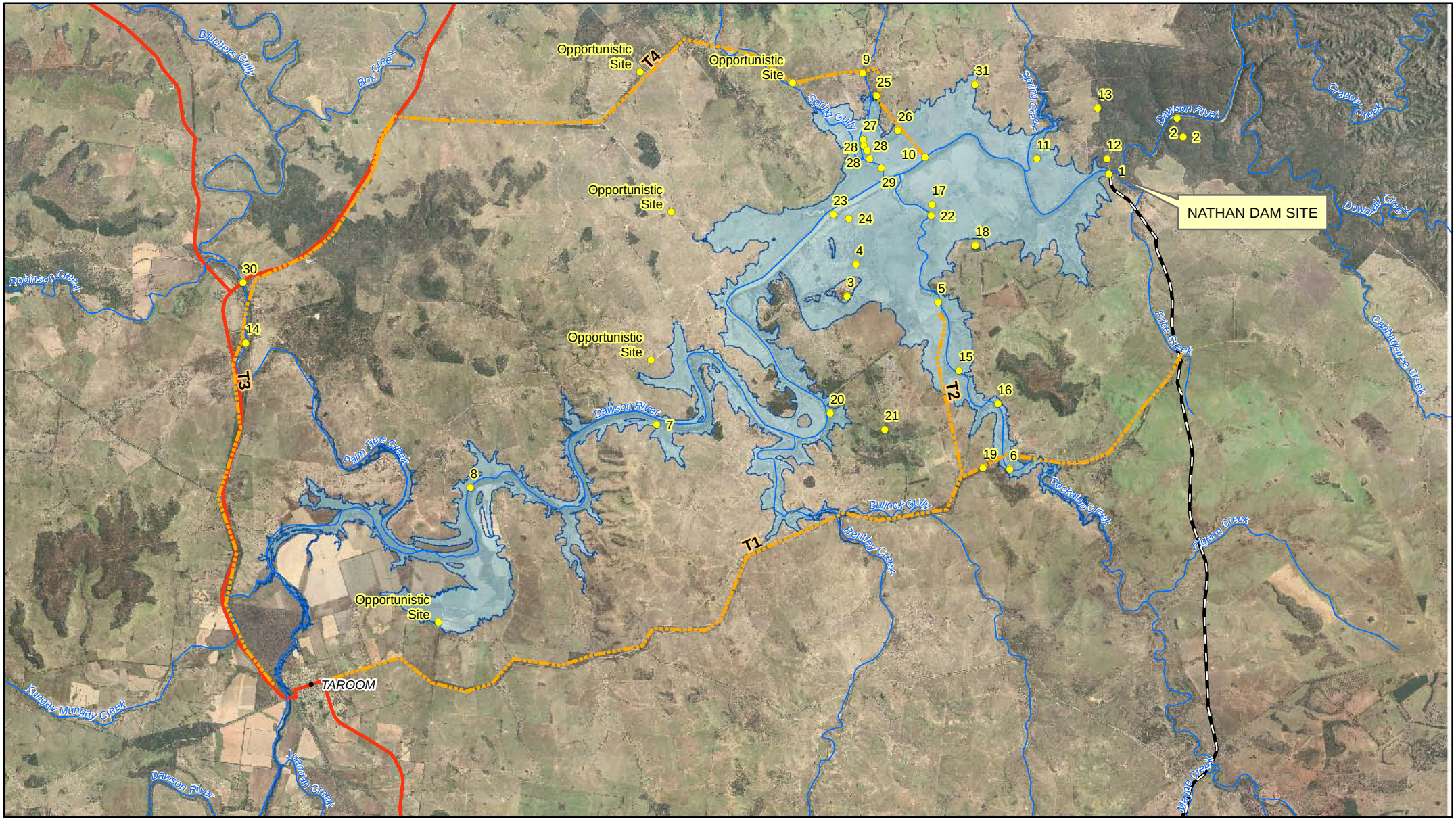
The winter survey consisted of targeted surveys for herpetofauna, avifauna and mammals, with an emphasis on habitat types which are of seasonal importance to altitudinal migrants and/or provide seasonal foraging resources during winter such as migratory wetland birds (e.g. Painted Snipe, *Rostratula australis*).

A detailed methodology for the survey/trapping methods used at each comprehensive site is included in Appendix 11-A. A description of sites and summary of field survey effort is provided in Table 11-1 with a detailed breakdown of survey effort in Appendix 11-A.

A range of survey techniques were employed at each site, including spotlighting, diurnal search for birds and herpetofauna, pitfall trap, harp trap, Anabat, call playback, mammal traps and infrared camera. There were no targeted surveys for threatened species, with the exception of the Boggomoss Snail, though the initial literature reviews identified the species that may be present and field staff were vigilant with respect to potential observations of the species.

The sites were established within selected representative habitat and those using trapping techniques (10 sites) were surveyed for a continuous period of five days and four nights. This is the period recommended by DERM (EPA, 1999). Intensive sampling of the dam study area targeted a total of 31 sites over a two week sampling period. The sampling effort involved four observers over the summer/autumn survey, totalling 40 field days (including travel, set up and trap decommissioning time). Field surveys were conducted in both the summer/autumn and winter periods, to account for any seasonal differences in the vertebrate species assemblage of the study area, in particular winter migrants.

There are no recognised best practice benchmarks for fauna survey techniques in Qld. The Brisbane City Council (BCC) Ecological Assessment Guidelines (BCC, Unknown) provide a summary of best practice survey techniques for all major vertebrate fauna groups that occur within Brisbane City. For fauna surveys, a minimum of four days and nights survey time is recommended and adequate consideration of seasonal variations, timing, duration and climatic conditions. A review of the survey techniques employed for the Project concludes that they are comparable to the best practice fauna survey techniques recommended by BCC.



LEGEND

- Towns of Interest
- Fauna Survey Sites
- Vehicle-based Transects
- Major Roads
- Watercourses
- Full Supply Level (183.5m AHD)

Projection: GDA94 Zone 56

Figure 11-1

0 1 2 4
Kilometres

N

Scale 1:200,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Location of survey sites - dam study area

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Table 11-1 Location and habitat type of fauna survey sites

Site No.	Site Name (Property)	Coordinates (DMS)	Habitat Type	Survey Type[1]
1	Dam Wall Site	25° 28' 0" S; 150° 6' 55" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	SP, DS, AB, CP, MT, IC
2	Nathan Gorge	25° 26' 56" S; 150° 8' 41" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	SP, DS, HT, AB, CP, IC
3	Poplar Box on sand (Glebe Homestead)	25° 30' 36" S; 150° 0' 56" E	Sparse eucalypt woodland (poplar box) on floodplains / wetlands with brigalow clumps	SP, DS, PT, HT, AB, MT, IC
4	Coolabah (Glebe Homestead)	25° 29' 54" S; 150° 1' 8" E	Sparse Eucalypt woodland (coolabah) on floodplains/wetlands – monotypic community	SP, DS, AB, CP, MT, IC
5	Mid Cockatoo Ck (west)	25° 30' 43" S; 150° 2' 59" E	Sparse Eucalypt woodland (coolabah) on floodplains/wetlands	SP, DS, AB, CP, MT, IC
6	Upper Cockatoo Ck (Cracow Rd)	25° 34' 21" S; 150° 4' 48" E	Sparse eucalypt woodland on floodplains / wetlands with fringing Queensland blue gums	SP, DS, PT, HT, AB, CP, MT, IC
7	River Red Gum (Dawson River south)	25° 33' 14" S; 149° 56' 30" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	SP, AB, CP
8	Bundulla Road (Dawson Crossing)	25° 34' 19" S; 149° 51' 55" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	SP, AB
9	Boggomoss Reserve	25° 25' 51" S; 150° 1' 24" E	Non-remnant brigalow clumps	SP, DS, PT, AB, CP, MT, IC
10	Glebe Weir	25° 27' 44" S; 150° 2' 49" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	SP, DS, PT, AB, CP, MT, IC
11	Spring Creek (Spring Ck Station)	25° 27' 47" S; 150° 5' 22" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	SP, DS, HT, AB, CP, MT, IC
12	Cypress Pine (Spring Ck Station)	25° 27' 49" S; 150° 7' 2" E	Mid-dense eucalypt / cypress pine / she-oak woodland on sand	SP, DS, PT, AB, CP, MT, IC
13	Brigalow (Spring Ck Station)	25° 26' 43" S; 150° 6' 50" E	Non- remnant – brigalow patch	SP, DS, AB
14	Chain Lagoons	25° 31' 11" S; 149° 46' 46" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum with cabbage palm)	SP, DS, AB, CP
15	Mid Cockatoo Ck (east)	25° 32' 10" S; 150° 3' 26" E	Sparse eucalypt woodland (coolabah) on floodplains / wetlands	SP, DS, AB, CP
16	Upper Cockatoo Ck (east)	25° 32' 53" S; 150° 4' 14" E	Sparse eucalypt woodland (coolabah) on floodplains / wetlands	SP, DS, AB, CP
17	Brigalow Patch (Cockatoo Ck)	25° 28' 35" S; 150° 2' 50" E	Mid-dense brigalow &/or belah woodland on alluvium	SP, DS, AB, CP
18	Belah Patch	25° 29' 28" S; 150° 3' 48" E	Mid-dense belah on sedimentary rocks	SP, DS
19	Poplar Box (Cracow Rd)	25° 34' 15" S; 150° 4' 2" E	Sparse eucalypt woodland (poplar box) on floodplains / wetlands	DS
20	Dawson River Billabong	25° 33' 7" S; 150° 0' 29" E	Mid-dense fringing riparian woodland	DS, AB
21	Bottle Tree Scrub	25° 33' 27" S; 150° 1' 48" E	Mid-dense brigalow / belah with semi-evergreen vine thicket understorey on cracking clays or gilgai	DS
22	Lower Cockatoo Ck	25° 28' 48" S;	Sparse eucalypt woodland (coolabah) on floodplains	DS

Site No.	Site Name (Property)	Coordinates (DMS)	Habitat Type	Survey Type[1]
	(east)	150° 2' 48" E	/ wetlands	
23	Dawson River (south)	25° 28' 46" S; 150° 0' 29" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	DS
24	Coolibah Floodplain	25° 29' 11" S; 150° 1' 23" E	Sparse eucalypt woodland (coolabah) on floodplains / wetlands	DS
25	Blue Gum Wetland (Mt Rose)	25° 26' 14" S; 150° 1' 33" E	Sparse eucalypt woodland on floodplains / wetlands with fringing Queensland blue gum	SP, DS, AB
26	Blue Gum (Mt Rose)	25° 27' 5" S; 150° 2' 9" E	Sparse eucalypt woodland on floodplains / wetlands with fringing Queensland blue gum	SP, DS, AB, CP
27	Blue Gum GAB spring (Mt Rose)	25° 27' 13" S; 150° 1' 18" E	Non- remnant – wetland with blue gum fringing woodland on alluvium.	SP, DS, AB
28	Other GAB springs (Mt Rose)	25° 27' 17" S; 150° 1' 15" E 25° 27' 22" S; 150° 1' 18" E 25° 27' 34" S; 150° 1' 22" E	Non- remnant – wetlands	SP, DS
29	Spring Gully (Mt Rose)	25° 27' 40" S; 150° 1' 35" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum)	SP, DS, AB, CP
30	Palm Tree Creek (Leichhardt Hwy)	25° 29' 53" S; 149° 46' 43" E	Mid-dense fringing riparian woodland (river red gum &/or Queensland blue gum with cabbage palm)	DS
31	Unnamed Creek (Spring Ck Station)	25° 26' 4" S; 150° 3' 55" E	Non- remnant – brigalow &/or belah patch	DS

1 Fauna survey methods:

SP = Spotlighting
DS = Diurnal Search (Birds and herpetofauna)
PT = Pitfall Trap
HT =Harp Trap
AB = Anabat
CP = Call Playback
MT = Mammal Traps (Cages, Elliotts Type A and B)
IC = Infrared Camera

The survey limitations and weather conditions during the surveys are contained in Appendix 11-A.

Weather conditions during the survey periods were generally within the long term average values for the region. Temperatures during the day for the summer/autumn survey were between 28 to 31.5 degrees Celsius (°C) and overnight temperatures fell to between 14.5 and 17.5°C. Minimum temperatures were slightly lower than the long term average (Taroom Post Office averages from 1870 - 2008) of 18°C. Cloud cover was low.

No rain fell during the survey period apart from several very brief, isolated showers over the study area on 18 of March. Total rainfall during the previous wet season (1 October 2007 to 31 March 2008) was generally average based on long term rainfall data for the region (Bureau of Meteorology, BoM 2008a). The rainfall was associated with a late developing La Nina system, an active monsoon trough and localised thunderstorm activity, which occurred after many years of below or very much below average rainfall (BoM 2008b).

Temperatures during the day for the winter survey were between 28 to 31.5°C and overnight temperatures fell to between 0.5 and 8.5°C. Minimum temperatures were lower than the long term average of between 5-6°C and were influenced by a cold front crossing southern Australia during the survey period. Maximum daytime temperatures also fluctuated significantly. Cloud cover was generally low and a light frost occurred on the morning of 30 and 31 of July. Light showers occurred over the study area in response to the crossing of the cold front early in the survey period.

Boggomoss Snail surveys

During the surveys conducted for the IAS for the Dawson Dam proposal in 1996, the Boggomoss Snail (*Adclarkia dawsonensis*) was discovered within a Great Artesian Basin (GAB) spring on Mt Rose Station, approximately 1.7 km to the north of Glebe Weir. A specimen of another snail species previously collected from Theodore was later identified as the Boggomoss Snail. In response to this discovery, the Queensland Museum conducted a survey of likely habitat sites within the Taroom-Theodore region. A further population of the snail was identified from the Camping and Stock Reserve at Isla-Delusion Road crossing of the Dawson River ('Isla-Delusion Camping Reserve') located more than 50 km downstream of the proposed dam wall. At the time of the IAS, these two populations constituted the known range of the snail. The snail is now listed as Critically Endangered under the EPBC Act.

Staff from the Queensland Museum completed a survey of the Mt Rose Station population in 1997 and estimated the population size as less than 100 individuals. The Isla-Delusion Camping Reserve population was estimated at less than 500 individuals. However, these estimates were based on the capture of 18 live snails in a limited number of habitats and consequently a series of targeted surveys have been conducted for the Boggomoss Snail as part of the current EIS to better estimate their population size and distribution. These are described below.

BAAM (2008 and 2009)

Biodiversity Assessment and Management Pty Ltd (BAAM), led by Dr John Stanisic with field assistance by SKM, completed surveys for the Boggomoss Snail in late 2008 within the known sites and within riparian habitat areas along the Dawson River from Taroom to Theodore. Two surveys of nine days were conducted from 7 October to 16 October 2008 and from 24 November to 3 December 2008. The objectives of the study were to:

- determine if the Boggomoss Snail exists at other locations within the Dawson River Valley;
- assess the condition of the Boggomoss Snail populations;
- revise the population size estimate for the Mt Rose boggomoss population;
- obtain additional information about the habitat and microhabitat requirements of the Boggomoss Snail that would assist in the conduct of translocation trials and the recovery of the species; and
- select locations based on the above for the conduct of translocation trials that may also act as sites for potential translocation.

A total of 53 sites were searched within the Dawson River and selected major tributaries, including Cockatoo Creek, Palm Tree Creek and Spring Creek (Figure 11-2). Searching involved turning ground debris and raking through leaf litter. At Mt Rose, searching was very targeted to sandpaper figs and large gum trees. The population estimate was based on multiplying the mean recorded snail density per microhabitat by the number of sandpaper figs / large gums on the site. Further details of the methodology and survey sites are included in Appendix 11-B.

SKM (2009)

SKM completed surveys for the Boggomoss Snail in mid 2009 to quantify the spatial distribution and population size of the snail in the Dawson River catchment. Two targeted surveys of 12 days were conducted from 19 July to 25 July 2009 and from 17 August to 21 August 2009. The objectives of the survey were to locate any additional populations of the Boggomoss Snail outside the range of historic search effort, provide an estimate of the population size within its known distribution and provide preliminary assessment of newly identified habitat areas for translocation purposes. SKM surveyed a total of 109 sites from the upper Dawson Valley (near Injune), downstream to Theodore (Figure 11-2). Searching involved sifting through leaf litter and ground debris. At riparian sites where live snails were found a 100 m transect with sub-plots was established to estimate the population size. The population estimate was based on multiplying the mean recorded snail density per plot (square metre) by the estimated total area of similar habitat on the site. Further details of the methodology and survey sites are included in Appendix 11-C.

JKR Ecological and SKM (2010)

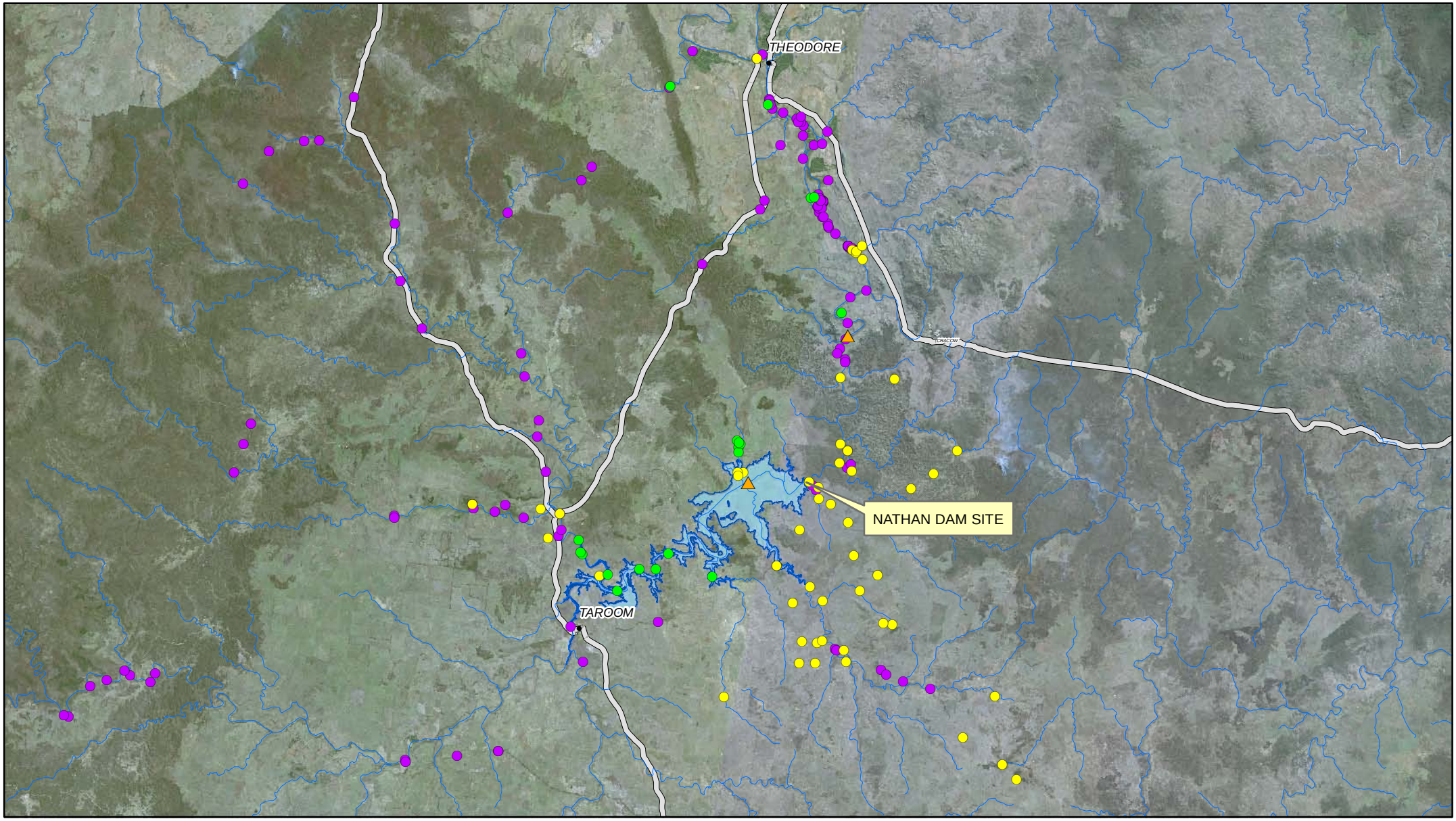
JKR Ecological together with SKM completed targeted surveys for the Boggomoss Snail between 28 June and 2 July 2010 to gather further information on the spatial distribution and population size of the Boggomoss Snail within the Dawson River catchment. The objectives of this survey were to:

- locate any additional populations of the Boggomoss Snail throughout the Dawson River catchment, including outside the range of historic search effort and within areas considered to represent marginal habitat;
- discuss previous population size estimates within its distribution and make comparison between the methodologies employed by BAAM and SKM;
- provide population estimates for newly discovered populations; and
- provide a preliminary assessment of newly identified habitat areas for translocation purposes.

A total of 25 new sites were surveyed (additional to those previously surveyed) for the Boggomoss Snail within the middle Dawson River catchment including the Dawson River itself between Taroom and Baralaba (Figure 11-2). The SKM methodology for population estimate based on available habitat was employed. Further detail on the methodology and survey sites is included in Appendix 11-D.

The location of the Boggomoss Snail survey sites for the collective surveys undertaken by BAAM, SKM and JKR Ecological are shown in Figure 11-2. It should be noted that JKR represents a former SKM staff member so there has been consistency in field staff throughout the Project.

Since the last survey (July 2010), a major flood event occurred in January 2011. Flood is recognised as a major risk to the Boggomoss Snail, and this may have affected the population numbers in both the Mt Rose boggomosses and the riparian habitats. However the snail has maintained populations in riparian habitat to the time of the surveys so is apparently able to survive and recover from such events.



LEGEND

- Weir
- Watercourse
- Major Roads
- Full Supply Level (183.5 m AHD)
- JKR (2010) Snail Survey Sites
- SKM (2009) Snail Survey Sites
- BAAM (2008) Snail Survey Sites

Projection: GDA94 Zone 56

Figure 11-2

0 5 10 20
Kilometres

N

Scale 1:700,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Location of Boggomoss Snail survey sites

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Pipeline

The study area for the proposed pipeline was defined as a 100 metre (m) corridor centred on the relevant sections of the Warrego Highway, Leichhardt Highway and Nathan Road, as well an alignment from Wandoan to Chinchilla. The width of the road reserves varies considerably over the length of the pipeline from more than 50 m along the highways to only 4-5 m along Nathan Road. The 100 m study corridor was considered sufficient to capture the variability in road reserve width and to provide an indication of habitats outside the corridor, acknowledging that the actual construction corridor will predominantly be only 30 m wide. This also meant that minor alignment changes could be assessed as a result of the field surveys.

Selection of potential sites in which to conduct rapid habitat assessments was primarily completed through an inspection of the Regional Ecosystem (RE) mapping and aerial photography for the corridor, which provided an indication of the nature and extent of fauna habitats. RE mapping is presented at 1:100 000 scale. At this large scale there are patches of vegetation that are too small or too narrow to be identified by this mapping process; however, this limitation is overcome by field surveys.

Within portions of the pipeline corridor, much of the existing remnant vegetation cover has been cleared for pasture or cultivation. Much of the remnant vegetation remains in narrow strips (which can be long) along watercourses and within road reserves. Although these strips can be degraded they often contain valuable habitat for wildlife and provide essential connectivity to large remnants within an otherwise highly fragmented landscape (EPA, 2002). Between Wandoan to Chinchilla the pipeline corridor passes through a large forested area connecting Barakula State Forest and Gurulmundi State Forest.

Therefore, in order to adequately describe the terrestrial fauna habitats along the pipeline corridor, a combination of sites within remnant vegetation and within linear patches (including riparian corridors) were assessed.

Nevertheless, the RE data are useful in defining fauna habitats occurring within the locality. In addition, most threatened species are more likely to be found in or around remnant vegetation than in non-remnant or disturbed habitats. The REs within a 100 m buffer along the pipeline corridor were analysed and grouped according to broad habitat types that are likely to influence fauna assemblages. These habitats were identified as preferred sites to conduct the habitat assessments. Table 11-2 identifies these habitat types and their equivalent REs.

Table 11-2 Habitat types occurring along the pipeline corridor

Vegetation Structure[1]	Habitat Type	Equivalent Regional Ecosystems
Very Sparse	Queensland blue grass grassland with brigalow clumps on sedimentary rocks	11.9.12
Sparse	Mixed eucalypt woodland on floodplains / wetlands	11.3.2, 11.3.3, 11.3.4, 11.3.21, 11.3.27
	Acacia woodland on scarps	11.7.2
	Eucalypt woodland on granite	11.7.5, 11.9.7, 11.9.2, 11.10.7
	Poplar box / brigalow on alluvium	11.3.17, 11.3.18
	Eucalypt woodland on sand	11.3.39, 11.5.9

Vegetation Structure[1]	Habitat Type	Equivalent Regional Ecosystems
Mid-dense	Open forest	11.10.1, 11.4.12
	Cypress pine / eucalypt woodland on alluvium	11.3.19
	Fringing riparian woodland	11.3.25, 11.3.26
	Eucalypt / cypress pine / she-oak woodland on sand	11.5.1, 11.5.4, 11.5.21, 11.10.9
	Eucalypt woodland on duricrusts	11.7.4, 11.7.6, 11.7.7
	Brigalow / poplar box open forest	11.9.10, 11.9.1
	Brigalow / belah on cracking clays or gilgai	11.4.3, 11.9.5
	Brigalow on sedimentary rocks	11.9.6
Dense	Semi evergreen vine thickets	11.9.4, 11.8.3
Variable	Regrowth vegetation or remnant vegetation below the RE mapping threshold	Non-remnant

[1] Vegetation Structure – as listed in the REDD (EPA, 2007)

Survey methods - pipeline

The fauna habitat assessment aimed to qualify the habitat types occurring within the pipeline corridor and particularly the suitability for threatened species. Rapid habitat assessment proformas were completed at each of the sites selected during the desktop selection process. The proformas have been developed to assess general vegetation structure and composition and those habitat features that are known to influence the use of a site by fauna. Habitat features were assessed within a one hectare plot and included:

- presence / abundance of hollow-bearing trees (live or dead);
- size and number of surface rocks / rock piles;
- approximate coverage and depth of leaf litter;
- structure and diversity of vegetation;
- presence of waterways or wetlands and associated flora;
- presence of riparian vegetation and roost sites in wetlands for waterbirds;
- presence of black cracking clay soils;
- presence of caves or other roost sites for microchiropteran bats; and
- presence of mistletoe.

At all rapid habitat assessment sites and some opportunistic sites, dedicated searches for fauna were conducted over a 5000 m^2 area, with an emphasis on searching for threatened species. Diurnal searches involved the following:

- turning logs and rocks and searching underneath bark and bark piles at the base of trees for reptiles and amphibians;
- fifteen minute point count surveys for birds, whereby the observer stands in the centre of the plot and records all birds seen and heard within the plot. Birds outside the plot and fly-overs were noted as such; and
- searches for scats, tracks and other signs (e.g. scratch marks, feeding scars) of mammal activity within the plot.

In addition to the diurnal searches, nocturnal searches were undertaken using vehicle based transects (excluding section from Wandoan to Chinchilla). Spotlighting from a vehicle travelling at slow speeds was used as this technique is an effective survey method for detecting frogs, reptiles and some nocturnal birds (i.e. nightjars).

Opportunistic sites were also assessed along the pipeline and are defined as those sites where brief observational notes on broad habitat conditions or ecological features of interest were noted (e.g. a wetland adjacent to the pipeline corridor).

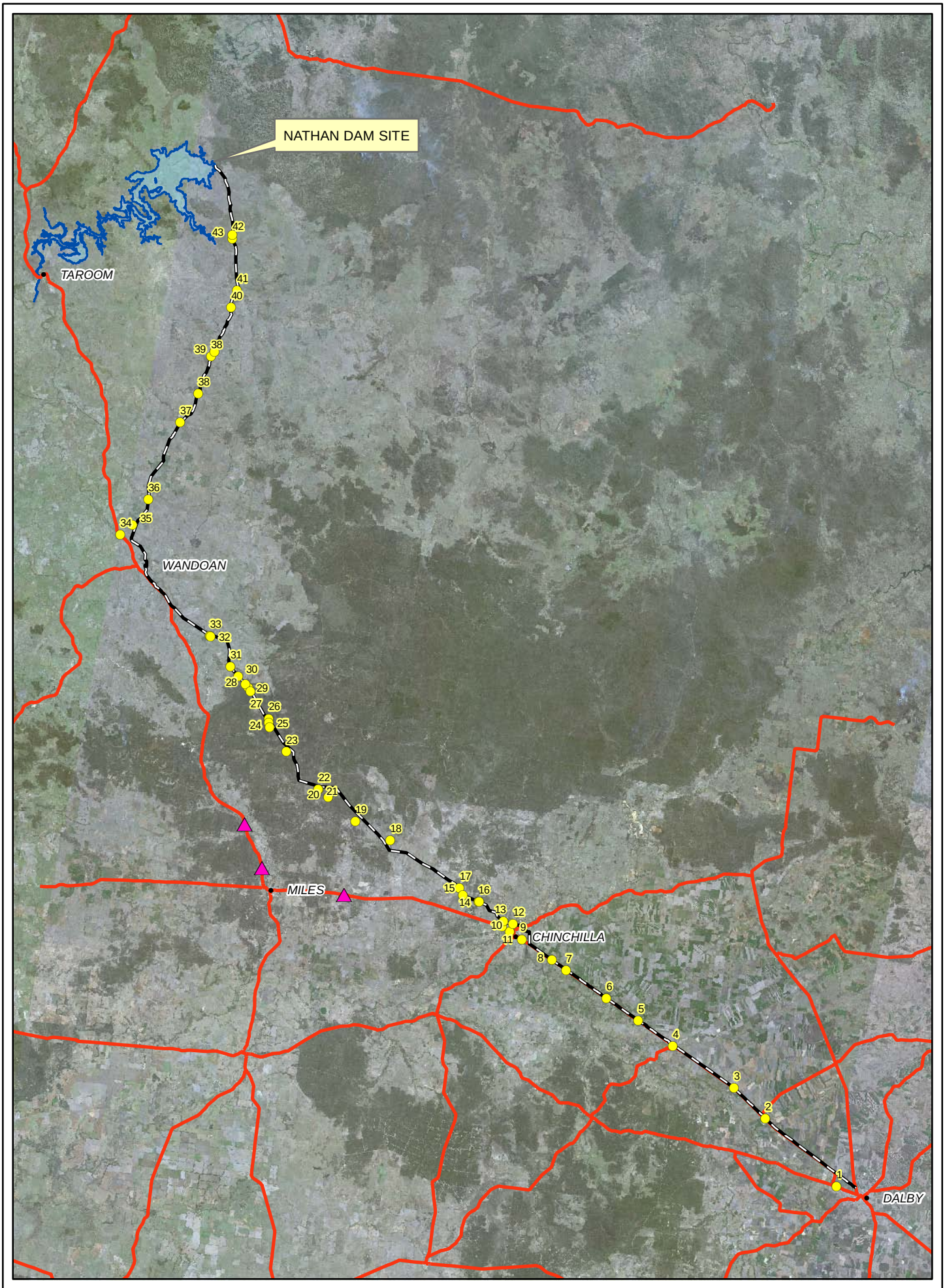
Timing and survey effort

The field survey of the pipeline corridor was completed by SKM over five days between the 12-16 May 2008 by two ecologists. Twenty-five rapid habitat assessment sites and 25 opportunistic sites were completed during the survey period.

A second field survey was undertaken to assess the realignment of the pipeline between Wandoan and Chinchilla. This was completed by SKM over four days between 7 and 10 June 2010 by two ecologists. The survey periods were during winter and therefore focussed on evaluating habitat suitability for fauna, rather than searching for fauna species, due to seasonal limitations in the detection of fauna along the pipeline route.

The location of survey sites on the pipeline corridor is shown in Figure 11-3 and a description of sites included in Appendix 11-A.

Since the field survey of the pipeline was undertaken in June 2010, there have been minor realignments made to the pipeline route. For these areas, the RE mapping has been consulted for the determination of potential fauna habitat. These areas will need to be surveyed during the approval process for the Project.



LEGEND

- Towns of Interest
- Fauna Survey Sites
- Golden-tailed Gecko
- Proposed Pipeline
- Major Roads
- Full Supply Level (183.5m AHD)

Projection: GDA94 Zone 56

Figure 11-3

0 5 10 20
Kilometres

N

Scale 1:900,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Pipeline survey sites

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11.1.3. Dam and surrounds

11.1.3.1. Desktop review

Several studies report on surveys of invertebrate and vertebrate fauna within the region, however, the scale and intensity of the surveys vary.

The first detailed study of the vertebrate fauna in the Taroom region was completed by Crossman and Reimer (1986) who surveyed the area from 1977 to 1979. They identified 328 species in total comprising 19 frogs, 52 reptiles, 209 birds and 48 mammals, including 14 threatened species. Although this study covered a far larger area than completed for the current assessment, it effectively encompassed portions of the current study area and the species documented by Crossman and Reimer provides valuable baseline data for the recent faunal history of this area.

Comprehensive fauna surveys were undertaken by various consultants from 1996 to 1997 in response to a previous proposal to dam the Dawson River (then named the Dawson Dam). The water storage for the original dam investigation is slightly different to that currently proposed due to the location of the dam wall further downstream from that currently proposed and an increased dam height (to 185.3 m AHD). Nevertheless, many of the sites used by these surveys are relevant to the current study.

Ison Environmental Planners (1996)

Ison completed two surveys of vertebrate fauna from four sites (Taroom Town Common, Munbulla Bridge, above Nathan Gorge and Cockatoo Creek), whilst the October survey included three sites downstream of the original dam wall location (Precipice Creek, Bottletree Scrub and Cabbage Palm Creek). These surveys identified a total of 152 fauna species, including the Little Pied Bat (*Chalinolobus picatus*), which is listed as near threatened in Queensland and was the only threatened species detected (Table 11-3).

Queensland Museum

A Queensland Museum survey for the Dawson Dam targeted macro invertebrates (land snails, terrestrial isopods, spiders and insects) and vertebrates of the GAB springs of the Taroom region. GAB springs (or boggomosses) are depressions within the landscape that are fed by upwellings from the Great Artesian Basin. GAB springs support a diversity of plant species that are unique from the surrounding vegetation communities, which in turn support an often unique invertebrate assemblage, including the critically endangered Boggomoss Snail (*Adclarkia dawsonensis).*This species is not restricted to such springs however. Vertebrate diversity was not considered to be uniquely influenced by GAB springs other than as a water source and a dry season refuge for frogs (Ingram, 1997).

Hyder Environmental (1997)

Hyder completed a fauna study of the original dam impact area over four primary sites (Taroom Town Common, Glebe Weir, Nathan Gorge and Bundulla Road). An additional five sites were surveyed opportunistically throughout the survey period including, Spring Creek, further downstream of Nathan Gorge, Lake Murphy Conservation Reserve, roadside vegetation four km north of Taroom and cleared paddocks. Two threatened species were observed, namely the Squatter Pigeon (*Geophaps scripta scripta*) and Cotton Pygmy-goose (*Nettapus coromandelianus*).

Queensland Parks and Wildlife Service (2002)

The Queensland Parks and Wildlife Service (QPWS) completed a study of the vertebrate fauna of the lower Dawson Floodplain in 2002 (Venz et al. 2002). Although this study is not directly comparable with the current fauna study, many fauna species are expected to complete seasonal dispersal along the Dawson River and are likely to utilise similar habitats along the Dawson River floodplain. The QPWS study identified a total of 327 species (44 mammals, 203 birds, 61 reptiles, and 19 amphibians) within the study area, including 58 species of conservation significance. Thirteen of these species are currently listed as threatened species under Queensland and/or Commonwealth legislation (Table 11-3).

A complete list of fauna (threatened and common species) potentially present in the study area was compiled from the literature review and included all records from fauna database searches (Appendix 11-A). The list includes 24 amphibians, 78 reptiles, 212 birds, 41 mammals and two invertebrates which are of conservation significance for a total of 366 species. Due to the much larger study area, non-threatened fauna listed in Crossman and Reimer (1986) and the QPWS (2002) studies were not included. Twenty-seven threatened species are included (Table 11-3). These include two invertebrates, seven reptiles, 14 birds and five mammals.

Table 11-3 Threatened fauna potentially present in the Taroom region

Species	Common Name	NC Status[1]	EPBC Status[2]
INVERTEBRATES			
Adclarkia dawsonensis	Boggomoss Snail	LC	CE
Jalmenus eubulus	Imperial Hairstreak (northern subspecies)	V	-
AMPHIBIANS			
Cyclorana verrucosa	Rough Frog	NT	-
REPTILES			
Acanthophis antarcticus	Death Adder	NT	-
Denisonia maculata	Ornamental Snake	V	V
Egernia rugosa	Yakka Skink	V	V
Furina dunmalli	Dunmall's Snake	V	V
Paradelma orientalis	Brigalow Scaly-foot	V	V
Rheodytes leukops	Fitzroy Tortoise	V	V
Strophurus taenicauda	Golden-tailed Gecko	NT	-

Species	Common Name	NC Status[1]	EPBC Status[2]
BIRDS			
Accipiter novaehollandiae	Grey Goshawk	NT	-
Calyptorhynchus lathami	Glossy Black Cockatoo	V	-
Ephippiorhynchus asiaticus	Black-necked Stork	NT	-
Erythrotriorchis radiatus	Red Goshawk	V	V
Falco hypoleucos	Grey Falcon	NT	-
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	V	V
Lophoictinia isura	Square-tailed Kite	NT	-
Melithreptus gularis	Black-chinned Honeyeater	NT	-
Neochmia ruficauda ruficauda	Star Finch (eastern)	E	E
Nettapus coromandelianus	Cotton Pygmy-Goose	NT	-
Ninox strenua	Powerful Owl	V	-
Rostratula australis	Australian Painted Snipe	V	V
Stictonetta naevosa	Freckled Duck	NT	-
Turnix melanogaster	Black-breasted Button-quail	V	V
MAMMALS			
Chalinolobus dwyeri	Large Pied Bat	V	V
Chalinolobus picatus	Little Pied Bat	NT	-
Dasyurus hallucatus	Northern Quoll	LC	E
Petrogale penicillata	Brush-tailed Rock Wallaby	V	V
Nyctophilus timoriensis	Eastern Long-eared Bat (south-eastern form)	V	V

1 Queensland status under the *Nature Conservation (Wildlife) Regulation 2006*: E = Endangered; V = Vulnerable; NT = Near Threatened; LC = Least Concern

2 Commonwealth status under *Environment Protection and Biodiversity Conservation Act 1999*: CE = Critically Endangered; E = Endangered; V = Vulnerable

Five threatened species that were identified by Crossman and Reimer (1986) were absent from the database searches, although this is expected given the much smaller search area that was used to interrogate the databases. One of these species, the Brush-tailed Rock Wallaby (*Petrogale pencillata*), was noted by Crossman and Reimer (1986) as common on the rocky slopes and cliff lines of the lower Dawson River. However, further taxonomic studies on the eastern *Petrogale* complex has identified a number of new species that were originally grouped as Brush-tailed Rock-Wallabies. This record is therefore more likely to be attributable to the more recently named Herbert's Rock-Wallaby (*Petrogale herberti*) (Eldridge and Close, 1992). This species is listed as least concern under the Queensland NC regulation.

There are a couple of small patches of essential habitat for the Imperial Hairstreak located in the dam study area, east of Taroom.

11.1.3.2. Distribution of fauna habitats

The landscape within the study area is a mix of predominantly cleared grazing lands and improved pasture for beef production and remnant vegetation. Cleared land comprises 52% of the total water storage. Chapter 10 of the EIS

provides a detailed account of the extent and area of remnant and non-remnant vegetation communities within the water storage.

The study area is characterised by a number of low ridges, hills and floodplains adjacent to the Dawson River. A number of tributaries flow to the Dawson River several of which will be inundated to varying lengths in their lower reaches by the dam. A short distance downstream of the proposed dam wall is Nathan Gorge, which is a largely undisturbed area characterised by sandstone cliffs and ledges surrounding river red gum (*Eucalyptus camaldulensis*) and paperbark (*Melaleuca* spp.) riparian wetlands. The Dawson River passes through Precipice National Park and eventually is impounded by the Gyranda Weir, approximately 30 km downstream of Nathan Gorge. When the weir reaches capacity water backs up to the proposed dam wall site, periodically inundating the river red gum wetlands within Nathan Gorge.

The study area is situated within a highly fragmented landscape that has been subject to historical clearing practices for improved pasture and livestock grazing and more recently for the clearing of regrowth vegetation. These land uses and land management practices have resulted in a matrix of remnant and non-remnant vegetation patches within an agricultural landscape. The largest patches remain at Taroom Town Common, Nathan Gorge and Spring Creek. Smaller patches are located to the north-west of Glebe Road, on some of the smaller hills and ranges, along major road reserves and along the Dawson River and major tributaries (such as Cockatoo Creek), although these are either patchy or narrow, linear remnants. Large remnants are also centred around Precipice National Park which is part of a largely intact green belt that includes Isla Gorge National Park and Theodore State Forest to the north and Rockybar State Forest to the south.

Broad fauna habitats within the dam study area include:

- River red gum and/or Queensland blue gum woodland on alluvium - Tall open forest of river red gum (*Eucalyptus camaldulensis*) and/or Queensland blue gum (*E. tereticornis*) of the Dawson River and tributaries. This community contains a relatively high density of large, old trees, including many with hollows of varying sizes and stages of formation. The lower vegetation layers are generally absent to sparse, with a dense cover of grasses particularly on stream banks. A moderate coverage of fallen timber was observed at most sites, including large branches and logs. Large surface rocks were generally absent within this community apart from occasional isolated rocks and several outcroppings within Nathan Gorge and at the proposed dam wall site;
- Cypress Pine and/or ironbark on sands - This community occurs as a large patch close to the proposed dam site and surrounding the Nathan Gorge area being dominated by cypress pine (*Callitris glaucophylla*) with occasional emergent narrow-leaved red ironbark (*E. crebra*). She-oaks (*Allocasuarina* spp.) form a dominant mid-storey layer and become dense in patches. The under-storey is generally comprised of sparsely spaced shrubs with a low to moderate coverage of leaf litter. There is a low presence of fallen timber and an absence of large surface rocks;
- Coolabah woodland on alluvium - This community occurs as fragmented patches throughout the study area, predominantly on the low floodplains of the Dawson River and associated tributaries. It is a woodland community with often a monoculture of Coolabah (*E. coolabah*) forming the canopy and sparse midstorey and understorey strata. The ground cover is generally grassy with a low to moderate abundance of fallen timber and some patches contain wetland plants, e.g. rushes and sedges;

- Brigalow and/or belah open forest with occasional emergent eucalypt species on clay or sand - This community has been extensively degraded and remains as small, fragmented patches throughout the study area. Brigalow (*Acacia harpophylla*) often forms a dense canopy with belah (*Casuarina cristata*) and mixed eucalypt species may exist as an emergent layer. The midstorey is at a generally moderate coverage and the ground cover is composed of a sparse to moderate layer of leaf litter. Some patches of brigalow woodland were found to contain elements of semi-evergreen vine thickets such as bottle trees (*Brachychiton rupestris*) and scrub leopardwood (*Flindersia dissosperma*) although grazing by cattle has removed much of the understorey and ground cover diversity; and
- Boggomosses (GAB springs) - The GAB springs are upwellings from Artesian waters and are semi-permanent waterholes with associated aquatic plant growth. The habitat value of these springs for terrestrial fauna is limited to the condition of existing vegetation surrounding the springs, for providing a water source in dry seasons and as a potential breeding site for frogs. Two boggomoss areas within the study area are listed on the Register of the National Estate and these will be affected by the Project.

Other habitats within the study area include waterbodies and wetlands. The major waterbody in the study area is the lake created by Glebe Weir, which lies upstream of the proposed Nathan Dam site, but within the proposed water storage. Glebe Weir was overflowing at the time of the fauna survey as a result of good summer/autumn rainfall. The lake provides some habitat features for waterbirds (such as dead standing timber and surrounding eucalypt communities).

Wetland areas include river red gum and paperbark communities within Nathan Gorge, lowland floodplains adjacent to the Dawson River and smaller wetlands with fringing cabbage tree palm (*Livistona australis*) near Taroom and along creeks and streams.

11.1.3.3. Wildlife corridors and core habitats

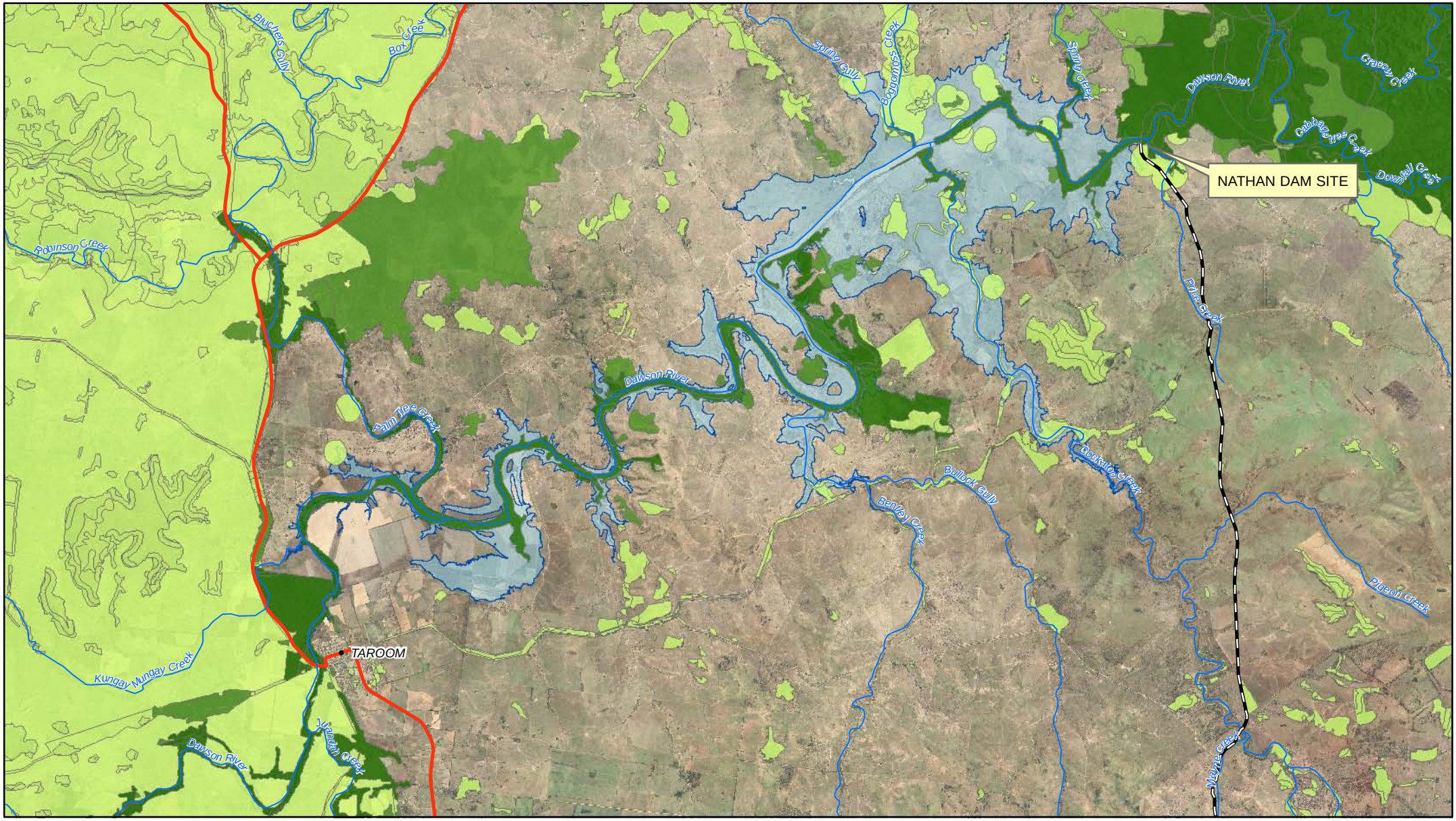
Review of the BPA data for the BBS Bioregion showed that very few vegetation patches within the dam study area are ascribed a high corridor value (Figure 11-4). Notable patches include Nathan Gorge and Precipice National Park, Taroom Town Common and the Dawson River which is an east-west corridor through the dam study area. North-south corridors across the dam study area are generally absent. Palm Tree Creek provides some connection between the Dawson River and low-medium value habitat to the north. A major north-south connection is located approximately 10 km downstream of the dam wall which encompasses Precipice National Park and Isla Gorge National Park. A narrow low value east-west corridor also exists along Cracow Road approximately 5-10 km south of the Dawson River.

Movement opportunities for fauna through the landscape west of the dam wall are therefore limited to areas of relatively continuous canopy cover such as within road reserves and vegetated waterways.

11.1.3.4. Fauna diversity

Two hundred and sixteen species of vertebrate fauna were recorded in the current study, comprising 16 amphibians, 37 reptiles, 125 birds, 21 non-flying mammals and 17 bats. At a regional level this represents 67% of the known regional fauna (54% of amphibians, 50% of reptiles, 50% of birds and 77% of mammals). Overall species richness between survey sites averaged 20 species per site (Table 11-4) but was highest around Glebe Weir, primarily as a result of high bird diversity.

A full list of species recorded is provided in Appendix 11-A. The location of records of significant vertebrate fauna species across the study area is shown in Figure 11-5. Species profiles for significant species are also included in Appendix 11-A.



LEGEND

- Towns of Interest
- Proposed Pipeline
- Major Roads
- Watercourses
- Full Supply Level (183.5m AHD)

Biodiversity Planning Assessment

- Low
- Medium
- High
- Very High

Projection: GDA94 Zone 56

Figure 11-4

0 1 2 4
Kilometres

N

Scale 1:200,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Wildlife corridors - dam study area

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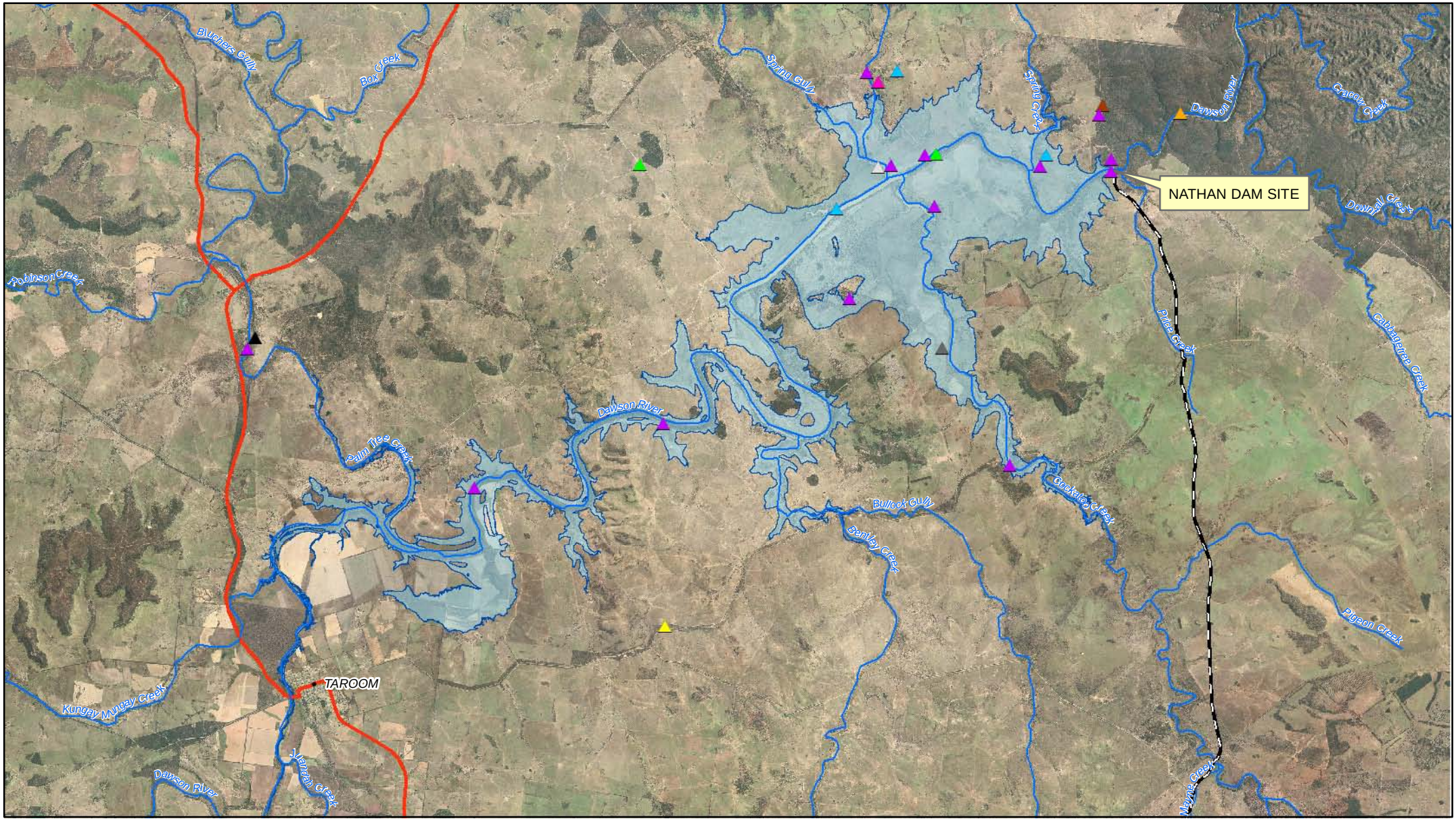

LEGEND

- Towns of Interest
- Proposed Pipeline
- Major Roads
- Watercourses
- Full Supply Level (183.5m AHD)

Significant Fauna Locations

- Black-chinned Honeyeater
- Brigalow Scaly-foot
- Golden-tailed Gecko
- Grey Falcon
- Grey Snake
- Painted Honeyeater
- Rough Frog
- Short-necked Worm-skink
- Squatter Pigeon
- Little Pied Bat

Projection: GDA94 Zone 56

Figure 11-5

0 2 4
Kilometres

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Scale 1:200,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Threatened fauna locations - dam study area

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Table 11-4 Vertebrate fauna species richness by survey site

Site Number	Name	Amphibians	Reptiles	Birds	Non-flying Mammals	Bats	Total
1	Dam Wall Site	4	4	18	5	4	35
2	Nathan Gorge	3	3	8	4	3	21
3	Poplar Box on sand (Glebe Homestead)	3	1	58	5	9	76
4	Coolibah (Glebe Homestead)	5	2	26	2	2	37
5	Mid Cockatoo Ck (west)	2	4	7	3	1	17
6	Upper Cockatoo Ck (Cracow Rd)	5	3	18	6	3	35
7	River Red Gum (Dawson River south)	4	0	1	10	6	21
8	Bundulla Road (Dawson Crossing)	2	0	0	4	1	7
9	Boggomoss Reserve	3	4	9	5	2	23
10	Glebe Weir	5	3	27	10	4	49
11	Spring Creek (Spring Ck Station)	5	2	22	8	4	41
12	Cypress Pine (Spring Ck Station)	1	5	12	8	4	30
13	Brigalow (Spring Ck Station)	0	3	15	7	3	28
14	Chain Lagoons	4	2	19	8	4	37
15	Mid Cockatoo Ck (east)	3	3	14	1	2	23
16	Upper Cockatoo Ck (east)	0	0	14	0	0	14
17	Brigalow Patch (Cockatoo Ck)	2	2	28	0	1	33
18	Belah Patch	0	0	0	0	0	0
19	Poplar Box (Cracow Rd)	0	0	0	0	0	0
20	Dawson River Billabong	1	1	20	2	1	25
21	Bottle Tree Scrub	0	0	7	0	0	7
22	Lower Cockatoo Ck (east)	5	1	36	0	0	42
23	Dawson River (south)	1	1	22	0	0	24
24	Coolibah Floodplain	0	0	0	0	0	0
25	Blue Gum Wetland (Mt Rose)	5	1	19	1	0	26
26	Blue Gum (Mt Rose)	1	0	17	2	0	20
27	Blue Gum GAB Spring (Mt Rose)	3	2	8	2	1	16
28	Other GAB Springs (Mt Rose)	4	0	2	0	0	6

Site Number	Name	Amphibians	Reptiles	Birds	Non-flying Mammals	Bats	Total
29	Spring Gully (Mt Rose)	1	1	30	5	3	40
30	Palm Tree Creek (Leichhardt Hwy)	2	1	14	0	0	17
31	Unnamed Creek (Spring Ck Station)	0	3	12	0	0	15

Species richness by habitat type

Table 11-5 shows the median number of species within each fauna group recorded at each site and grouped according to broad habitat types. The most species rich habitat type overall was the Poplar Box woodland community with a mean of around 55 species compared with the GAB springs which are ranked as the least species rich at 11 species.

Table 11-5 Mean species richness by fauna group and broad habitat types ranked from highest to lowest

Site Name (no. of survey sites)	Amphibians	Reptiles	Birds	Non-flying Mammals	Bats	Mean no. of species
Poplar box woodland (3)	4	2	38	6.5	5	55.5
Cypress pine on sand &/or Ironbark woodland (1)	1	5	12	0	12	30
River red gum &/or Queensland blue gum woodland (13)	3	1	17	0	6	24
Coolabah woodland on alluvium (6)	1.5	1.5	10.5	1.5	0	20
Brigalow &/or belah open forest (6)	0	2.5	9.5	0	0.5	15
GAB springs (4)	3.5	1	5	0	1.5	11

Seasonal variation

Twenty five species were added to the summer/autumn fauna list as a result of the winter survey. These included five amphibians, three reptiles, 13 birds and two mammals. Fauna of note observed during this survey included the Short-necked Worm-Skink (*Anomalopus brevicollis*), which is listed as least concern in Queensland (formerly rare), the Barking Owl (*Ninox connivens*), which DERM considers a non-EVR priority taxa in the BBS and the Koala (*Phascolarctos cinereus*), which is considered a 'special least concern animal' under the Queensland NC Regulation (formerly known as culturally significant wildlife). Two bird species are winter migrants to the Taroom region, Fairy Martin (*Hirundo ariel*) and Silvereye (*Zosterops lateralis*), although a proportion of the Silvereye population can be sedentary within southern Queensland (Pizzey and Knight, 2007).

11.1.3.5. Invertebrates of conservation significance

Boggomoss Snail

One invertebrate of conservation significance is known to occur within the dam study area, the Boggomoss Snail (*Adclarkia dawsonensis*). As discussed in Section 11.1.2.4, a series of surveys have been undertaken to assess the distribution and population size of the Boggomoss Snail in the region.

The results of the BAMM (2008) survey are contained in Appendix 11-B. A summary of the survey findings are provided below:

- the size of the Mt Rose Station population was revised to greater than 350 individuals, up from an estimated less than 100 individuals;
- two additional populations of the snail were identified on GAB springs on Mt Rose Station but the number of snails found was too low to allow an estimate of the population size;
- the known range of the Isla-Delusion population was extended to include upstream habitat along the Dawson River;
- the microhabitat preference of the species was revised to include deep, moist accumulated litter and including under fallen timber but no restriction to particular tree species was noted;
- the preferred habitat of the Boggomoss Snail was confirmed as the alluvial flats (floodplains) of the Dawson River between Taroom and Theodore which have largely been cleared for farming. Historical records indicate these gilgaied black soils supported brigalow (a closed canopy vegetation community) which probably formed the core area of the snail's original distribution, a view supported by the habitat preference of its sister species (*Adclarkia cameroni*) on the Condamine River in similar brigalow communities;
- boggomoss and riparian habitats are considered secondary but significant habitats in the context of historical habitat loss; and
- predation by mice and rats was seen as a significant factor affecting the Boggomoss Snail based on the numbers of predated shells recovered and the results of a limited trapping program during the survey.

The results of the SKM (2009) survey are contained in Appendix 11-C. A summary of the survey findings are provided below:

- 32 live snails were found at 12 sites within the riparian zone of the Dawson River from Nathan Gorge to approximately 10 km upstream of Theodore, and shells were collected from a further four sites;
- breeding populations of the snail, designated by the presence of adults and juveniles, were located at Isla-Delusion Camping Reserve, Lagoona and on Southend, approximately 8 km downstream from Isla-Delusion. In addition, several large intact habitat patches were located downstream;
- most snails were collected from within 50 m of the banks of the Dawson River within open to closed forests of Carnarvon Palm (*Livistona nitida*). Typical microhabitats included under deep leaf litter at the base of Queensland Blue Gum (*Eucalyptus tereticornis*), Carnarvon Palm,Sandpaper Figs (*Ficus opposita* and *F. coronata*) and Green Kamala (*Mallotus cloaxyloides)*, under accumulations of decaying Carnavon Palm fronds and under rotting logs. This observation supported the micro-habitat preference comments of BAAM; and

- population estimates were obtained for four populations of the Boggomoss Snail; Dawson River upstream of Gyranda Weir, Isla-Delusion Camping Reserve / Lagoona, an ephemeral wetland at Southend and a Dawson River Anabranch at Southend (Table 11-6). Population estimates were calculated based on the area of habitat in which live snails were found (patch specific density). The estimates did not include habitats in which only shells were found, those sites that were yet to be searched or sites at which live snails were found but the habitat patch was too small to support a full transect. Further information on the methodology used for the density estimates is provided in Appendix 11-C.

The results of the JKR Ecological (2010) survey are contained in Appendix 11-D. The JKR report provides new data, synthesises the findings from all surveys to date and provides a revised estimate of the population size of the Boggomoss Snail.

A summary of the survey findings are provided below:

- the Boggomoss Snail was recorded from two new sites (Ad9 and Ss12), both of which are located on the property Southend. Significantly, one site was found to support a relatively high abundance of Boggomoss Snails. Although clearly affected by flooding and extended inundation, the occupied habitat at Southend supported a reasonable cover of leaf litter and flood debris;
- population transects were completed at the two new sites;
- an additional area of habitat has been included within the estimate of overall habitat for the species at Southend (Table 11-6); and
- searches under six sandpaper figs at survey site Ss12 (Southend) did not find any live Boggomoss Snails and only one dead sub-adult Boggomoss Snail. Searches under Sandpaper Figs at Ad 9 (Isla Delusion Crossing) also yielded zero return. As no data were obtained from the BAAM method, no attempt was made to extrapolate population estimates for the patch.

In summary, a total of 187 sites in the Dawson River catchment have been surveyed between 2008 and 2010 through the collective efforts of BAAM, SKM and JKR Ecological. This has covered most potential habitat sites within the region, though some areas of potential habitat on private property have not been assessed. The species (live snails) has been recorded from 17 sites, increased from the original two sites identified in the Recovery Plan for the species (Stanisic, 2008). The distribution of records (showing both live snails and shells) is illustrated in Figure 11-6.

Population estimates have been obtained for six sites at which breeding occurs; Mt Rose Station, Isla-Delusion Camping Reserve, Southend Station (x 3 sites) and Gyranda. Breeding was denoted by the presence of live juvenile and adult snails. With the exception of Mt Rose, these sites all occur within the Dawson River riparian zone downstream of Nathan Gorge. The Mt Rose and Dawson River sites are likely to comprise two distinct subpopulations because of their isolation from each other and their limited chances of reconnection. They were probably part of the same population prior to clearing of the land for farming. The Mt Rose subpopulation is made up of three sites associated with three separate GAB spring wetlands. The Dawson River subpopulation is made up of five sites at Isla-Delusion Camping Reserve, Southend Station (x 3) and Gyranda. Although separate, these sites are connected by the Dawson River riparian corridor and are therefore likely to have genetic exchange during flooding.

Population estimates for breeding sites are provided in Table 11-6. The Mt Rose population estimate is based on the BAAM microhabitat density. The Dawson River population estimates are based on the SKM patch-specific densities. The standard error (SE) for the dataset was applied to the population estimate to give a population range. A detailed description of the methodology used in calculating these estimates is provided in Appendix 11-B for the Mt Rose population and Appendix 11-D for Dawson River populations.

Table 11-6 Boggomoss Snail population estimates

Site	Area Searched (m^2)	No. live snails	Habitat Area (m^2)	Snail Density (m^2)	Population Estimate	Population Range[1]
Mt Rose (BAMM, 2009)[2]	6 micro-habitats	22	7,500 100 micro-habitats	3.66 (per micro-habitat)	350	NA[3]
Isla Delusion (SKM, 2009)	100	8	143,986	0.08	11,519	8,844-14,193
Southend - Wetland (SKM, 2009)	20	6	1,073	0.3	322	302-342
Southend - Dawson River Anabranch & Wetland (JKR Ecological, 2010)	30	5	60,180	0.17	12,036	11,454–13,157
Gyranda (SKM, 2009)	20	1	70,164	0.05	3,508	2,204-4,811
Southend – Palm Grove (SKM, 2009)	100	2	103,071	0.02	2,061	147-3,976
Population Total			**385,974 m^2 38.59 ha**		**29,796**	**22,951-36,479[4]**

1 Population range based on population estimate multiplied by standard error to give a lower and upper limit

2 Population estimate for main Mt Rose boggomoss only.

3 Standard error not provided by BAAM

4 Population range does not include Mt Rose subpopulation estimate

The population estimate for the Boggomoss Snail has been calculated at 29,446 (standard error 22,951-36,479) for the Dawson River subpopulation and 350 for the Mt Rose subpopulation for which an estimate was made. Population estimates were not made for all sites where live snails were found, either because the habitat patch was too small to allow a population estimate by the SKM methodology, or the recorded snail densities were too low to allow a population estimate by the BAAM methodology. The population estimates are given separately due to the different methods used.

It is acknowledged that estimating the population size of a species that is cryptic and very patchily distributed is not precise, as indicated by the standard errors. The SKM method used was a standard sub-sampling approach but due to the different patch sizes, the sampling effort at each site was not uniform. More important than an exact population figure is the fact that the population is clearly significantly larger than originally thought and the species is far more widely distributed than originally thought (17 sites instead of 2).

The habitat preferences of the species are also broader than those considered historically. Broad habitat types in which the species currently occurs include the following:

- GAB spring wetlands with a canopy of Queensland Blue Gum and midstorey of Sandpaper Fig at Mt Rose Station;
- riparian forest associations within RE 11.3.25 on the Dawson River which support Queensland Blue Gum or River Red Gum with Carnarvon Palm as a co-dominant species in the canopy or a dominant sub-canopy species;
- monospecific stands of Carnarvon Palm on the Dawson River, including minor anabranch systems; and
- open forest of Queensland Blue Gum fringing ephemeral wetlands on the Dawson River floodplain.

These are considered to be refugial remnants of the historical core habitat of this species which has since been cleared. The microhabitat preferences of the species include under deep leaf litter at the base of Sandpaper Figs (at Mt Rose in particular), Queensland Blue Gums and Carnarvon Palms, under rotting logs and under accumulations of decaying palm fronds.

In terms of long-term population viability, the largest and most intact habitat systems occur downstream of the Isla-Delusion Crossing, particularly on the properties Lagoona (which is a part of the Isla-Delusion habitat) and Southend. A mix of adult and sub-adult snails has been reported from all of the known populations, indicating that conditions remain suitable for recruitment of individuals to those populations.

The snail surveys reaffirm the preferred habitat of the Boggomoss Snail as the black soil alluvial flats (floodplain) of the Dawson River between Taroom and Theodore. Historically, these were an extensive archipelago of habitats supporting a locally circumscribed vegetation community located between the stream-bound riparian habitats dominated by Carnarvon Palm and the drier scrubs of the surrounding hillsides (BAAM, 2008). According to the CSIRO land system maps (Speck, 1968) the Mt Rose alluvial flats were largely 'brigalow country on alluvium associated with the Dawson River'. The soils were depositional alluvium on deep cracking clays with gilgai formations. The vegetation was brigalow with some shrub understorey and associated grassland (Speck *et al.*1968). Since then, the landscape of the Dawson River floodplains has been highly modified for grazing and agriculture.

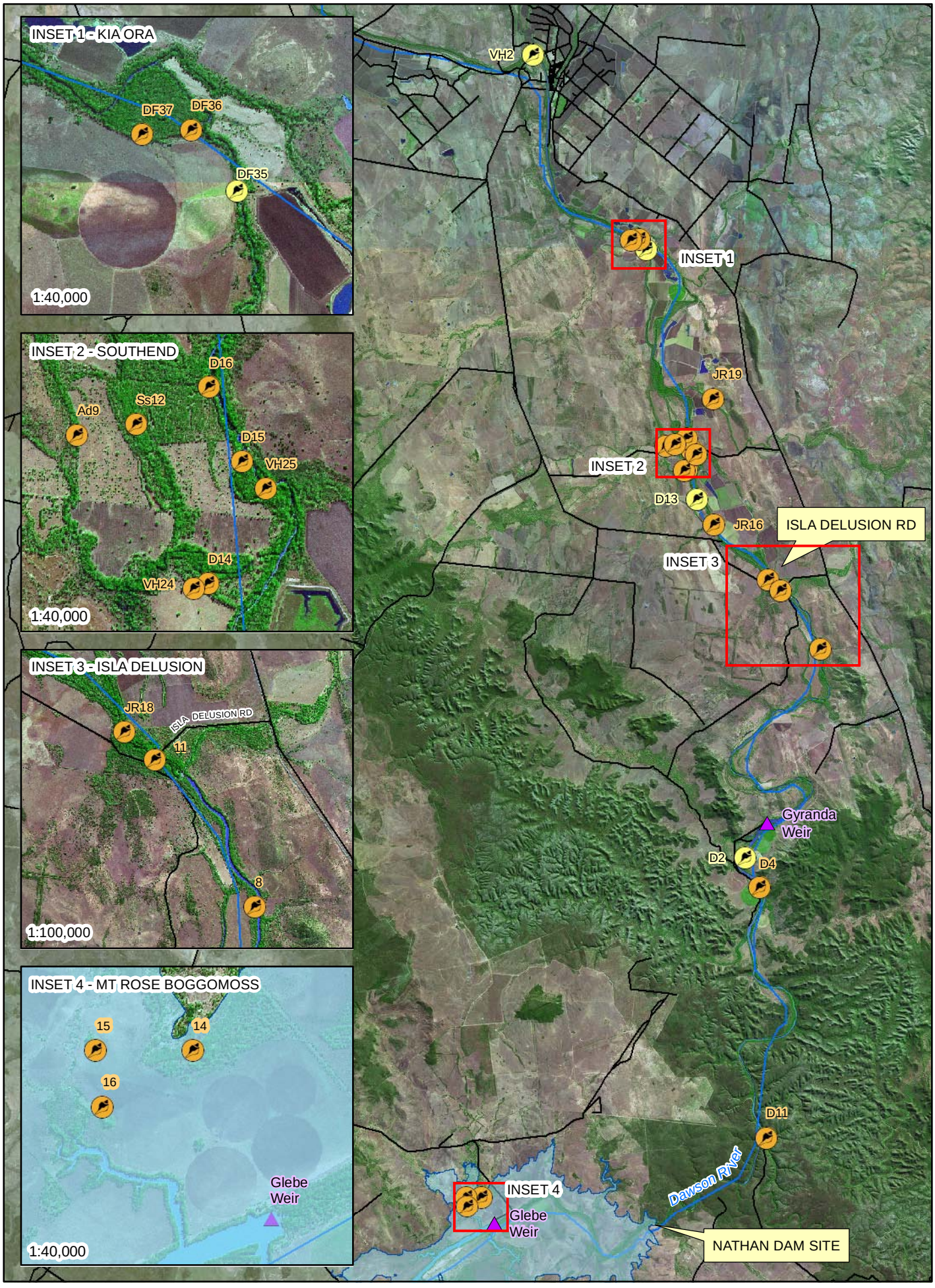
Stanisic (BAAM, 2008) suggests that these gilgaied brigalow habitats formed the historical core habitat of Boggomoss Snail. This theory is supported by the ecology of a sister species of the Boggomoss Snail (*Adclarkia* sp.) which lives in gilgaied brigalow habitats surviving in road verges in the Brigalow-Chinchilla area. This is a very similar looking snail to the Boggomoss Snail and with a very similar thin shell. The closed canopy of these brigalow communities, the associated deep accumulated litter and timber on the ground provide the necessary microhabitat for the survival of the snail. The gilgais help maintain a relatively stable moist environment because of their ability to retain moisture for extended periods after rainfall.

In this context, the Mt Rose boggomosses and stream-bound riparian habitats of the nearby Dawson River are refugial remnants of preferred habitats maintained by the moisture from the GAB springs or the riparian vegetation. It should be noted that the common name of the species is something of a misnomer because it is not restricted to boggomosses. Indeed it has only been recorded on three of the 30 or so boggomosses in the Dawson Valley. The Boggomoss and riparian habitats are considered secondary but significant habitats in the context of historical habitat loss. The Boggomoss Snail is able to survive near the boggomosses or Dawson River due to a combination of the moist environment (maintained through good ground cover and a relatively closed canopy) and the accumulation of deep litter and timber. Litter accumulations in the riparian habitat will occasionally be reduced because of the effects of intermittent

flooding while this poses less risk to the Mt Rose boggomosses. Riparian populations are threatened by floods which scour the snail's microhabitat and even drown the snails if there is extended submergence, and drying of the riparian habitat during drought (BAAM, 2010). Although to a lesser frequency, the Mt Rose population is also threatened by occasional flooding.

The completion of the JKR Ecological (2010) study following a major flood provided an insight into population persistence in the more dynamic riparian environments of the Dawson River. Live snails were located in riparian woodland which had been inundated to a depth of at least four metres for an extended period of time, indicating that riparian populations can, and do, survive major floods and/or rely on flooding to colonise riparian habitat patches. As a result, both the riparian and Mt Rose populations are expected to have survived the major flood that inundated the floodplain and Mt Rose boggomosses in January 2011.

The effects of the dam on downstream flows and flooding frequency are assessed in Section 11.2.1.1.



LEGEND

- Live Snails
- Shells
- Weir
- Watercourse
- Roads
- Full Supply Level (183.5m AHD)

Projection: GDA94 Zone 56

Figure 11-6

0 1.5 3 6
Kilometres

N

Scale 1:250,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Boggomoss Snail records

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Other invertebrate species

The Imperial Hairstreak Butterfly (*Jalmenus evagoras eubulus*) is a threatened butterfly, the larvae of which feed exclusively on brigalow phyllodes. Although the fauna survey did not target invertebrates other than the Boggomoss Snail, the Brigalow Invertebrate Site, which is not within the dam impact area, is noted as a significant habitat area for this species, and this species is likely to occur in Brigalow dominated vegetation communities.

11.1.3.6. Amphibians

Sixteen species of amphibian were found including one introduced species, the Cane Toad (*Rhinella marinus*). One species, the Rough Frog (*Cyclorana verrucosa*), is listed as near threatened in Queensland and was observed at the Glebe Weir site (Site 10) and in a GAB spring within pasture adjacent to The Bend Road. One species, the Salmon-sided Frog (*Limnodynastes salmini*), is considered by DERM to be a non-EVR priority taxa in the BBS bioregion (EPA, 2002a). This species has a patchy distribution east from near Chinchilla, but is relatively secure (abundant) to the west. Ephemeral wetlands are noted by the EPA's Fauna Expert Panel (EPA, 2002a) as being of importance to this species.

Two species, Green Tree-frog (*Litoria caerulea*) and Striped Burrowing Frog (*C. alboguttata*) were routinely encountered on roads during spotlighting over the summer/autumn survey. Other species were detected in or near creeks, waterholes and roadside drains where water from previous rainfall events remained. Tadpoles were also observed within these areas, although were not identified to genus. Amphibian activity throughout the summer/autumn survey period was generally high, although calling by males was significantly lower than was expected suggesting that the peak breeding period had passed.

Similar to most frogs, breeding by the observed species generally occurs during the warmer months of the year and is correlated with good rainfall events (Barker *et al.,* 1995). Exceptions to this include the Desert Tree Frog (*L. rubella*) and the Great Brown Broodfrog (*Pseudophryne major*) which can breed opportunistically throughout the year, depending upon rainfall.

Calling by males was concentrated at several sites during the winter survey, including Sites 25 (Qld Blue Gum woodland) and 27 (Qld Blue Gum GAB spring) and was dominated by Spotted Grass Frog (*L. tasmaniensis*) and Eastern Sign-bearing Froglet (*Crinia parinsignifera*).

The study area provides suitable habitat for a diversity of amphibians despite the intensive grazing pressures within the region. Remnant vegetation is generally found adjacent to creeks and along the Dawson River, which provides some habitat for stream-breeding frogs. Evidence of trampling of riparian vegetation by cattle and wild horses was noted. In addition, the pasturelands, particularly within floodplains, provide habitat for open grassland species (such as the Striped Burrowing Frog and Spotted Grass Frog) after good rainfall events.

11.1.3.7. Reptiles

Thirty-seven reptile species were identified including two freshwater turtles, six geckoes, 14 skinks, two pygopods (flap-footed lizards), ten snakes, two dragons and one monitor lizard.

Three threatened species were identified in the study area including:

- Golden-tailed Gecko (*Strophurus taenicauda*), which is listed as near threatened in Queensland;
- Brigalow Scaly-foot, which is listed as vulnerable under Queensland and Commonwealth legislation; and
- Grey Snake (*Hemiaspis damelii*), which is listed as endangered in Queensland.

Only the Grey Snake was recorded from within the dam impact area. Freshwater turtles are discussed in Chapter 13 Aquatic Fauna.

Suitable habitat for reptiles within the study area is generally limited to remnant vegetation with an intact understorey and an abundance of shelter sites. Preferred shelter sites include piles of fallen bark, fallen rotting timber, deep leaf litter and dead standing timber. Areas of suitable habitat were found to occur predominantly along the banks of the Dawson River (including patches of flaking sandstone) and within remnant vegetation fenced off from stock. In addition, some pastureland on cracking clay soils provides habitat for reptiles which shelter within soil cracks. The Grey Snake is one such species.

Vegetated road reserves are likely to provide movement corridors between habitat patches for some reptiles and road surfaces (particularly bituminous road surfaces) provide basking sites. All snake species were observed on the local road network during spotlighting transects or from road kill.

11.1.3.8. Birds

One hundred and twenty-five bird species were observed including four threatened species, Black-chinned Honeyeater (*Melithreptus gularis*), Painted Honeyeater (*Grantiella picta*) and Grey Falcon (*Falco hypoleucos*), which are all listed as near threatened in Queensland and the southern subspecies of the Squatter Pigeon (*Geophaps scripta scripta*), which is listed as vulnerable under both the NC Act and EPBC Act.

The Cotton Pygmy-goose (*Nettapus coromandelianus*) is listed as near threatened in Queensland and was observed at Lake Murphy located to the north-west of the dam study area during this study. An incidental observation of this species was made by BAAM on the Mt Rose GAB spring during the Boggomoss Snail surveys in October (*pers. comm.* T. Reis, 2008). A Black-necked Stork (*Ephippiorhynchus asiaticus*), which is also listed as near threatened in Queensland, was observed on the same boggomoss during BAAM's survey.

Three species observed during the current study are considered to be non-EVR Priority Taxa by the EPA; Grey-crowned Babbler (*Pomatostomus temporalis*), Grass Owl (*Tyto capensis*) and Barking Owl (*N. connivens*). The Grey-crowned Babbler, Barking Owl, Masked Owl (*Tyto novaehollandiae*), and Australian Bustard (*Ardeotis australis*) are also considered to be near threatened by Garnett and Crowley (2000).

The study area contains a range of open country and woodland birds that are reasonably common throughout southern Queensland. Birds such as Magpies (*Gymnorhina tibicien*), Butcherbirds (*Cracticus* spp.) and Crows (*Corvus* spp.) are common in the open grassland and lightly timbered pastures and are highly mobile throughout these landscapes. Similarly, granivorous (seed eating) birds were abundant throughout the study area, benefitting from the production of seeds in pastures and other grassland areas. Smaller birds such as Fairy-wrens (*Malurus* spp.), Thornbills (*Acanthiza* spp.) and Finches (*Taeniopygia* spp. and *Neochmia* spp.) also occur in more open habitats, although they

prefer a dense understorey or ground covers to provide shelter. Honeyeaters such as Friarbirds (*Philemon* spp.) tend to converge in riparian vegetation depending upon flowering of trees, particularly eucalypts in riparian areas.

11.1.3.9. Non-flying mammals

Twenty-two non-flying mammals were identified including nine introduced species. The diversity of native species is considered to be low, particularly with respect to small, ground-dwelling marsupials and rodents. Despite completing over 900 trap nights only one individual was captured, namely a Striped-faced Dunnart (*Sminthopsis murina*). The absence of these fauna groups may be a result of small overall habitat patch size, extensive fragmentation of habitats within the study area, abundance of carnivores (native and exotic), an absence of shelter sites (i.e. lack of density and/or structure in understorey vegetation) or impacts from extensive grazing.

The species diversity of other mammals (i.e. macropods, possums) was as expected considering the low diversity and quality of habitats within the dam study area. These species can persist in often highly disturbed and fragmented habitats and are highly mobile through such landscapes.

Of note is the presence of Greater Glider (*Petauroides volans*) along the banks of the Dawson River and Koala along Cockatoo Creek. Both species are considered to be non-EVR priority taxa by DERM. Greater Glider is Australia's largest glider (by body weight) and shelters by day in the hollows formed in large, old trees. Consequently, the glider occurs in undisturbed forests (or at least with the presence of remnant trees) containing large hollows and the presence of Greater Glider within a site can be a useful indicator of habitat quality. In addition, the presence of Koalas along Cockatoo Creek is significant. Although this species is not listed as a threatened species outside of the South East Queensland Bioregion, DERM notes that their population is declining in the eastern portion of the BBS Bioregion (EPA, 2002a).

The Black-striped Wallaby (*Macropus dorsalis*) was observed along Glebe Weir Road during the winter survey. This species is considered to be a non-EVR priority taxon by DERM. There are few records from the eastern BBS Bioregion and the population is declining in the South East Queensland Bioregion (EPA, 2002a). In addition, the Rufous Bettong (*Aepyprymnus rufescens*) and Common Brush-tailed Possum (*Trichosurus vulpecula*) are non-EVR priority taxa, although they are still relatively common in the eastern BBS Bioregion and their occurrence within the site is not unexpected.

11.1.3.10. Bats

The survey detected a total of 17 species of microbats (including those species classed as definite, probable and possible identification).

Note that the use of the terms Probable and Possible are used by Greg Ford (Anabat Echolocation Call Analysis Specialist) to class the reliability of species identification from recorded calls. "Definite" is described as absolutely no doubt about identification of the bat making the call; "Probable" is defined as most likely the species named but low probability of confusion with species with similar calls; and "Possible" is defined as call is comparable with the listed species, but moderate to high probability of confusion with species with similar calls.

One species, the Little Pied Bat (*Chalinolobus picatus*), is listed as near threatened in Queensland and was identified from thirteen sites throughout the study area including the dam impact area. Three other microbats located during the survey are considered to be non-EVR priority taxa by the EPA (EPA, 2002a). These species are:

- Eastern Bentwing-bat (*Miniopterus schreibersii oceansis*) is considered to be at risk in the BBS as this species roosts in large colonies of up to 15 000 to 20 000 individuals. Any significant impact on a colony will therefore have a significant impact on the species. No suitable habitat for colonies (i.e. abandoned mines, caves, etc.) was observed within the dam study area;
- Inland Forest Bat (*Vespadelus baverstocki*) was considered to be at the edge of the species range in the BBS (at the time of the EPA's expert panel report) and there are significant gaps in the knowledge of this species. This species roosts in tree hollows of up to 50 individuals (van Dyck and Strahan, 2008). The Inland Forest Bat cannot be differentiated by call data from the Little Forest Bat (*V. vulturnus*), although the latter is more likely in the Taroom area; and
- Hoary Wattled Bat (*Chalinolobus nigrogriseus*) is considered to be near the western limit of its geographic range in the Taroom area. This species roosts in tree hollows and rock crevices.

Several of the microchiropteran bats identified are known to utilise caves and rock crevices as roost sites and/or maternity camps. A number of caves or potential cave sites were observed within the dam study area in areas of sandstone although no cave-roosting sites were confirmed. These include areas within Nathan Gorge downstream of the dam site, cliffs and caves on the main ridge on to the north-west of the Glebe Road – Cracow Road intersection and areas to the east of the Leichhardt Highway.

11.1.3.11. Likely occurrence of significant taxa

For the purpose of this assessment, significant taxa are defined as those listed in any category under the EPBC Act, NC Act or BBS BPA.

In relation to the occurrence of threatened species, desktop analysis, field surveys and habitat assessment revealed that one amphibian, seven reptiles, eleven birds, four mammals and two invertebrates are either known, likely or possible occurrences within the study area. Fifteen non-EVR priority taxa are also considered known, likely or possible occurrences.

The following tables (Table 11-7and Table 11-8) consider the likelihood of occurrence of these species within the dam construction footprint and water storage (dam impact area). The likelihood of occurrence has been determined in accordance with the following methodology:

- known - species positively recorded by this survey or other survey by qualified ecologists during past 30 years;
- likely - based on the presence of suitable habitat and recent database records from study area or proximity;
- possible - suitable habitat present for the species, but no recent database records from the study area or proximity; and
- unlikely - based on a lack of suitable habitat and lack of proximate records.

Table 11-7 Likelihood of occurrence of threatened fauna within the dam impact area

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
AMPHIBIANS			
Cyclorana verrucosa Rough-collared Frog	NT (NC)	A burrowing species inhabiting open grasslands and woodlands where it is usually found near temporary ponds, ditches, clay pans and creeks.	**Known** This species was recorded immediately adjacent to the Dawson River downstream of Glebe Weir in RE 11.3.25 within the water storage, and along Spring Creek in RE 11.3.3/11.3.4 outside the impact area.
REPTILES			
Hemiaspis damelii Grey Snake	E (NC)	The Grey Snake generally occurs west of the Great Dividing Range on low-lying floodplains in association with heavy cracking clay soils and can include dry sclerophyll forests and woodlands. It usually shelters during the day near a watercourse.	**Known** A single individual was recorded crossing Glebe Road in the vicinity of Cockatoo Creek in the water storage.
Strophurus taenicauda Golden-tailed Gecko	NT (NC)	Brigalow and cypress Pine woodlands of the Brigalow Belt bioregion.	**Likely** Recorded along Cracow Road between Taroom and Price Creek outside the dam impact area.
Paradelma orientalis Brigalow Scaly-foot	V (EPBC) V (NC)	Restricted to the brigalow belt but found in a wide variety of open forest habitats (Schultz and Eyre 1997; Tremul 2000).	**Likely** Available habitat which is proximal to and buffering a known occurrence recorded from Callitris woodland on sand to the north of the dam wall site, but outside the impact area.
Acanthophis antarcticus Common Death Adder	NT (NC)	Inhabits a wide range of habitats from forests and woodlands, grasslands, heath.	**Likely** Species not observed during field surveys. Suitable habitat exists within dam impact area. QM records for the species in the study area.
Denisonia maculata Ornamental Snake	V (EPBC)	Occurs in brigalow woodland, riparian woodland, and open forest growing on natural levees (Shine 1983; Cogger *et al.* 1993). Shows a preference for moist areas (Wilson and Knowles 1988).	**Possible** No observations or records. Suitable habitat occurs within the dam impact area and is within normal distribution range of this species.
Egernia rugosa Yakka Skink	V (EPBC)	Factors limiting distribution are poorly known. Occurs in dry sclerophyll forest or woodland and rocky areas where it lives in communal burrow complexes, often under heaped dead timber, and in deep rock crevices; often uses rabbit warrens and has also been recorded under shearing sheds and other rural buildings. Its presence may be recognised by communal defecation site (Wilson 2005; Cogger, *et al* 1993).	**Possible** No observations or Wildlife Online records. Suitable habitat exists within the impact area however may be suboptimal.

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
Furina dunmalli Dunmall's Snake	V (EPBC) V (NC)	Occurs in the brigalow belt region (McDonald *et al.* 1991; Cogger *et al.* 1993). This species is genuinely rare throughout its range with very few records.	**Possible** No observations or Wildlife Online records. Suitable habitat exists within the impact area however may be suboptimal.
BIRDS			
Geophaps scripta scripta Squatter Pigeon (southern)	V (EPBC) V (NC)	Inhabits a wide range of vegetation types. It prefers areas of sandy soil dissected by low gravely ridges, which have the shortest cover of grasses. Nearly always found near permanent water (Marchant and Higgins 1993).	**Known** Species has been positively observed in the Project area within woodland of Dawson River and GAB springs in the impact area. Likely to occur in woodland areas which support good cover of native grasses.
Falco hypoleucos Grey Falcon	NT (NC)	Typically encountered in arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	**Known** Limited suitable habitat exists throughout the dam impact area, however this species was observed along the Dawson River within the water storage.
Ephippiorhynchus asiaticus Black-necked stork	R (NC)	Inhabits permanent and ephemeral freshwater wetlands and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines. Feeds in shallow, still water on a variety of prey including fish, frogs, eels, turtles, crabs and snakes (Pizzey and Knight 2007).	**Likely** Recorded from Lake Murphy Conservation Area, west of the study area. Suitable wetland habitat (including farm dams, Glebe Weir) exists within the dam impact area.
Grantiella picta Painted Honeyeater	NT (NC)	Open forest and woodland but generally only where mistletoe is present throughout much of eastern Australia (Beruldsen 2003).	**Likely** An individual was observed at Nathan Gorge downstream of the dam wall site.
Melithreptus gularis Black-chinned Honeyeater	NT (NC)	Occurs along inland slopes of the Great Dividing Range in eastern Australia. Occupy dry eucalypt woodland within an annual rainfall range of 400-700 mm, particularly associations containing ironbark and box (Garnett and Crowley 2000).	**Likely** An individual was observed in riparian River Red Gum woodland on the Chain Lagoons located off the Leichhardt Highway west of the dam study area. Potential habitat occurs in the water storage, within riparian woodlands along the Dawson River and tributaries which are relatively connected.
Lophoictinia isura Square-tailed kite	NT (NC)	Inhabits the forested and wooded lands of tropical and temperate Australia (Marchant and Higgins 1993). The species may be recorded inland along timbered watercourses (Debus and Czechura 1989).	**Likely** Extensive areas of habitat associated with Nathan Gorge likely to support this species. Wildlife Online record exists within the study area.
Nettapus coromandelianus Cotton pygmy-goose	R (NC)	Preferred habitat is deep freshwater lagoons, swamps and dams, particularly those with water lilies or other floating vegetation (Marchant and Higgins 1990).	**Likely** Recorded from Lake Murphy Conservation Area, west of the study area. Suitable habitat (farm dams, Glebe Weir) exists within the dam impact area.

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
Rostratula australis Australian Painted Snipe	V (EPBC)	Inhabits freshwater and brackish wetlands, including flooded grasslands, Melaleuca swamps and saline sedge lands.	**Likely** QM records exist within study area and study area is within species range. Wetlands associated with the Dawson River floodplain likely to provide seasonal habitat for this species because it contains resources capable of supporting individuals.
Erythrotriorchis radiatus Red Goshawk	V (EPBC)	Requires large tracts of habitat which include productive riparian and floodplain zones. Breeding pairs use the same territories year after year (Marchant and Higgins 1993).	**Possible** No observation or records. Extensive riparian woodlands associated with Nathan Gorge and Precipice National Park provide suitable habitat.
Ninox strenua Powerful Owl	V (NC)	Pairs occupy large home ranges in mountain forests, gullies, and forest margins, sparse hilly woodlands, coastal forests, woodlands, scrubs, exotic pine plantations and larger trees in the urban environment (Pizzey and Knight 2007).	**Possible** Extensive tracts of habitat are available within and adjacent to Nathan Gorge.
Neochmia phaeton Crimson Finch	V (NC)	Inhabits tall grass and reed beds associated with riparian woodlands.	**Possible** Historical records of this species from Glebe Weir.
Lathamus discolor Swift Parrot	E (EPBC)	Inhabits dry open, box–ironbark forests and woodlands. In Queensland it is often associated with stands of mature Queensland blue gum (*Eucalyptus tereticornis*).	**Unlikely** Study area is on the northern limit of migratory range and therefore habitat within study area is considered unsuitable based on consideration of literature and field knowledge. No observations or Wildlife Online records..
Neochmia ruficauda ruficauda Star Finch (eastern)	E (EPBC) E (NC)	Inhabits tall grass and reed beds associated with swamps and watercourses. It may also be found in grassy woodlands, open forests and mangroves. The condition of this habitat varies according to season, grazing pressure and fire. It is considered to be regionally extinct within the BBS Bioregion. (EPA 2002a).	**Unlikely** Some suitable habitat may occur within impact area, however, vegetation is unlikely to support this species because no observations were made during field surveys or on Wildlife Online records.
Turnix melanogaster Black-breasted Button-quail	V (EPBC) V (NC)	Inhabits dry rainforest, vine scrub and lantana thickets, (Marchant and Higgins 1993).	**Unlikely** Vegetation is unlikely to support this species as no intact areas of dry vine thicket occur in the impact area. No observations or Wildlife Online records.
Stictonetta naevosa Freckled Duck	NT (NC)	Inhabits large, well vegetated swamps (Pizzey and Knight 2007).	**Unlikely** Study area is outside the recorded distributional limits of this species.

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
MAMMALS			
Chalinolobus picatus Little Pied Bat	NT (NC)	Inhabits dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest, mallee, bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Can tolerate high temperatures and dryness but needs access to nearby open water.	**Known** Detected at 11 of 14 sites surveyed using Anabat and captured at site 3. Most of these sites located within the water storage.
Nyctophilus corbeni[1] South-eastern Long-eared Bat	V (EPBC)	Occurs in *Callitris*/ironbark/box open forest and buloke woodland in southern Queensland (EPA 2002a).	**Possible** Species not detected during field surveys but recorded in the surveys of the Lower Dawson River Floodplain (Venz *et al*., 2002). However this species was placed in the "status uncertain" category due to indistinguishable Anabat call record. Therefore this record is not confirmed. Suitable habitat occurs in the study area however may be known to be suboptimal.
Chalinolobus dwyeri Large-eared Pied Bat	V (EPBC) V (NC)	Inhabits low to mid-elevation dry open forest and woodland close to preferred roosting sites which include caves.	**Possible** Suitable habitat may exist in caves in the Dawson Ranges (not in impact area), however may be known to be suboptimal as there were no observations or records within study area.
Dasyurus hallucatus Northern Quoll	E (EPBC)	Inhabits a range of open woodland and open forest types preferring rocky areas. Within Queensland a number of fragmented populations, including dense populations within Mackay-Whitsunday areas (Menkhorst and Knight 2001).	**Possible** Suitable habitat occurs within the impact area which is potentially important, however may be known to be suboptimal as there were no observations or Wildlife Online records for this species.
Hipposideros semoni Semon's Leaf-nosed Bat	E (EPBC)	Poorly studied species, inhabiting rainforest and savannah woodland (Menkhorst and Knight 2001).	**Unlikely** The study area is beyond known distribution of the species. Vegetation is unlikely to support the species because there were no reported sightings of individuals during field surveys.
Petrogale penicillata Brush-tailed Rock Wallaby	V (EPBC) V (NC)	Inhabits rock piles and cliffs with numerous crevices and ledges in vegetation ranging from rainforest to dry sclerophyll forest (Menkhorst and Knight 2001).	**Unlikely** Does not occur in study area as vegetation is unlikely to support the species. Historical records indicate confusion with Herbert's Rock Wallaby.

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
Pteropus poliocephalus Grey-headed Flying Fox	V (EPBC)	Forages through a variety of eucalypt forests and woodlands, where preferred flowering and fruiting plants are available. Occurs along east coast of Australia; rarely 200 km inland (Menkhorst 2004).	**Unlikely** The study area is beyond the distribution of this species. Vegetation is unlikely to support the species because there were no reported sightings of individuals during field surveys.
INVERTEBRATES			
Adclarkia dawsonensis Boggomoss Snail	CE (EPBC)	Field surveys suggest that the Boggomoss Snail is confined to the alluvial flats and riparian environments between Taroom and Theodore (BAAM 2008).	**Known** Species has been positively recorded in the Project area. One sub-population known from 3 boggomosses at Mt Rose Station (near Glebe Weir) and one subpopulation known from five riparian sites along the Dawson River downstream of Glebe Weir.
Jalmenus eubulus Imperial Hairstreak Butterfly (northern subspecies)	V (NC)	Brigalow forest is the principal vegetation community associated with this butterfly, and the preferred food plant of the larvae is brigalow.	**Likely** Suitable habitat exists within impact area and there are several Wildlife Online records exist for this species within the study area.

1 Status: EPBC = *Environment Protection and Biodiversity Conservation Act 1999*
NC = *Nature Conservation (Wildlife) Regulation 2006*
CE = Critically Endangered; E = Endangered; V = Vulnerable; NT = Near Threatened

2 Previously known as *Nyctophilus timoriensis*

Table 11-8 Likelihood of occurrence of significant fauna (non-EVR priority taxa (Qld EPA) and near-threatened (Action Plan for Australian Birds)) in the dam impact area

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
AMPHIBIANS			
Limnodynastes salmini Salmon-striped Frog	Non-EVR	Associated with ephemeral wetland sites in a variety of vegetation types from open grassland to woodland.	**Known** Recorded from Dawson River floodplain within the water storage.
REPTILES			
Chelodina expansa Broad-shelled Turtle	Non-EVR	Wilson and Swan (2005) note that this species lies concealed in debris on the bottom or among root mats in silty rivers, streams and waterholes.	**Known** Recorded from the Dawson River near Glebe Weir within the water storage.

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
BIRDS			
Ardeotis australis Australian Bustard	NT	Grasslands, spinifex, open scrublands, open woodlands, sandhills, pastoral lands, burned ground, crops, airfields (Pizzey and Knight 2007).	**Known** Recorded from a number of sites within study area, including the impact area. Abundant in the broader study region.
Pomatostomus temporalis Grey-crowned Babbler	Non-EVR	Open forests, woodlands, scrublands, farmlands (Pizzey and Knight 2007).	**Known** Widespread in the study area including the impact area.
Tyto novaehollandiae Masked Owl	NT	Forests, open woodlands, farmlands with large trees (e.g. river red gums adjacent to cleared lands) (Pizzey and Knight 2007).	**Likely** Associated with River Red Gum woodland and adjacent habitat on the Dawson River.
Melanodryas cucullata Hooded Robin	Non-EVR	Dry environs including open woodland, mallee and semi-arid mulga lands (Pizzey and Knight 2007).	**Likely** Recorded from dry Ironbark woodland near Gulrulmundi c.90 km south-east of Taroom and suitable habitat exists within the impact area.
Tyto capensis Grass Owl	Non-EVR	Tall grass, swampy, sometime tidal areas, grassy plains, coastal heaths, grassy woodlands, cultivated areas (Pizzey and Knight 2007.).	**Likely** Recorded from tall grassland to the north of the Dawson River. Suitable habitat exists within the impact area.
MAMMALS			
Miniopterus schreibersii Eastern Bentwing-bat	Non-EVR	A range of habitat types including rainforest, wet and dry sclerophyll forest, tall open forest, open woodland, grasslands and floodplains (Churchill 1998).	**Known** Recorded from a number of sites in the study area including the impact area.
Vespadelus baverstocki Inland Forest Bat	Non-EVR	Inhabits acacia, *Callitris* and casuarina woodlands, mallee, open eucalypt woodland, river red gum woodland, shrubland and grassland communities across Australia (Churchill 1998).	**Known** Recorded from a number of sites in the study area, including the impact area.
Chalinolobus nigrogriseus Hoary Wattled Bat	Non-EVR	Inhabits monsoon forest, tall open forest, open woodland, vine thickets, coastal scrub, sand dunes, grasslands and floodplains (Churchill 1998).	**Known** Recorded from a number of sites in the study area, including the impact area.
Phascolarctos cinereus Koala	Non-EVR	Inhabits wet and dry sclerophyll forests along eastern coast of Australia. Extends inland along major river systems (Menkhorst & Knight 2001).	**Known** Recorded from two sites along Cockatoo Creek within the water storage.
Aepyprymnus rufescens Rufous Bettong	Non-EVR	Prefers grassy open forests and woodlands and can tolerate cleared land if not heavily grazed (EPA 2002a).	**Known** Recorded from Glebe Weir Road and on tracks to the south of the dam wall site.

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
Petauroides volans Greater Glider	Non-EVR	Inhabits sclerophyll forests provided that suitably large hollows are available for shelter and nesting (Menkhorst & Knight 2001).	**Known** Recorded from Glebe Weir and Cockatoo Creek within the water storage.
Macropus dorsalis Black-striped Wallaby	Non-EVR	Prefers sclerophyll forests and brigalow scrubs. Hides in dense vegetation during the day and emerging to forage in open grassy areas at night (Menkhorst & Knight 2001).	**Known** Recorded from along Glebe Weir Road.
Trichosurus vulpecula Common Brushtail Possum	Non-EVR	Occurs in most habitats with tree cover. (Menkhorst & Knight 2001).	**Known** Recorded from a variety of sites within the study area including the impact area.

1 Status: NT = Near Threatened; Non-EVR = Priority species

11.1.3.12. Migratory species

Eight migratory species are known or likely occurrences within the dam study area. The likelihood of occurrence for each of these species within the water storage area and dam construction footprint is detailed in Table 11-9, and has been determined in accordance with the methodology outlined in Section 11.1.3.11.

Table 11-9 Likelihood of occurrence of migratory species in the dam impact area

Specific Name Common Name	EPBC Act Status	Habitat Preferences	Likelihood of occurrence
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	This species is associated with permanent waterbodies including estuaries, larger inland waterways, dams and wetlands.	**Known** Recorded from the Dawson River within the water storage.
Hirundapus caudacutus White-throated Needletail	Migratory	White-throated Needletail is ubiquitous, potentially foraging over any habitat type.	**Known** Recorded throughout the study area, including the water storage.
Ardea ibis Cattle Egret	Migratory	Utilises a range of habitat types including cleared paddocks.	**Known** Recorded within the water storage. Also Wildlife Online records.
Merops ornatus Rainbow Bee-eater	Migratory	Ubiquitous, potentially foraging over any habitat type.	**Known** Recorded within the water storage. Also Wildlife Online records.
Nettapus coromandelianus albipennis Cotton Pygmy-goose	Migratory	Deeper freshwater swamps, lagoons, dams with water lilies and other semi emergent water plants (Pizzey and Knight, 1999).	**Likely** Recorded from Lake Murphy Conservation Area, west of the study area. Suitable habitat (farm dams, Glebe Weir) exists within the impact area. No database records in the study area.

Specific Name Common Name	EPBC Act Status	Habitat Preferences	Likelihood of occurrence
Myiagra cyanoleuca Satin Flycatcher	Migratory	The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, riparian zones and other moist habitat types.	**Likely** Wildlife Online records. Suitable habitat associated with Nathan Gorge within impact area.
Rhipidura rufifrons Rufous Fantail	Migratory	Found in a range of habitats including rainforest, dense wet forests, swamp woodlands and mangroves.	**Likely** Wildlife Online records. Suitable habitat exists associated with Nathan Gorge within impact area.
Ardea alba Great Egret	Migratory	Occurs in a variety of freshwater wetland types and intertidal mudflats.	**Likely** Wildlife Online records. Suitable habitat exists throughout water storage.
Gallinago hardwickii Latham's Snipe	Migratory	This species prefers soft wet ground or shallow water with tussocks and other green or dead growth to scrub or open woodland; samphire areas on saltmarshes and mangrove fringes. (Pizzey and Knight, 1999). Also occurs around constructed waterbodies such as farm dams.	**Possible** No observations records, but floodplain wetlands of the Dawson River provide ideal habitat within water storage.
Monarcha melanopsis Black-faced Monarch	Migratory	The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies.	**Possible** No observations or records, but suitable habitat associated with Nathan Gorge within impact area.
Rostratula benghalensis Painted Snipe	Migratory	The Painted Snipe inhabits freshwater and brackish wetlands, including flooded grasslands, Melaleuca swamps and saline sedge lands.	**Possible** No observations or records, but floodplain wetlands of the Dawson River provide ideal habitat within water storage.
Numenius minutus Little Curlew	Migratory	Prefers open plains, grasslands, sports fields, parklands, mudflats, and cleared agricultural areas (Simpson and Day 2004).	**Possible** No observations or records. May use Dawson River floodplain during seasonal flooding events within water storage.
Hirundo rustica Barn Swallow	Migratory	Prefers disturbed open agricultural areas and open urban areas for forage and roost (Pizzey and Knight 2003).	**Possible** No observations or records and no records from field surveys.
Crocodylus porosus Salt-water Crocodile	Migratory	Coastal rivers, swamps, estuaries and open sea north of about Rockhampton (Wilson 2005). Species has been recorded from the Freshwater reaches of the Fitzroy River, downstream of the Project area.	**Unlikely** No observations or records. No suitable habitat upstream of Nathan Gorge.

11.1.3.13. Pest animal species

Ten introduced animal species were identified from within the dam study area, including five species listed as Class 2 declared pests in Queensland and five non-declared species. These are listed in Table 11-10.

Table 11-10 Pest animals in the dam study area

Species	Common name	Status1
Bos taurus	Cattle	Non-declared
Canis lupus	Dingo, Feral Dog	Class 2
Equus equinus	Horse	Non-declared
Felis catus	Feral Cat	Class 2
Lepus capensis	Brown Hare	Non-declared
Mus musculus	House Mouse	Non-declared
Oryctolagus cuniculus	European Rabbit	Class 2
Rhinella marina	Cane Toad	Non-declared
Sus scrofa	Pig	Class 2
Vulpes vulpes	Red Fox	Class 2

1 Declared status under the *Land Protection (Pest and Stock Route Management) Act 2002*:

Class 1 Not generally established in Queensland and has potential to cause an adverse economic, environmental or social impact;

Class 2 Established in Queensland and can cause significant adverse economic, environmental or social impact; or

Class 3 Established in Queensland and has or could have adverse economic, environmental or social impact.

Biosecurity Queensland's list of significant plant pests and diseases was reviewed to determine the potential for invertebrates of economic or conservation significance to occur in the study area. Plants pests which are considered likely to occur in the Project area are summarised in Table 11-11.

Table 11-11 Potential for significant plant pests in the region

Species	Common name	Distribution and Risk	Status[1]
Bemisia tabaci biotype B	Silverleaf Whitefly	Pest of range of crop and ornamental plants. Found throughout QLD	Emerging
Phenacoccus solenopsis	Solenopsis Mealybug	Pest of wide range of crops and weeds in Emerald and Bowen Basin. Detected in cotton crops in the Emerald and the Burdekin regions.	Exotic, notifiable
Scirtothrips aurantii	South African Citrus Thrips	Pest of ornamental and fruit crops, especially citrus. Found on mother of millions in Qld.	Emerging, notifiable
Thrips palmi	Melon Thrips	Pest of fruit and vegetables found in various parts of the state.	Emerging

1 Notifiable: Notifiable pests under Schedule 2 of the Plant Protection Regulation 2002. Legally required to report sightings to the Department of Primary Industries and Fisheries (DPI&F).

Exotic pests: Exotic plant, pests and diseases are those which are not present in Australia, or those which are present but not established and are under an official containment and/or eradication program.

Emerging pests: Emerging plant, pests and diseases are those which are present in Queensland but their presence is being monitored.

11.1.3.14. Representativeness of fauna habitats

DERM releases an analysis of remnant vegetation coverage throughout the state at regular intervals. The analysis provides a breakdown of remnant vegetation according to land tenure and can be viewed by sub-regions. Note that subregions are a subdivision of a bioregion. Subregions delineate the major geomorphic patterns within bioregions and may be defined by a suite of land systems, geological units and associated landforms, or environmental domains (Neldner, *et al.,* 2005). The dam study area is located on the interface of the Taroom Downs sub-region and the Barakula sub-region within the greater BBS bioregion. In determining the representativeness of fauna habitats within the dam study area, the extent of remnant vegetation remaining within both the Taroom Downs and Barakula sub-regions was examined.

Table 11-12 presents the approximate area of mapped remnant vegetation within the water storage expressed as a percentage and compared to the extent remaining with both sub-regions combined. The extent of remnant vegetation within each sub-region is further broken down into two broad land tenures:

- Other – freehold and leasehold land tenures; and
- Protected – tenures including National Parks, State Forests and Others (e.g. unallocated State land). This does not include sites listed under the Register of the National Estate, such as Boggomosses Area No. 1 and No. 2.

No Protected Area tenure is impacted by the water storage.

Fauna habitats have been derived from the descriptions of REs from the Regional Ecosystem Description Database (REDD) (EPA, 2007) and are shown in Table 11-12.

Table 11-12 Representativeness of fauna habitats within the water storage

Habitat Type	Tenure Grouping*	Approx. area of remnant vegetation within Taroom Downs and Barakula sub-regions (ha)	Approx. area of remnant vegetation within water storage & dam footprint (ha and percentage of total)
Eucalypt woodland on alluvial floodplains (REs 11.3.2,11.3.3,11.3.4)	Other	17207	1674.6 (9.7%)
	Protected	7454	0
Eucalypt woodland on granite (REs 11.9.7, 11.10.7, 11.10.7a)	Other	11820	83.2 (0.7%)
	Protected	2644	0
Riparian woodland on alluvium (RE 11.3.25)	Other	15610	1587.6 (10.2%)
	Protected	3508	0
Cypress pine woodland (REs 11.10.9, 11.3.19)	Other	10037	100.5 (1%)
	Protected	4807	0
Brigalow/Belah open forest (REs 11.3.1, 11.9.1, 11.9.5, 11.9.5a, 11.9.10)	Other	16987	186.5 (1.1%)
	Protected	2647	0
Eucalypt woodlands on wetlands/GAB springs (REs 11.3.22, 11.3.27)	Other	1100	22.9 (2.1%)
	Protected	163	0

11.1.4. Pipeline

11.1.4.1. Desktop review

The northern portion of the pipeline corridor from Wandoan along Nathan Road, is very near the Surat Basin Railway Corridor and the results of field surveys completed for that project are directly relevant to the Nathan Dam Project. A total of 171 different fauna species were observed during the Surat Basin Railway field survey (Connell Hatch, 2008), including 90 species of bird, 17 amphibian species, 31 reptile species and 33 mammal species. Significant species recorded included Rough Frog, Squatter Pigeon and the Little Pied Bat.

11.1.4.2. Distribution of fauna habitats

The pipeline corridor traverses several different landscapes along the route. The northern section from the proposed dam wall to Wandoan traverses undulating to hilly country used for cattle grazing. This landscape has been generally cleared, although some vegetation remains in small, isolated patches within road reserves and along drainage lines. The section from south of Wandoan to Chinchilla is located within a hilly landscape primarily devoted to forest reserves. The corridor intersects large tracts of remnant vegetation connecting areas of State Forest (SF). The southern section from Chinchilla to Dalby is located within flat and high quality agricultural and grazing lands, punctuated by vegetation retained within infrastructure corridors (e.g. road, rail and other easements) and along waterways. These landscapes are discussed in Sections 10.2.4.2, 10.2.4.3 and 10.2.4.4, respectively. A full description of fauna habitats on the pipeline corridor is provided in Appendix 11-A.

Nathan Dam wall site to Wandoan (northern section)

The northern section of the pipeline corridor traverses a largely cleared, undulating to hilly country on poorer soils (alluvium, sandy loams and sedimentary rocks) than those in the southern section. Some vegetation is retained within the road reserve and along waterways, although this vegetation is generally in poor condition from weed invasion and grazing impacts.

Habitats for fauna are limited to several localised patches of remnant vegetation, including linear remnants along watercourses such as Bullock and Bungaban creeks. These patches are likely to be used by a similar fauna assemblage (i.e. highly mobile and disturbance adapted species) as that found in the southern section of the pipeline corridor.

Some habitat for significant fauna species occurs along and adjacent to this section of the pipeline corridor, such as within regrowth Brigalow woodland. Although much of this vegetation is disturbed from weed invasion and is less than ten metres in width in places, suitable habitat exists for species such as Golden-tailed Gecko and Brigalow Scaly-foot. In addition, an extensive floodplain exists within the vicinity of Cockatoo Creek containing grassland on cracking clays soils. Despite some grazing pressures, this community provides habitat for the near threatened Rough-collared Frog and the endangered Grey Snake.

Wandoan to Chinchilla (middle section)

The mid section of the pipeline corridor deviates from the Leichhardt Highway approximately 5 km south of Wandoan heading southeast to connect with the Warrego Highway at Chinchilla. The section traverses a hillier, more forested landscape, on alluvial and sandy plains and sedimentary rocks and the associated habitats are considered to be of

higher value to fauna. This section crosses several creeks, namely Charleys Creek, Rocky Creek, Dogwood Creek, Bottle Tree Creek and Downfall Creek, and traverses large tracts of remnant vegetation which provide continuous linkages between Barakula SF to the north east with Binkey SF, Gurulmundi SF and Cherwondah SF to the south west (Section 9.2.4).

Large tracts of remnant narrow-leaved ironbark, cypress pine and/or belah woodland were observed throughout the pipeline corridor from Chinchilla to Miles (RE 11.5.21). Within these areas fallen trees, branches and leaf litter are common, which provide potential habitat for least concern and threatened species such as the Golden-tailed Gecko and Brigalow Scaly-foot. Only one patch of brigalow was found, a non-remnant strip comprising of brigalow, belah and narrow-leaved bottletree (RE 11.9.5) located off Downfall Creek Road (sites 1 and 2). The pipeline also crosses several creeks with remnant riparian *Eucalyptus tereticornis* woodland fringing drainage lines (RE 11.3.25) or *E. tereticornis* woodland on alluvial plains (RE 11.3.4). Within these areas mature hollow-bearing trees are common which provide potential habitat for arboreal mammals and birds such as gliders, koalas, owls and tree roosting bats. Two sites were of particular note for their high quality fauna habitat. Remnant *Eucalyptus* spp. and *Callitris* spp. woodland on alluvial plains (RE 11.3.14) was observed within the pipeline corridor off Little Tree Creek Road (site 8). This area had the most complex vegetation structure with a tall and short understorey shrub layer and grassy ground layer, with minimal grazing and a rocky creek nearby. This area provides good quality habitat for small birds and macropods, and potential habitat for the vulnerable Squatter Pigeon. A diversity of honeyeaters and small birds were observed including Yellow-tufted Honeyeater, Fuscous Honeyeater, White-eared Honeyeater, Scarlet Honeyeater, Yellow-faced Honeyater, Little Friarbird, Striated Pardelote, Yellow-rumped Thornbill and Rufous Whistler. A patch of remnant narrow-leaved ironbark, cypress pine and belah woodland (RE 11.5.1) was observed within the pipeline corridor along Grays Lane, off Engine Road (site 20). Within this area fallen trees, branches and leaf litter are abundant, which provide optimum habitat for the Golden-tailed Gecko and Brigalow Scaly-foot, and a layered understorey of *Acacia* spp. and shrub species provide habitat for small birds.

The Golden-tailed Gecko, which is listed as near threatened under the NC Act, was detected at three locations within the Leichhardt Highway road corridor from Wandoan to Miles. Within these areas, geckos had a distinct preference for habitats with a dominant layer of cypress pine and on sandy substrates. The gecko was not detected in other Cypress Pine dominated communities on different substrates (e.g. heavy clays). Therefore it is likely that the Golden-tailed Gecko occurs in similar habitats across the Wandoan to Chinchilla pipeline section.

A high diversity of fauna species is expected to be observed within this section of the pipeline corridor, based on the habitat values described for the Wandoan to Chinchilla section. In particular, vegetation on sandy loams are considered to provide an abundance of shelter sites for reptiles and small mammals and mature vegetation along waterways and floodplains are expected to provide significant food resources for arboreal mammals and birds during peak flowering periods. The Hooded Robin (*Melanodryas cucullata*) was observed along Leichhardt Highway and is considered a non-threatened priority taxon by the EPA and Garnett & Crowley (2000) list the species as near threatened.

Chinchilla to Dalby (southern section)

The southern section of the pipeline corridor from Chinchilla to Dalby transects the plains of the Darling Downs region. This section is primarily alluvial and clay soils and is characterised by expansive crop fields containing primarily sorghum (at the time of survey). Remnant vegetation occurs in small and fragmented patches along creeks and drainage lines

and occasionally within the road reserve. Vegetation within road reserves ranged from relatively intact corridors of less than 50 m in width to small stands of regrowth trees.

Several cleared infrastructure easements were observed within sections of the road reserve, which further reduced the width of the vegetation strip.

Overall, the habitat values for most fauna within this section are very low as the majority of the corridor is cleared, and is likely to be used by common, highly mobile species that can disperse through modified and fragmented landscapes. These include birds such as crows, Australian Magpies and butcherbirds.

As a large proportion of the Brigalow Belt has been cleared for agriculture, vegetation retained within road reserves and along waterways is recognised as important habitat for fauna as it provides essential connections through such landscapes (EPA, 2002). The habitat values for fauna within roadside and waterway vegetation depend upon the quality and condition of the vegetation. Some of this vegetation and associated grasslands also provides potential habitat for threatened species such as Rough Frog, Grassland Earless Dragon (*Tympanocryptis pinguicolla*) and the Five-clawed Worm-skink (*Anomalopus mackayi*).

11.1.4.3. Wildlife corridors and core habitats

A review of the BPA data and expert panel reports for the BBS bioregion revealed that a number of bioregional wildlife corridors intersect the pipeline corridor (Figure 11-7). Barakula SF lies approximately 5 km to the north east of the corridor (at its closest point) and is considered a 'core' area by DERM. Two corridors of State Significance emanate from Barakula SF and are crossed by the pipeline route. These corridors include Western Creek/Dunmore to Barakula SF through Kogan, and Barakula SF to Yuleba (west of Miles on the Warrego Highway).

In addition, a number of creeks intersecting the pipeline corridor are mapped as bioregional wildlife corridors, including Charleys Creek, Rocky Creek, Dogwood Creek, Bottle Tree Creek, Juandah Creek and Cockatoo Creek. Rocky Creek and Charleys Creek are mapped as corridors of state significance and provide essential connections between large areas of core habitat (e.g. Barakula SF). Juandah Creek and Cockatoo Creek are considered to be of regional significance and provide movement opportunities through the fragmented landscape.

11.1.4.4. Fauna diversity

Three threatened taxa (in addition to those listed in Table 11-3 as occurring in the Taroom region) are known to occur along the pipeline corridor from the literature review and fauna database searches (Table 11-13).

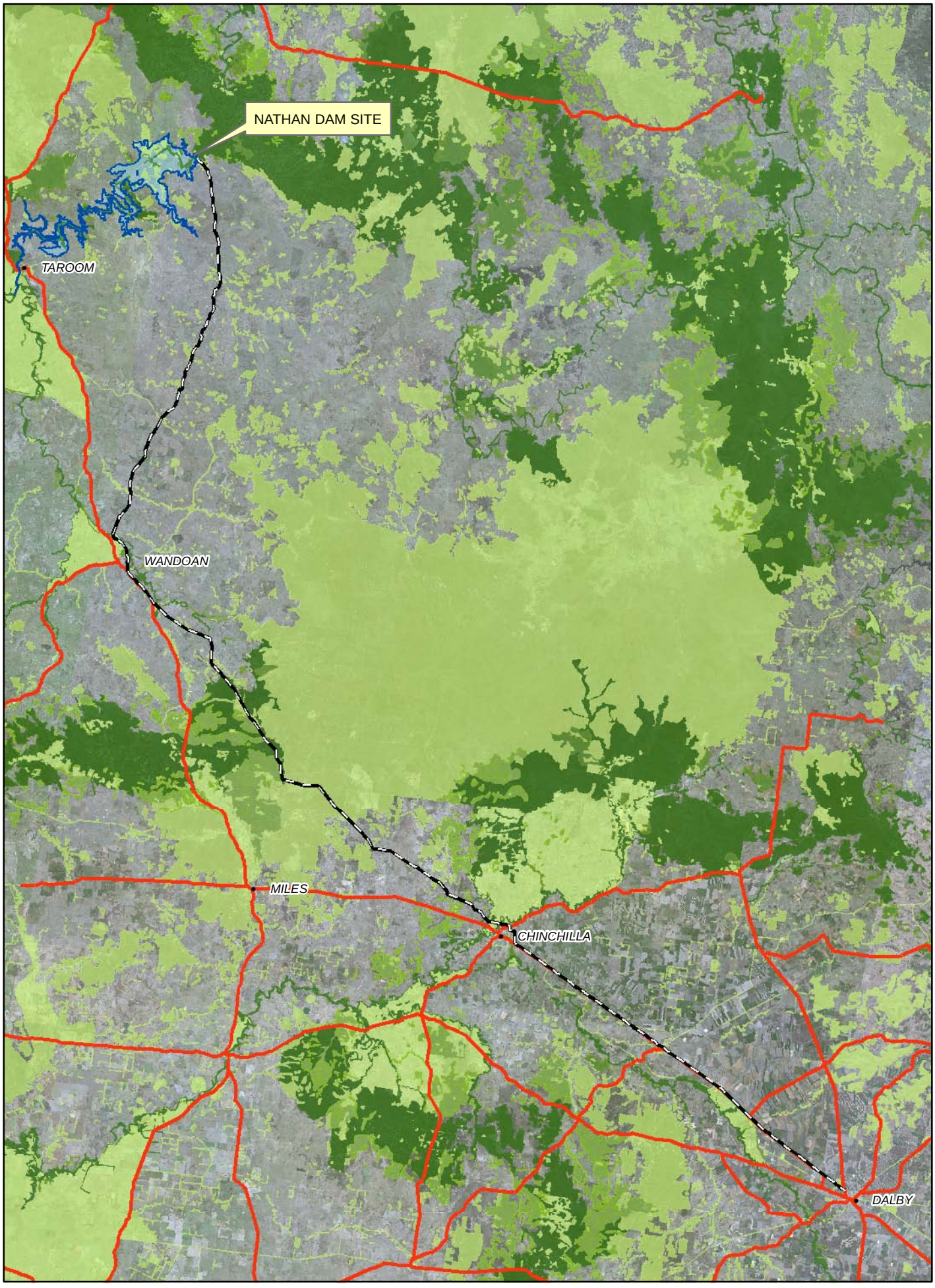
Table 11-13 Additional threatened fauna that may occur on the pipeline corridor

Species Name	Common Name	Status[1]	References
REPTILES			
Anomalopus mackayii	Five-clawed Worm-Skink	V (EPBC) E (NC)	EPBC Protected Matters Search
Tympanocryptis pinguicolla	Grassland Earless Dragon	E (EPBC) E (NC)	EPBC Protected Matters Search
MAMMALS			
Pteropus poliocephalus	Grey-headed Flying Fox	V (EPBC)	EPBC Protected Matters Search

1 Status: EPBC = *Environment Protection and Biodiversity Conservation Act 1999*
NC = *Nature Conservation (Wildlife) Regulation 2006*
E = Endangered; V = Vulnerable; NT – Near Threatened

A total of 51 species of vertebrate fauna were observed along the pipeline corridor during the field surveys including one frog, nine reptiles, 38 birds and two mammals. Note that some of these are associated with a superseded pipeline route. Nine species that were observed along the pipeline were not observed during the surveys for the dam (Appendix 11-A). These species are all listed as least concern under the NC Act.

The location of significant fauna recorded from the pipeline corridor is shown in Figure 11-5. Field survey results are provided in Appendix 11-A.



LEGEND

- Towns of Interest
- Proposed Pipeline
- Major Roads
- Full Supply Level (183.5m AHD)

Biodiversity Planning Assessment

- Low
- Medium
- High
- Very High

Projection: GDA94 Zone 56

Figure 11-7

0 10 20
Kilometres

N

Scale 1:900,000 (at A4)

SKM SunWater Making Water Work

NATHAN DAM AND PIPELINES EIS

Wildlife corridors within the pipeline corridor

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11.1.4.5. Likely occurrence of significant taxa

The study area for the pipeline overlaps with the study area for the dam. Consequently, many significant taxa that are likely to be found in the dam study area are likely to be found along the northern portion of the pipeline corridor. In order to gain a meaningful understanding of the value of habitats present along the pipeline corridor, this assessment is primarily concerned with the potential occurrence of significant taxa outside the dam study area.

Table 11-14 and Table 11-15 consider the likelihood of occurrence of these species within the pipeline corridor and has been determined in accordance with the methodology outlined in Section 11.1.3.11. Much of the information on habitat preferences has been provided in Table 11-7 to Table 11-9.

Table 11-14 Likelihood of occurrence of threatened fauna within the pipeline corridor

Species Name Common Name	Status[1]	Habitat Preferences	Likelihood of occurrence
AMPHIBIANS			
Cyclorana verrucosa Rough-collared Frog	NT (NC)	Inhabits open grasslands and woodlands.	**Likely** Suitable habitat exists throughout the pipeline corridor, predominantly adjacent to waterways and depressions. Recorded in the surveys of the Surat Basin railway.
REPTILES			
Strophurus taenicauda Golden-tailed Gecko	NT (NC)	Inhabits brigalow and cypress pine woodlands.	**Likely** Recorded from three sites along Leichardt Highway between Miles and Wandoan during May 2008 survey of superseded pipeline route. However similar habitat is present throughout the middle section of the pipeline corridor.
Paradelma orientalis Brigalow Scaly-foot	V (EPBC) V (NC)	Inhabits a wide variety of open forest habitats (Schultz and Eyre 1997; Tremul 2000).	**Likely** Species was not detected during field surveys, but Wildlife Online record in proximity. Suitable habitat exists within road reserves containing large Brigalow patches.
Acanthophis antarcticus Common Death Adder	NT (NC)	Inhabits a wide range of habitats from forests and woodlands, grasslands, heath.	**Likely** Species not detected during field surveys, but Wildlife Online record in proximity. Suitable habitat exists within large habitat patches in the mid section of the pipeline corridor.
Denisonia maculata Ornamental Snake	V (EPBC)	Occurs in brigalow woodland, riparian woodland, and open forest growing on natural levees.	**Possible** No observations or records within the study area. Suitable habitat occurs within the mid and northern sections of the pipeline corridor and is within normal distribution range of this species, however, may be known to be suboptimal.

Species Name Common Name	Status[1]	Habitat Preferences	Likelihood of occurrence
Egernia rugosa Yakka Skink	V (EPBC)	Inhabits dry sclerophyll forest or woodland and rocky areas where it lives in communal burrow complexes, often under heaped dead timber, and in deep rock crevices.	**Possible** No observations or records within the study area. Suitable habitat exists within the mid section of the pipeline corridor however may be known to be suboptimal.
Furina dunmalli Dunmall's Snake	V (EPBC) V (NC)	Inhabits brigalow, belah and cypress pine communities on heavy soils.	**Possible** No observations or records within the study area. Suitable habitat exists within the mid section of the pipeline corridor however may be known to be suboptimal.
Anomalopus mackayi Five-clawed worm skink	V (EPBC) V (NC)	Restricted to a small number of natural temperate grassland sites dominated by native grasses.	**Possible** No observations or records of within the study area. Known sites for this species north of Toowoomba are relatively extensive native grasslands but none along route. Road reserves within the southern section of the pipeline corridor contains potential habitat for this species however may be known to be suboptimal.
Tympanocryptis pinguicolla Grassland Earless Dragon	E (EPBC)	Restricted to a small number of natural temperate grassland sites to the southwest of Toowoomba.	**Unlikely** Despite extensive searches in recent years, there have been no reported sightings. The distribution of the species has not been extended and does not include the pipeline corridor.
BIRDS			
Ephippiorhynchus asiaticus Black-necked stork	NT (NC)	Inhabits freshwater wetlands including margins of billabongs, swamps, shallow floodwaters (Pizzey and Knight 2007).	**Likely** Extensive areas of pasture may provide temporary habitat during seasonal flooding. Recorded in the vicinity of dam study area and Wildlife Online records in proximity.
Falco hypoleucos Grey Falcon	NT (NC)	Inhabits arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	**Likely** Limited suitable habitat exists throughout the pipeline corridor, within large waterway systems. Wildlife Online records in proximity.
Geophaps scripta scripta Squatter Pigeon (southern)	V (EPBC) V (NC)	Inhabits a wide range of vegetation types, nearly always near permanent water (Marchant and Higgins 1993).	**Likely** Recorded in the dam study area. Species is likely to occur in woodland areas next to water which support good cover of native grasses along the pipeline corridor.
Rostratula australis Australian Painted Snipe	V (EPBC)	Inhabits freshwater and brackish wetlands, including flooded grasslands, Melaleuca swamps and saline sedgelands.	**Likely** Study area is within species range and QM records in proximity. Well vegetated wetlands associated with river floodplains are likely to provide seasonal habitat for this species.

Species Name Common Name	Status[1]	Habitat Preferences	Likelihood of occurrence
Ninox strenua Powerful Owl	V (NC)	Pairs occupy large home ranges in a variety of large habitat patches (Pizzey and Knight 2007).	**Likely** Extensive tracts of habitat are available within and adjacent to Barakula SF and adjacent reserves. Recorded in the EPA (2002) surveys of the dam study area.
Lophoictinia isura Square-tailed kite	NT (NC)	Inhabits the forested and wooded lands of tropical and temperate Australia (Marchant and Higgins 1993).	**Likely** Extensive areas of habitat associated with Barakula SF and other reserves are likely to support this species. Recorded in the EPA (2002) surveys of the dam study area and Wildlife Online records in proximity.
Erythrotriorchis radiatus Red Goshawk	V (EPBC)	Requires large tracts of habitat which include productive riparian and floodplain zones.	**Possible** No observations or Wildlife Online records. Riparian vegetation within Barakula State Forest (SF) and other SFs and throughout the mid section of the pipeline corridor may provide suitable habitat which potentially important however may be known to be suboptimal.
Lathamus discolor Swift Parrot	E (EPBC)	Inhabits dry open, box–ironbark forests and woodlands.	**Possible** Study area is on the northern limit of migratory range, although potential habitat occurs along large waterways in the southern section of the pipeline corridor. No database records in proximity.
Neochema phaeton Crimson Finch	V (NC)	Inhabits tall grass and reed beds associated with riparian woodlands.	**Possible** Potential habitat occurs along large waterways in the southern section of the pipeline corridor. No database records in proximity.
Turnix melanogaster Black-breasted Button-quail	V (EPBC) V (NC)	Inhabits dry rainforest, vine scrub and Lantana thickets (Marchant and Higgins 1993).	**Unlikely** Mapped remnant vine thickets occur within the study area, however, these habitats do not occur along the pipeline corridor and therefore is not considered suitable for this species.
Neochmia ruficauda ruficauda Star Finch (eastern)	E (EPBC) E (NC)	Inhabits tall grass and reed beds associated with swamps and watercourses. It is considered to be regionally extinct within the BBS Bioregion. (EPA 2002a).	**Unlikely** Some suitable habitat occurs within study area, however, is not likely to support the species as there are no database records of this species.
Nettapus coromandelianus Cotton pygmy-goose	NT (NC)	Inhabits deep freshwater lagoons, swamps and dams, particularly those with water lilies or other floating vegetation (Marchant and Higgins 1990).	**Unlikely** Although suitably large wetland systems occur within the study area, these habitats do not occur within the pipeline corridor.

Species Name Common Name	Status[1]	Habitat Preferences	Likelihood of occurrence
Stictonetta naevosa Freckled Duck	NT (NC)	Large, well vegetated swamps (Pizzey and Knight 2007).	**Unlikely** Study area is at the northern distributional limits of this species. Suitable habitat exists within the pipeline corridor.
MAMMALS			
Chalinolobus picatus Little pied bat	NT (NC)	Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest, mallee, bimbil box.	**Likely** Detected at numerous sites within the dam study area and similar habitats are present within the pipeline corridor.
Chalinolobus dwyeri Large-eared Pied Bat	V (EPBC)	Low to mid-elevation dry open forest and woodland close to preferred roosting sites which include caves.	**Possible** Suitable habitat may exist in caves in the Dawson ranges and other areas of remnant vegetation, however, may be known to be suboptimal. No observations or database records in proximity of pipeline corridor.
Dasyurus hallucatus Northern Quoll	E (EPBC)	Inhabits a range of open woodland and open forest types preferring rocky areas (Menkhorst and Knight 2001).	**Possible** Suitable habitat occurs within study area within large habitat patches such as Barakula SF, however may be known to be suboptimal. No observations or database records in vicinity of pipeline corridor.
Nyctophilus corbeni[2] South-eastern Long-eared Bat	V (EPBC)	Occurs in callitris/ironbark/box open forest and bulloke woodland in southern Queensland (EPA 2002a).	**Possible** Species not detected during field surveys but recorded in the surveys of the Lower Dawson River Floodplain (Venz *et al*., 2002). However, this species was placed in the "status uncertain" category due to indistinguishable Anabat call record. Therefore this record is not confirmed. Suitable habitat occurs in the study area however may be known to be suboptimal.
Hipposideros semoni Semon's Leaf-nosed Bat	E (EPBC)	Foraging habitat includes rainforest and savannah woodland (Menkhorst and Knight 2001).	**Unlikely** Vegetation is unlikely to support the species as study area is beyond known distribution of the species. No observations or records in the study area.
Petrogale penicillata Brush-tailed Rock Wallaby	V (EPBC) V (NC)	Inhabits rock piles and cliffs with crevices and ledges (Menkhorst and Knight 2001).	**Unlikely** Vegetation is unlikely to support the species as there were no observations, database records or habitat in the study area.

Species Name Common Name	Status[1]	Habitat Preferences	Likelihood of occurrence
Pteropus poliocephalus Grey-headed Flying Fox	V (EPBC)	Forages through a variety of eucalypt forests and woodlands, where preferred flowering and fruiting plants are available. Occurs along the east-coast of Australia.	**Unlikely** Vegetation is unlikely to support the species as study area falls outside of known distribution which is along the coast (east of the Great Dividing Range).
INVERTEBRATES			
Jalmenus evagoras eubulus Imperial Hairstreak (Northern Subspecies)	V (NC)	Primarily associated with Brigalow communities.	**Likely** Suitable habitat exists within study area and there are several Wildlife Online records for this species within the study area.

1 Status: EPBC = *Environment Protection and Biodiversity Conservation Act 1999*

NC = *Nature Conservation (Wildlife) Regulation 2006*

E = Endangered; V = Vulnerable; NT = Near Threatened

2 Previously known as *Nyctophilus timoriensis*

Table 11-15 Likelihood of occurrence of significant fauna within the pipeline corridor

Specific Name Common Name	Status[1]	Habitat Preferences	Likelihood of occurrence
AMPHIBIANS			
Limnodynastes salmini Salmon-striped Frog	Non-EVR	Inhabits ephemeral wetland sites in a variety of vegetation types from open grassland to woodland.	**Likely** Suitable habitat exists within waterways and seasonal inundation of pasturelands. Recorded throughout dam study area.
REPTILES			
Chelodina expansa Broad-shelled Turtle	Non-EVR	Inhabits silty rivers, streams and waterholes (Wilson and Swan 2008).	**Likely** Suitable habitat exists within large waterways throughout the pipeline corridor.
BIRDS			
Melanodryas cucullata Hooded Robin	Non-EVR	Inhabits open woodland, mallee and semi-arid mulga lands (Pizzey and Knight 2007).	**Known** Recorded from dry Ironbark woodland near Gulrulmundi in pipeline corridor.
Pomatostomus temporalis Grey-crowned Babbler	Non-EVR	Open forests, woodlands, scrublands, farmlands (Pizzey and Knight 2007).	**Known** Widespread in the pipeline corridor.
Tyto capensis Grass Owl	Non-EVR	Inhabits tall grass, swampy, grassy plains, grassy woodlands and pasture (Pizzey and Knight 2007.).	**Likely** Suitable grassland areas occur throughout the pipeline corridor. Database records in proximity.
Tyto novaehollandiae Masked Owl	Non-EVR	Inhabits forests, open woodlands, farmlands with large trees (Pizzey and Knight 2007).	**Likely** Associated with River Red Gum woodland and adjacent habitat on large waterways. Database records in proximity.
Ardeotis australis Australian Bustard	NT (NC)	Inhabits grasslands, spinifex, open scrublands, open woodlands, sandhills, pastoral lands, burned ground, crops, airfields (Pizzey and Knight 2007).	**Likely** Abundant in the study area, although not recorded during the field survey.
MAMMALS			
Miniopterus schreibersii Eastern Bentwing-bat	Non-EVR	Inhabits wet and dry sclerophyll forest, tall open forest, open woodland and floodplains (Churchill 1998).	**Likely** Suitable habitats exist within the central section of the pipeline corridor. Recorded in dam study area.
Vespadelus baverstocki Inland Forest Bat	Non-EVR	Inhabits a variety of open eucalypt communities (Churchill 1998).	**Likely** Suitable habitats exist within the central section of the pipeline corridor and along large waterways. Recorded in dam study area.

Specific Name Common Name	Status[1]	Habitat Preferences	Likelihood of occurrence
Chalinolobous nigrogriseus Hoary Wattled Bat	Non-EVR	Inhabits tall open forest, open woodland, vine thickets, grasslands and floodplains (Churchill 1998).	**Likely** Suitable habitats exist within the central section of the pipeline corridor. Recorded in dam study area.
Phascolarctos cinereus Koala	Non-EVR	Inhabits sclerophyll forests along eastern coast of Australia. Extends inland along major river systems (Menkhorst & Knight 2001).	**Likely** Suitable habitat exists within large waterways along the pipeline corridor. Recorded in dam study area and database records in proximity.
Aepyprymnus rufescens Rufous Bettong	Non-EVR	Prefers grassy open forests and woodlands and can tolerate cleared land if not heavily grazed (EPA 2002a).	**Likely** Suitable habitats are located within the central section of the pipeline corridor within and adjacent to large forest reserves. Recorded in dam study area.
Petauroides volans Greater Glider	Non-EVR	Inhabits sclerophyll forests provided that suitably large hollows are available for shelter and nesting (Menkhorst & Knight 2001).	**Likely** The species was recorded from Cockatoo Creek in dam study area and similar habitat exists within large waterways along the remainder of the pipeline corridor.
Macropus dorsalis Black-striped Wallaby	Non-EVR	Prefers sclerophyll forests, Brigalow scrubs and adjacent grassland (Menkhorst & Knight 2001).	**Likely** Suitable habitats are located within the central section of the pipeline corridor within and adjacent to large forest reserves. Recorded in dam study area.
Trichosurus vulpecula Common Brushtail Possum	Non-EVR	Occurs in most habitats with tree cover. (Menkhorst & Knight 2001).	**Likely** Suitable habitats occur throughout the pipeline corridor, except for largely cleared areas such as the southern section. Recorded in dam study area.

1 Status: NT = Near Threatened; Non-EVR = Priority Species

11.1.4.6. Migratory species

Seven migratory species are known or likely occurrences within the pipeline corridor.

Table 11-16 Likelihood of occurrence of migratory species within the pipeline corridor

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
Merops ornatus Rainbow Bee-eater	Migratory	Ubiquitous, potentially foraging over any habitat type.	**Known** Recorded during field survey along the pipeline corridor. Also Wildlife Online record.
Ardea ibis Cattle Egret	Migratory	Utilises a range of habitat types including cleared paddocks.	**Likely** Recorded in the dam study area. Common species associated with pasturelands, usually near to water.

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
Ardea alba Great Egret	Migratory	Occurs in a variety of freshwater wetland types and intertidal mudflats.	**Likely** Recorded on Birds Australia database and may use seasonally inundated pastures and floodplains.
Hirundapus caudacutus White-throated Needletail	Migratory	White-throated Needletail is ubiquitous, potentially foraging over any habitat type.	**Likely** Recorded in the dam study area and likely to forage over various wooded habitat types in the pipeline corridor.
Myiagra cyanoleuca Satin Flycatcher	Migratory	Inhabits tall forests, preferring wetter habitats such as heavily forested gullies, riparian zones and other moist habitat types.	**Likely** May use waterways as migration pathways. Recorded on Wildlife Online database.
Rhipidura rufifrons Rufous Fantail	Migratory	Inhabits rainforest, dense wet forests, swamp woodlands and mangroves.	**Likely** May use waterways as migration pathways. Recorded on Wildlife Online database.
Rostratula benghalensis Painted Snipe	Migratory	Inhabits freshwater and brackish wetlands, including flooded grasslands, Melaleuca swamps and saline sedgelands.	**Likely** Qld Museum record in proximity and may use seasonally inundated pastures and floodplains within pipeline corridor.
Gallinago hardwickii Latham's Snipe	Migratory	Inhabits soft wet ground or shallow water with tussocks and other green or dead growth to scrub or open woodland. (Pizzey and Knight, 1999).	**Possible** No observations or database records, but may use seasonally inundated pastures and floodplains within pipeline corridor.
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Inhabits permanent waterbodies including estuaries, larger inland waterways, dams and wetlands.	**Possible** Known from the Dawson River and may occur along other large inland waterways such as the Condamine River, however habitat within pipeline corridor is marginal.
Hirundo rustica Barn Swallow	Migratory	Prefers disturbed open agricultural areas and open urban areas for forage and roost (Pizzey and Knight 2003).	**Possible** No observations or records.
Monarcha melanopsis Black-faced Monarch	Migratory	Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies.	**Possible** No observations or database records, but may use waterways as migration pathways.
Numenius minutus Little Curlew	Migratory	Prefers open plains, grasslands, sports fields, parklands, mudflats, and cleared agricultural areas (Simpson and Day 2004).	**Possible** No database records, but may use floodplains and pastures during seasonal flooding events.
Nettapus coromandelianus albipennis Cotton Pygmy-goose	Migratory	Deeper freshwater swamps, lagoons, dams with waterlilies and other semi emergent water plants	**Unlikely** Although suitably large wetland systems and Wildlife Online records occur within the study area, these

Specific Name Common Name	Status	Habitat Preferences	Likelihood of occurrence
		(Pizzey and Knight, 1999).	habitats do not occur within the pipeline corridor.
Crocodylus porosus Salt-water Crocodile	Migratory	Coastal rivers, swamps, estuaries and open sea north of about Rockhampton (Wilson 2005). Species has been recorded from the Freshwater reaches of the Fitzroy River, downstream of the Project area.	**Unlikely** No database records. No suitable habitat upstream along large river systems.

11.1.4.7. Pest animal species

Nine introduced animal species were identified from within the pipeline study area including five declared pest species under the *Land Protection (Stock and Pest Route Management) Act 2002*. All of these species are likely occurrences within the pipeline corridor in a variety of habitats. The body of a large, presumed feral Dog (i.e. no identifying collar) was observed at Cockatoo Creek. Further, dog scats and tracks were observed throughout the mid section of the pipeline corridor.

11.1.5. Associated Infrastructure

The description of environmental values for the associated infrastructure is covered in the dam study area in Section 11.1.3.

11.2. Potential impacts and mitigation measures

This section addresses Section 3.3.3.2 of the ToR, describing the potential impacts of construction and operation of the Project, including the dam and water storage, pipeline and associated infrastructure, and measures to mitigate these impacts.

11.2.1. Dam and surrounds

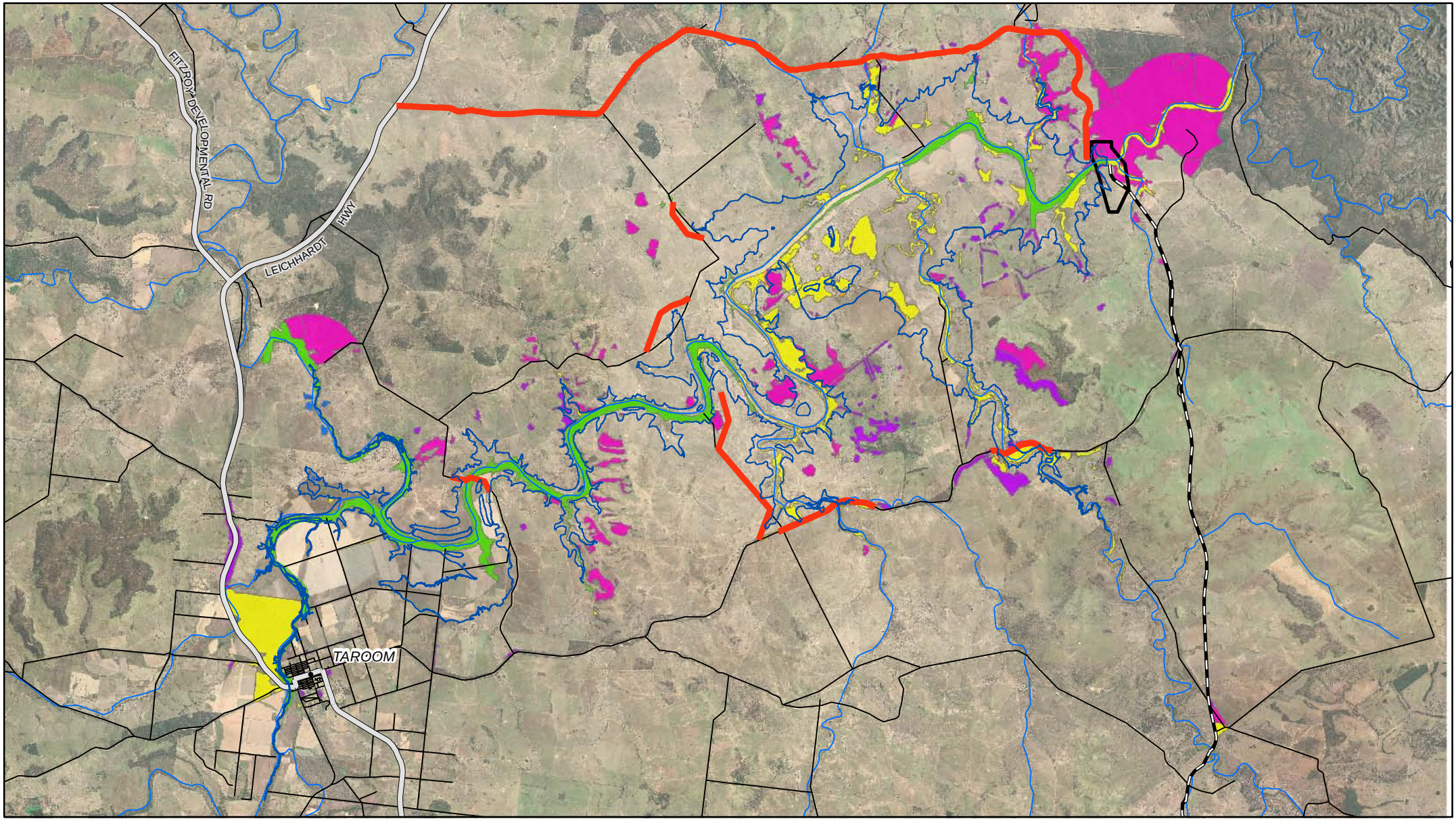
The aspects of the dam construction and operation that have the potential to impact on terrestrial fauna and fauna habitat include:

- construction of a dam wall and associated items;
- clearing of vegetation within the dam construction footprint and water storage as described in Chapter 10;
- construction related disturbances such as the generation of noise, dust, traffic and artificial night lighting;
- operation of the dam including permanent inundation of the water storage, allowance for flood and environmental flows, operation of the fishway and turtleway, maintenance work (i.e. slashing of grassed areas) and recreational use; and
- water level fluctuations within the water storage and temporary inundation of the flood buffer.

11.2.1.1. Loss of fauna habitat

Construction

The dam construction footprint and water storage will result in the loss of approximately 3655 ha of remnant vegetation and 341.6 ha of non remnant vegetation which serves as habitat for a diversity of fauna species. The extent of remnant and non remnant habitat is shown on Figure 11-8. The majority of vegetation within the water storage will eventually be lost, though some vegetation not cleared initially may take some time to die, depending on the rate of filling of the dam. The nature of the FSL will mean that some islands will be created within the water storage. Although it has been assumed that these areas will be functionally lost (as a result of fragmentation), they will not be cleared of vegetation and will be revegetated (if necessary) to provide habitat for fauna which can make practical use of them, i.e. birds (particularly waterbirds), bats, insects and turtles. Although disturbed to some extent, the clearing and/or inundation of this habitat for the dam construction footprint and water storage will cause a reduction in habitat for fauna, impacting on a number of species particularly those of low mobility (e.g. amphibians, small reptiles and small non-flying mammals).



LEGEND

- Towns of Interest
- Proposed Pipeline
- Watercourses
- Local Roads
- State Controlled Roads
- Road Upgrade/Construction
- Dam Construction Footprint
- Full Supply Level (183.5m AHD)

Remnant Habitat Type

- Brigalow/Belah Open Forests
- Cypress Pine/Ironbark Woodlands
- Eucalypt Alluvial Woodlands
- Non-Alluvial Woodlands
- Riparian Woodlands
- Wetlands/GAB Springs

Projection: GDA94 Zone 56

Figure 11-8

0 1 2 4
Kilometres

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Scale 1:200,000 (at A4)

SKM SunWater Making Water Work

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Remnant and non-remnant habitat impacted by dam construction footprint and water storage

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Fauna populations will be impacted by the removal of habitat that provides shelter, food and/or nesting resources, and interruption of movement corridors which can lead to reduced viability of fauna populations (Section 11.2.1.2).

The impact on areas of fauna habitat is summarised in Table 11-17.

Table 11-17 Area of remnant habitat impacted within the dam and surrounds

Habitat	REs	Dam Construction Footprint (ha)	Water storage (ha)	TOTAL
Riparian woodlands	11.3.25	0.6	1586.9	1587.5
Eucalypt alluvial woodlands	11.3.3, 11.3.2, 11.3.4	30.1	1644.4	1674.6
Eucalypt non alluvial woodlands	11.10.7, 11.10.7a, 11.9.7	24.6	58.6	83.2
Cypress Pine woodlands	11.3.19, 11.10.9,	43.9	56.6	100.5
Brigalow / Belah open forests	11.3.1, 11.9.1, 11.9.5, 11.9.5a, 11.9.10	2.2	184.2	186.4
Wetlands / GAB Springs	11.3.27, 11.3.22		22.8	22.8
Waterways	-	-	Length 75 km	
Total Remnant (ha)		**101.4**	**3553.6**	3655
Total Regrowth (ha)			**341.6**	**341.6**

The dam construction footprint and water storage will not impact on the larger and higher value habitat patches at Nathan Gorge (Precipice National Park), Spring Creek and Taroom Town Common.

Section 2.1.1.1 provides measures for the minimisation of habitat clearance impacts on terrestrial fauna. Approval for clearing is required under the VM Act, NC Act and most probably the EPBC Act. Appropriate measures to be incorporated into a clearing plan include:

- the presence of fauna spotter/catcher(s) accredited by Queensland Parks and Wildlife Service (QPWS) during vegetation clearing for safe handling and possible relocation of animals unable to safely move away from the disturbance;
- management procedures for the treatment of any injured animals;
- clearing of vegetation to be undertaken so that any more mobile, non-volant (cannot fly) fauna is able to move to other areas of suitable habitat, i.e., patches of habitat should not be disconnected in a haphazard fashion that limits movement;
- vegetation clearing will be staged, commencing with the area required for construction works. The remainder will be cleared progressively until the water storage is ready to fill; and
- appropriate material will be salvaged for use as 'large woody debris' aquatic fauna habitat, or terrestrial habitat above frequent flood inundation levels.

The fauna spotter/catcher is responsible for:

- actively searching all habitat within areas to be cleared and identifying wildlife species present; and
- facilitation of clearing activities, ensuring methods used are appropriate with minimal risk of injury or death to resident wildlife in accordance with the EMP and the instructions of the construction site manager.

As a rule, the fauna spotter/catcher will work ahead of proposed clearing activities and check vegetation and fauna habitats for the presence of native species. The most desirable approach is to allow wildlife to move out of the disturbance area of their own volition however particular habitat trees and tree hollows will require specialised treatment.

Habitat clearance will be undertaken in accordance with QPWS guidelines and the Draft Queensland Code of Practice for the welfare and management of wild animals affected by land-clearing and the modification or destruction of wildlife habitats and wildlife spotter/catchers (Hanger, 2006). This will follow the following guidelines:

Identification of Habitat Trees

- Habitat trees shall be identified prior to the selective clearing operations.
- Clearing conducted shall be using a staged approach.

Removal of Tree Hollows:

- If any denning, roosting or nesting animals are observed within hollow limbs, but cannot be readily removed by an ecologist, it is recommended that, where appropriate, the hollow end of the limb be blocked with porous material and a chainsaw be used to remove the limb. The limb should then be relocated to a suitable place, determined in consultation with QPWS and the hollow end unblocked at an appropriate time of day to minimise fauna predation. In the case that a colony of microchiropteran bats are located, then the roost will either be felled at night (once bats have vacated) or the entry points shall be blocked, and the roost will be moved to an appropriate area of vegetation to be retained on or adjacent to the site.

Flushing of Denning Fauna

- Prior to tree removal, an appropriately qualified ecologist shall attempt to “flush out” any denning or nesting animals not observed during the initial hollow inspection. This may involve hitting target trees with a sledgehammer or another similar technique. Following felling, a second inspection of the relevant trees shall be carried out to relocate fauna disturbed by the clearing process or remaining within the felled timber to a suitable location determined in consultation with QPWS.
- Where possible, the actual felling of the habitat trees shall be conducted in a manner that will maximize the chances of survival for any fauna remaining within the tree hollows. This involves pushing rather than cutting, and cushioning the tree fall with other felled timber and foliage

The habitat clearance strategy will encourage fauna to move into remaining habitats within Nathan Gorge, Spring Creek and Taroom Town Common, and the upper reaches of impacted waterways. The area surrounding the dam generally represents good quality habitat that would suit the range of species and species communities that will be impacted. However, fauna relocated from the area will likely need to compete with existing fauna for the available resources of food, shelter and habitat in surrounding areas. Further, clearance of habitat may have indirect impacts on species

communities, such as fragmentation and edge effects which are further discussed in Section 11.2.1.2. Generally though, ecological processes will not be affected in the area surrounding the dam.

Clearing of the dam construction footprint and water storage will create an inhospitable space during construction. Any fauna that re-enters the construction area will be at risk of injury or death from construction activities. As the area will largely be devoid of food, shelter and habitat resources, and will be subject to construction noise and vibration, these occurrences are likely to be uncommon.

The habitat clearing and fauna relocation measures seek to minimise habitat and fauna loss as far as practicable. However, the dam will still result in the loss of approximately 3655 ha of remnant habitat and 341 ha of non-remnant (regrowth) habitat. The mitigation strategies will be effective in encouraging the fauna to move into surrounding habitat where there are existing wildlife corridors (i.e. Dawson River and tributaries). However the predominant land use adjacent to the Dawson River riparian zone is cleared grazing land and the majority of fauna will be unable to traverse and/or inhabit this inhospitable environment. Further the surrounding habitat is unlikely to have the carrying capacity to accommodate displaced fauna from the loss of remnant habitat. As a result the residual impacts will be offset as part of the Project's Environmental Offset Strategy. The offset strategy will address relevant State and Commonwealth offset policies including the Queensland Government Environmental Offsets Policy (QGEOP) (EPA, 2008), the specific-issue Policy for Vegetation Management Offsets (DERM, 2009). Sunwater will seek to address the Queensland Government Draft Policy for Biodiversity Offsets (EPA, 2009) and Australian Government Draft Environmental Offsets Policy (DEW, 2007) in consultation with agencies. Further detail on the offset strategy is provided in Section 10.2.4. This will include strategic establishment of offsets (including revegetation) around the water storage to restore habitat and connectivity. There are a number of properties that have been or are planned to be purchased for the Project that offer excellent offset opportunities.

Impacts of loss of habitat on threatened fauna species are discussed in Section 11.2.1.3. Local fauna populations within the Dawson River valley will be maintained by establishment of offsets (including revegetation). This will aim to provide between two and three times the area of quality habitat that will be impacted (this includes any least concern remnant vegetation that provides habitat for threatened fauna). Sunwater will aim to establish offsets immediately following project approval so that the period between impact and usable new habitat is as short as possible. This will ensure that all wildlife has sufficient suitable habitat to occupy and no long term changes to species communities is expected. The majority of offsets are related to the water storage, and during any lag time, suitable habitat is available in the surrounding area (Nathan Gorge, Spring Creek and Taroom Town Common) for relocated fauna to utilise.

Operation

Flooding

The loss of habitat from inundation to FSL has been discussed collectively with the construction impacts in Section 11.2.1.1. Operation of the dam also involves occasional inundation of the flood margin. The 1 in 100 AEP flood level (Q100) with and without the dam is shown in Figure 2-13. Given the temporary and infrequent nature of these flood events (Chapter 14) impacts on terrestrial fauna and habitat are not considered to be significant. Vegetation and habitat will not be cleared in this area. The flood level will affect riparian habitats upstream of the FSL along tributaries and also floodplain habitats around the Taroom area. The flood level is similar to the current scenario (without Nathan

Dam) near the Taroom area. By their very nature, floodplain and riparian habitats are adapted to seasonal flood events and are considered unlikely to be adversely affected by short and infrequent inundation.

The inundation of the Dawson River itself between Taroom and the dam wall and a number of tributaries which flow into the Dawson River, will also restrict the movement of wildlife along these riparian corridors. This is discussed under habitat fragmentation in the following section.

Operational flow regime

Operation of the dam will also alter the flow regime downstream which has the potential to affect the riparian environment . Boggomoss snails currently utilise riparian areas along the Dawson River which become inundated with the rise and fall of this largely ephemeral river. The riparian zone supports moist habitat with scattered fallen logs which provide the snail with shelter and foraging sites. Riparian populations are threatened by floods which scour the snail's microhabitat and even drown the snails if there is extended submergence, and drying of the riparian habitat during drought (BAAM, 2010). The relationship between the Boggomoss snail and flows then relates to the maintenance of riparian vegetation as habitat and changes to flood flows.

The degree to which riparian vegetation relies on flows depends on species composition and water availability. As will be demonstrated in later sections of this chapter, the flows associated with riparian vegetation are typically medium to large in scale and tend to occur relatively infrequently. Riparian vegetation therefore can also rely on a number of other water sources including groundwater and rainfall.

In terms of long-term population viability, the largest and most intact habitat systems occur downstream of the Isla-Delusion Crossing, particularly on the properties Lagoona (which is a part of the Isla-Delusion habitat) and Southend within the riparian zone. A mix of adult and sub-adult snails has been reported from all of the known sub-populations, indicating that conditions remain suitable for recruitment of individuals to those populations.

It is for this reason an assessment of potential change to flows for this species, outlined in Section 28.5, has been undertake focussing on the riparian reach between Orange Creek Weir and the upper reaches of Theodore Weir. Two cross sections of the Dawson River within this reach have been used to establish the volume of water required to mimic "riparian flows" such that an assessment of potential changes can be undertaken.

The assessment of operational flow conditions as identified that the adoption of low flow release strategies will increase low flows relative to current levels and move towards the natural situation. This will maintain water levels, which in turn is expected to maintain riparian vegetation within close proximity to the water course. The riverine environment downstream is currently dominated by weir pools and as their operation is not expected to change significantly, water levels within the weir pools will be maintained at higher levels more often.

Riparian vegetation located at or above bankfill were also assessed.

Flow modelling (Section28.5.1) reveal that the frequency of flows that could directly impact on the snail or strip the riparian zone of mulch will be reduced by the Project. However, riparian flows are too infrequent to be the primary source of water and it is likely that riparian vegetation is reliant on a combination of water sources including groundwater and rainfall, upon which the Project will have no negative impact. The seasonality of these riparian flows is predicted to be maintained. It is therefore considered that the changes to downstream flows within the Isla Delusion and Southend

reach of the Dawson River will provide some protection from the damaging effects of floods and is unlikely to significantly impact upon the riparian habitat. Long-term monitoring of downstream riparian habitat however will be undertaken to confirm these predictions. Should decreases in riparian health be observed then remedial measures will be developed, possibly including alterations to the operational flow regime.

11.2.1.2. Habitat fragmentation

Construction

Habitat within the landscape of the dam study area is highly fragmented from historic vegetation clearing for grazing and agricultural uses. Habitat fragmentation results in a loss of connectivity impacting on fauna dispersal through the landscape. Fragmentation impacts will occur as a result of clearing the dam construction footprint. When construction is complete much of the site will be rehabilitated with native vegetation to recreate the original ecosystem. Some residual impact will be evident because of the presence of the dam wall and associated infrastructure.

Detailed design will aim to minimise fragmentation as much as possible by avoiding the need to clear vegetation in the first instance or at least passing on one side of a patch rather than dividing the patch in two. The clearing width in significant habitat that cannot be avoided will be the minimum necessary to complete the task.

Fragmentation of habitat resulting from inundation is addressed in the following section.

Operation

Impacts of fragmentation on threatened species is discussed in Section 11.2.1.3.

Inundation to FSL will create new edges on those habitats at the periphery of the water storage. Fauna may be impacted by increased penetration of native and exotic predators and competitors into the patch, changes in floristic composition resulting in loss of food resources and reduction in the size of the patch making the patch unable to support populations. Species that are mobile and widely distributed are able to colonise alternative habitats outside of the impact area. However, for species that are less mobile or restricted to a particular habitat type, connectivity is essential in order to disperse away from impacts, colonise new habitats, promote genetic diversity within populations and to utilise seasonal food or habitat resources.

The inundation of the Dawson River itself between Taroom and the dam wall and a number of tributaries which flow into the Dawson River, will also restrict the movement of wildlife along and across this east-west riparian corridor. As much of the habitats within the low-lying areas of the Dawson River valley have been cleared, remaining riparian corridors are the only dispersal pathway available to less mobile species. The nearest east-west corridor to the south is located along Cracow Road approximately 5 to 10 km south of the water storage (narrow vegetated roadside), and east-west connections to the north are highly fragmented (Section 11.1.3.3). Therefore the severing of the Dawson River riparian corridor is considered to have a significant impact on east-west local fauna movements. The major north south corridor to the east of the dam wall between Nathan Gorge and Precipice National Park will remain unaffected.

As discussed in Section 11.2.1.1, operation of the dam also involves temporary and infrequent inundation of the flood margin, including riparian habitats upstream of the FSL along tributaries and floodplain habitats around the Taroom area.

This will not fragment habitats for an extended period of time and is not anticipated to result in further impacts to dispersal.

The vegetation clearing strategy will aim to minimise the impacts of fragmentation along the Dawson River to some extent by not clearing riparian vegetation within 1.5 m vertical below FSL. While it is assumed this vegetation will eventually die when the dam reaches FSL for an extended period, if the dam does not fill in the short term, it provides an opportunity for the revegetation strategy to create effective habitat. The only way to effectively mitigate this impact will be to re-establish the riparian corridor. This will be achieved by rehabilitation and management of non-remnant habitat on land parcels surrounding the water storage. The rehabilitation work will enhance connectivity between areas of remaining vegetation, aid natural regeneration (i.e. filling gaps), and improve habitat quality through weed and feral animal control, fire management and exclusion of cattle grazing in critical areas.

11.2.1.3. Impacts on threatened fauna

Five threatened fauna species are known from the dam impact area including four species listed under the NC Act and two species listed under the EPBC Act. Nine threatened species will likely and a further ten species possibly occur in the dam impact area. Potential impacts on known and likely species (with the exception of the Boggomoss Snail) from construction and operation of the dam are discussed collectively in Table 11-18. Species considered as possible to occur in the Project area are only impacted by loss of potential habitat and in each case this is covered by the rehabilitation and offset strategies which includes establishment and or protection of such potential habitat. The impacts and mitigation measures for the Boggomoss Snail have been discussed separately in Table 11-19. The potential impacts on EPBC Act listed species in regards to the Significant Impact Guidelines are assessed in Chapter 28.

Table 11-18 Impacts on threatened fauna in the dam and surrounds

Species Name	Status[1]	Presence	Potential Impact
AMPHIBIANS			
Cyclorana verrucosa Rough-collared Frog	NT (NC)	Known	It is anticipated that the Rough-collared Frog is patchily distributed along the Dawson River floodplain and its tributaries and is protected in the nearby Precipice National Park (NP) and Lake Murphy Conservation Area (CA). The Project will result in the loss of 3284 ha of potential habitat for this species (REs 11.3.2, 11.3.3, 11.3.4 and 11.3.25) within the dam construction footprint and water storage. As this is a low mobility species, clearing of this habitat would have a direct impact on individuals of the Rough-collared Frog. The Rough-collared Frog is distributed in a band from southern inland Queensland to far western NSW. The loss of habitat for this species will impact on the range and abundance of this species within the water storage. With the implementation of mitigation measures and offsets the loss of habitat is not expected to have a significant impact on this species.
REPTILES			
Hemiaspis damelii Grey Snake	E (NC)	Known	It is anticipated that the Grey Snake is patchily distributed within open forests and woodlands associated with the Dawson River floodplain and tributaries. The Project will result in the loss of 3284 ha of potential habitat for this species ((REs 11.3.2, 11.3.3, 11.3.4 and 11.3.25) within the dam construction footprint and water storage. The distribution of the Grey Snake extends from central inland New South Wales north to Rockhampton. The Grey Snake is a fairly mobile species and is expected to be able to move along contiguous riparian corridors, into suitable riparian and floodplain habitat

Species Name	Status[1]	Presence	Potential Impact
			upstream of the FSL along tributaries during staged vegetation clearing and gradual inundation to FSL. However, the loss of habitat for this species will impact on the range of this species, and potentially abundance if the adjacent habitat does not have the carrying capacity to support this species. With the implementation of mitigation measures and offsets the loss of habitat is not expected to have a significant impact on this species.
Acanthophis antarcticus Common Death Adder	NT (NC)	Likely	The Common Death Adder was not recorded from the dam study area. Potential habitat for this species within the impact area includes Eucalypt woodlands, Cypress Pine / Ironbark woodlands and Brigalow / Belah open forests. The species can utilise a range of habitats, including grasslands, and loss of potential habitat from the Project is not considered to be significant for this species.
Paradelma orientalis Brigalow Scaly-foot	V (NC, EPBC)	Likely	The Brigalow Scaly-foot was found in Cypress Pine/Ironbark woodlands outside the impact area at Spring Creek Station. Although the Project will not impact on the known habitat for this species, the dam construction footprint and water storage will result in the loss of 3836 ha of potential habitat incorporating Cypress Pine/Ironbark woodlands (REs 11.10.7, 11.10.7a and 11.10.9) and Brigalow/Belah open forests (REs 11.9.1, 11.9.5, 11.9.5a and 11.9.10). There is an abundance of suitable habitat for this species occurring outside the impact area in Cypress Pine/Ironbark woodlands at Spring Creek and Nathan Gorge, and in Brigalow woodlands south of the water storage. Therefore the loss of potential habitat is not anticipated to have a significant impact on this species.
Strophurus taenicauda Golden-tailed Gecko	NT (NC)	Likely	The Golden-tailed Gecko was recorded in habitat outside the impact area, however potential habitat for this species occurs within the impact area in REs 11.3.19, 11.10.7a and 11.10.9. The dam construction footprint and water storage will result in the loss of 126 ha of potential habitat for this species. This is an arboreal species, however can readily traverse small gaps of open ground (was observed crossing the road between two habitat patches). As this is an arboreal species, clearing of potential habitat will potentially have direct impacts on individuals of the Golden-tailed Gecko should they be present. However, known habitat for the Golden-tailed Gecko is located surrounding the dam within roadside Brigalow along Cracow Road. Suitable habitat is also abundant in Cypress Pine woodlands at Spring Creek and Nathan Gorge. Given the availability of good quality habitat in the surrounding region, the potential impact on this species is not considered to be significant.
BIRDS			
Geophaps scripta scripta Squatter Pigeon (Southern)	V (NC, EPBC)	Known	The Squatter Pigeon occupies a variety of habitats and remains common in heavily-grazed country north of the Tropic of Capricorn (TSSC, 2008fp). The Squatter Pigeon was observed in grassy woodlands adjacent to waterways within the water storage, and also in in disturbed habitats with permanent watering points (around Mt Rose homestead) outside the water storage. Clearing of the dam construction footprint and water storage will result in the loss of 3398 ha of habitat for the Squatter Pigeon including grassy woodlands and riparian woodlands. This is unlikely to significantly impact on the Squatter Pigeon as they readily traverse open and disturbed areas in response to seasonal conditions and access to water, and are likely to continue to use existing habitat surrounding the water storage (i.e. Spring Creek Station).
Falco hypoleucos Grey Falcon	NT (NC)	Known	An individual was observed overflying Spring Gully on Mt Rose station. Foraging and nesting habitat for this species includes

Species Name	Status[1]	Presence	Potential Impact
			riparian and alluvial woodlands (REs 11.3.25, 11.3.2, 11.3.3 and 11.3.4) where it hunts primarily on birds. The dam construction footprint and water storage will result in the loss of 3284 ha of potential foraging and nesting habitat for the Grey Falcon. Suitable habitat for the Grey Falcon remains along tributaries upstream of the FSL, therefore the loss of this potential habitat is not anticipated to have a significant impact on this species. Creation of the water storage is expected to create a favourable environment for water birds, which will provide foraging habitat for this species.
Ephippiorhynchus asiaticus Black-necked Stork	NT (NC)	Likely	A flock of Black-necked Stork was observed on Lake Murphy CA, located approximately 15 km north-west of the dam study area. This habitat will not be impacted by the Project, however, the Black-necked Stork is likely to occur across the impact area in association with the existing Glebe Weir pool, freshwater wetlands and farm dams. The Project will result in the inundation of Glebe Weir and a number of freshwater wetlands associated with GAB springs on Mt Rose which provide habitat for this species. The loss of this habitat is not anticipated to have an impact on this species, as the Black-necked Stork is widely distributed throughout northern Australia and the water storage and expanded/new springs will continue to provide habitat for this species.
Grantiella picta Painted Honeyeater	NT (NC)	Likely	An individual was observed at Nathan Gorge downstream of the dam wall site. This habitat will not be impacted by the Project, however, potential habitat occurs in the impact area, within Brigalow and Eucalypt woodlands. The dam construction footprint and water storage will result in the loss and fragmentation of potential habitat. The impacts on the species are not considered to be significant as the Painted Honeyeater is a mobile species and is expected to be able to utilise suitable good quality habitat in the surrounding area, in particular at Nathan Gorge.
Lophoictinia isura Square-tailed Kite	NT (NC)	Likely	The Square-tailed Kite was not recorded from the dam study area, however potential habitat occurs in the water storage, within riparian woodlands along the Dawson River and tributaries which are relatively connected. The dam construction footprint and water storage will result in the loss and fragmentation of potential habitat. The impacts on this species are not considered to be significant, as the Square-tailed Kite is a highly mobile species and would be able to utilise extensive tracts of suitable habitat on the Dawson River downstream at Nathan Gorge and along tributaries.
Melithreptus gularis Black-chinned Honeyeater	NT (NC)	Likely	An individual was observed in riparian River Red Gum woodland on the Chain Lagoons located off the Leichhardt Highway west of the dam study area. This habitat will not be impacted by the Project, however, potential habitat occurs in the impact area, within riparian woodlands along the Dawson River and tributaries which are relatively connected. The dam construction footprint and water storage will result in the loss and fragmentation of potential habitat. The impacts on this species are not considered to be significant, as the Black-chinned Honeyeater is a mobile species and is expected to be able to move along contiguous riparian corridors, into suitable riparian habitat upstream of the FSL along the Daswon River and tributaries during staged vegetation clearing and gradual inundation to FSL.

Species Name	Status[1]	Presence	Potential Impact
Nettapus coromandelianus Cotton Pygmy-goose	NT (NC)	Likely	A flock of Cotton Pygmy-goose was observed on Lake Murphy CA, located approximately 15 km north-west of the dam study area. This habitat will not be impacted by the Project, however, the Cotton Pygmy-goose is likely to occur across the impact area in association with the existing Glebe Weir pool, freshwater wetlands and farm dams. The Project will result in the inundation of Glebe Weir and a number of freshwater wetlands associated with GAB springs on Mt Rose which provide potential habitat for this species. The loss of this habitat is not anticipated to have an impact on this species, as the Cotton Pygmy-goose is widely distributed throughout Australia and the water storage and expanded/new springs will continue to provide habitat for this species.
Rostratula australis Australian Painted Snipe	V (EPBC)	Likely	The Australian Painted Snipe was not recorded in the study area but is likely to be a vagrant to freshwater wetlands or farm dams with vegetation cover located in the water storage in response to seasonal rainfall events. The dam construction footprint and water storage will result in the loss of 22.8 ha of wetland habitat (RE 11.3.22 and 11.3.27) for this species. The loss of this habitat is unlikely to be significant for the Australian Painted Snipe, as the periphery of the water storage will continue to provide suitable habitat (e.g. dense vegetation fringing water). Further the possible expansion of wetland areas associated with GAB springs, and creation of new springs from increased groundwater pressure will also provide habitat for this species.
MAMMALS			
Chalinolobus picatus Little Pied Bat	NT (NC)	Known	The Little Pied Bat was recorded from 13 sites across the dam study area at watercourses and nearby woodlands. The species is insectivorous and is likely to forage across the majority of the vegetation areas of the impact area. Roosting habitat for the Little Pied Bat is likely to include all riparian and alluvial eucalypt woodlands. The dam construction footprint and water storage will result in the loss of 3289 ha of potential roosting / foraging habitat for the Little Pied Bat. Riparian woodlands will remain both up and downstream of the water storage along the Dawson River and tributaries. Trees, including dead standing trees, remaining on islands and fringing the water storage will also potentially provide roost locations. Further, insects attracted to the new water storage are expected to continue to provide a good foraging resource for this species. Relocation of habitat (stags and hollow limbs) would improve the roosting habitat for the Little Pied Bat.
INVERTEBRATES			
Jalmenus eubulus Imperial Hairstreak Butterfly (northern subspecies)	V (NC)	Likely	The Imperial Hairstreak is primarily associated with Brigalow communities. Clearing of the dam construction footprint and water storage will result in the loss of 186 ha of Brigalow dominant and co-dominant habitat for this species (REs 11.3.1, 11.9.1, 11.9.5, 11.9.5a, 11.9.10). This habitat is mainly restricted to riparian corridors and fragmented patches of Brigalow. Patches of Brigalow will remain scattered around the impact area, and with establishment of offsets for Brigalow ecological communities, the impact on this species foraging resource is not likely to be significant.

1 Status: EPBC = *Environment Protection and Biodiversity Conservation Act 1999*
NC = *Nature Conservation (Wildlife) Regulation 2006*
E = Endangered; V = Vulnerable; NT – Near Threatened

To minimise impacts on wildlife, a fauna spotter/catcher will be present before vegetation and habitat clearing to actively search known and potential habitat types for fauna, targeting threatened species, and relocating species caught into suitable habitats outside the impact area. To improve the condition and capacity of existing habitat in the surrounding area, relocation of fauna habitat features will be undertaken, including stags and hollow limbs to improve roosting and nesting habitat for fauna.

A Weed and Pest Management Plan will be implemented for construction and operation of the Project which will assist in controlling exotic weeds and pests which may degraded habitat and/or predate on threatened species.

The offset strategy will provide compensation for the clearance of habitat for threatened species (Section 10.4.2). Habitat offsets will be achieved by initially targeting those areas nearest to the area of impact which could increase the value of the offsets already offered, for example strategic in-filling (revegetation) of non-remnant areas that would provide linkages between offset or remnant habitats. In larger areas natural regeneration will be enhanced by strategic plantings of non-remnant areas to assist in regeneration to remnant status. Remnant habitat will be included in the offset strategy where it is immediately adjacent to offset areas or to existing protected areas to add value to the total managed estate. Non-remnant and remnant areas included within the overall strategy will be protected from conflicting uses, through weed and feral animal control, fire management and management of stocking rates and/or periodic exclusion of cattle.

There is potential for the Project to assist in the recovery of threatened species through protection and rehabilitation of habitat as part of the offset strategy and implementation of weed and pest management plans for construction and operation. With the implementation of mitigation measures and offsets, the Project is not expected to have a significant impact on any of these threatened species.

The impact assessment on the Boggomoss Snail from construction and operation of the dam is given in Table 11-19. The water storage will inundate 0.75 ha of known habitat for the Boggomoss Snail at Mt Rose Station, resulting in the loss of one sub-population (350 individuals). Although this represents a small reduction in population size (1.2%) and a small loss of known habitat (1.9%), the loss is of importance as it is the only remaining population that occurs in boggomoss habitat. A translocation plan will be implemented to collect and relocate as many snails as possible from the Mt Rose site to suitable sites outside the impact area. With the implementation of the translocation plan, it is considered that the size and genetic diversity of the Mt Rose subpopulation will be maintained. Existing threats to the Boggomoss Snail will be managed at these translocation sites, including weed and pest control, fire management and management of stocking rates. The translocation plan including examples of successful relocations of native land snails is provided in Appendix 11-E. Snails will be translocated to at least three separate sites to maximise the chances of success and spread the risk of threatening processes (i.e. fire, flooding) from destroying all relocation sites. In addition, as part of the rehabilitation and offset strategies, riparian habitat will be rehabilitated in and near known habitat downstream of the dam. Offsets for the loss of GAB spring wetlands (and recharge springs significant at a State level), which will involve restoration of degraded springs in the region, may also provide future habitat for the snail.

The impacts of the operational flow regime on the riparian environment are discussed in Section 11.2.1.1.

Further detail around the potential impact to reduced bank flows is discussed in Section 28.5 and 28.7.

Table 11-19 Impacts and mitigation on the Boggomoss Snail

Criteria	Impacts	Mitigation and Offsets
Lead to a long-term decrease in the size of a population of a species?	The Project will result in the flooding of one subpopulation of the Boggomoss Snail at three boggmosses at Mt Rose Station. In an unmitigated scenario this would result in the direct loss of an estimated 350 individuals. Combining the population estimates by BAAM and SKM, this would reduce the population size by 1.2%. With the implementation of the translocation plan, it is considered that the size and genetic diversity of the Mt Rose subpopulation will be maintained. Establishment of additional separate viable sub-populations is an appropriate conservation action for this critically endangered species. The riparian populations are under constant threat from two natural events, floods which scour the snail's microhabitat and perhaps drown the snails and drying of the habitat during drought. The operational flow regime will increase low flows relative to current levels, but will decrease the number of bankfull and overbank events, resulting in a longer period between flooding events. This reduction is not anticipated to lead to any substantive change in the riparian habitat. Reduction in overbank events may also be beneficial in reducing the threat of flooding to Boggomoss Snails.	A translocation plan will be implemented to relocate the Mt Rose sub-population into suitable habitat identified outside the water storage. The translocation plan is provided in **Appendix 11.E**. This has been prepared by Dr John Stanisic in consultation with SEWPaC. Areas of known habitat downstream will be included in the offset strategy and actions will be taken in these areas to reduce threats to the species. Long-term monitoring of riparian populations will be undertaken. Should decreases in habitat health be observed then remedial measures will be developed, possibly including alterations to the operational flow regime. As part of the offset strategy, SunWater intends protecting areas of downstream riparian habitat that the snail is known to inhabit. This habitat will be improved through weed and pest management and through stock management where that is an issue.
Reduce the area of occupancy of the species?	In total the known habitat for the Boggomoss Snail is approximately 38.81 ha across all sites where live snails were recordedpopulations. The Project will result in the flooding of 0.75 ha or 1.93% of known habitat in the region from Mt Rose Station. While small, this is considered a significant impact, as it is the only known boggomoss habitat where the species occurs which is not at risk of drying out. However it was considered to be at high risk of destruction from fire (BAAM, 2009). Successful implementation of the translocation plan, including introduction of the snail into three currently unoccupied, separate habitats, will lead to the establishment of separate viable populations and reduce the impact to negligible levels. Removal of the Mt Rose sub-population will reduce the overall range of the species as this is the most upstream known site. Favoured locations for translocation of the sub-population are in the same area so will directly address this issue.	A translocation plan will be implemented for the Boggomoss Snail (**Appendix 11.E**).
Fragment an existing population into two or more populations?	The distribution of the snail is discontinuous and the Project will not cause further fragmentation of the local populations of the Dawson River subpopulation. Although the Project will fragment the east-west riparian corridor along the Dawson River this will not impact on the Boggomoss Snail as the riparian populations are located downstream of the dam.	Operational flow regime.

Criteria	Impacts	Mitigation and Offsets
	It is likely that the Boggomoss Snail recolonises riparian habitats as a result of flooding events and this provides genetic exchange between riparian local populations. The operational flow regime (**Section 11.2.1.1**) will continue to allow both bankfull and overbank flooding events to occur. Although there will be a decrease in events, this is not expected to impact genetic exchange between the riparian local populations.	
Adversely affect habitat critical to the survival of a species?	The Boggomoss Snail is not exclusively associated with boggomosses and inhabits a range of moist habitats, with recent surveys finding the snail in riverine riparian zones and nearby ephemeral wetlands, and on boggomosses. These habitats are considered to be refugial remnants of the historical core habitat of this species. The riparian habitats are under constant threat from flooding and drying out. Therefore the loss of the only boggomoss habitat is significant because of its importance for long-term population viability. The reduction in flooding events is unlikely to lead to a substantive change in the riparian habitat.	A translocation plan will be implemented for the Mt Rose subpopulation (**Appendix 11.E**). Long-term monitoring of the riparian populations.
Disrupt the breeding cycle of a population?	The breeding cycle of the Boggomoss Snail is unknown, but no change is expected in the riparian populations. When the snails from Mt Rose are translocated, their breeding cycle may be interrupted as recognised in the translocation plan. With respect to the total population, such an impact is not considered significant.	The translocated snails will be monitored to record breeding and recruitment.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	As noted above, the habitat which will be lost at Mt. Rose Station represents approximately 1.93% of the available habitat. The remaining riparian habitat will be essentially unaffected by the Project.	Implementation of the translocation plan. Offset strategy including rehabilitation of areas of downstream riparian habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?	The Project will not introduce feral animals to the Project area though feral pigs may favour the edges of the water storage as they do current riparian zones. No change would be expected with respect to the five downstream sub-populations. Without mitigation, the risk of increased invasion by harmful species of the snail's habitat is considered very low.	A Pest Management Plan will be prepared to manage the occurrence of declared pests within the works area, flood margin, rehabilitation areas and areas allocated to offsets. At the relocation sites measures will be implemented to manage rodents. With mitigation, the risk of increased invasion by harmful species of the snail's habitat is considered negligible.
Introduce disease that may cause the species to decline?	The Project will not introduce any diseases.	No mitigation necessary.

Criteria	Impacts	Mitigation and Offsets
Interfere with the recovery of the species?	The Recovery Plan needs to be renewed every 5 years. Given the recently acquired information on the distribution of the Boggomoss Snail, it is recommended that the Recovery Plan be renewed. This is necessary because the existing plan focussed on management of the then known two sites whereas the snail has now been found at 17 sites. The plan was adopted in July 2008 and recommended an interim review after 3 years, i.e. July 2011 so the timing is opportune. As a commitment for this project, SunWater will fund renewal of the plan which is up renewal this year. The recovery actions for the Boggomoss Snail in the current plan include assessing the weed problem and controlling if necessary; developing and implementing a fire risk management plan; fencing the habitat critical to the survival of the snail to exclude cattle; protecting the habitat of the snail through a voluntary conservation agreement with the landowners, searching for additional populations of the species; determining the impact of other threatening processes; monitoring known populations of the snail; researching the genetics of the snail; researching the ecology and life cycle of the snail; and increasing public and landholder awareness of the snail. For construction of a dam on the Dawson River, the recovery plan suggested translocation of snails as a viable mitigation measure. A number of recovery actions have already been achieved through the Project including searching for additional populations in the region and increasing public and landholder awareness through surveys and media attention of the Project.	Renewal of the Recovery Plan. The Project will assist in the recovery of the Boggomoss Snail by identifying and protecting translocation sites and areas to be included in the offset strategy. Translocation will also lead to establishment of separate viable populations or subpopulations (depending on the location of the translocation site). Monitoring of the snail will be undertaken at translocation sites (enclosures) and downstream riparian sites. The recovery of the species is expected to be enhanced by these actions.

11.2.1.4. Impacts on migratory fauna

Four migratory species listed under the EPBC Act are known from the Project area and a further four migratory species are likely to occur. The potential impacts on the four know migratory species from construction and operation of the dam are discussed in Table 11-20. The potential impacts in regards to the Significant Impact Guidelines are assessed in Chapter 28.

Table 11-20 Impacts of the dam and surrounds on migratory fauna

Species Name	Presence	Potential Impacts
MIGRATORY WETLAND BIRDS		
Ardea ibis Cattle Egret	Known	These species are highly mobile and are likely to occur within the Project area depending upon seasonality and in response to rainfall.
MIGRATORY TERRESTRIAL BIRDS		
Haliaeetus leucogaster White-bellied Sea-Eagle	Known	The migratory terrestrial birds are likely to continue to utilise the margins of or the aerial space above the water storage over the longer term.
Hirundapus caudacutus White-throated Needletail	Known	The dam impact area is not known to contain any area of important habitat for a migratory species, or an ecologically significant proportion of the population of a migratory species. As such, the Project will not result in a significant impact on a migratory wetland or terrestrial bird.

Species Name	Presence	Potential Impacts
Merops ornatus Rainbow Bee-eater	Known	The Rainbow Bee-eater was recorded throughout the Project area in woodland communities. Some areas of suitable habitat would be removed by the Project, however preferred habitats are widely distributed throughout the range of the species and the Project is unlikely to significantly impact on the species.

11.2.1.5. Pest animals and diseases

Construction

Pest animals are present throughout the Project area including the following species declared under the LP Act; Dingo/Wild Dog, Feral Cat, European Rabbit, Pig and Fox. The construction of the dam is unlikely to significantly increase the distribution or abundance of pest animals as these species will lose habitat. However, Dingoes / Wild Dogs may be attracted to work sites if food or scraps are available.

A Pest Management Plan will be prepared to manage the occurrence of declared pests within the Project area during construction activities. Management measures will be consistent with recommendations in the Biosecurity Queensland's pest animal fact sheets. Measures to be implemented could include disposal of food scraps in designated areas (Chapter 20) and laying of poisoned baits for Dingoes / Wild Dogs.

Operation

Operation of the dam is not expected to increase the presence or distribution of pest animals within the Project area due to the loss of suitable habitats. Pigs are an exception as this species forages at the edges of wetlands and waterbodies, including water storages. A Pest Management Plan will be prepared to manage the occurrence of declared pests within the Project area during operation. This will include pest management within offset areas. Management measures will be consistent with recommendations in the Biosecurity Queensland's pest animal fact sheets. Measures for the control of Feral Pigs and other vertebrate pests within the Project area could include:

- shooting of feral cats, wild dogs and pigs under strict criteria;
- construction of pig traps adjacent to significant habitat areas; and
- laying of poisoned baits under strict criteria.

The Pest Management Plan will be developed by qualified wildlife ecologists and will take into account potential impacts of control methods, such as baiting on non-target species.

There is a low risk of the spread of plant pests (invertebrates) from construction and operation of the dam, as the Project does not involve transport of agricultural crops.

11.2.1.6. Noise, vibration and dust

Construction

Construction of the dam and clearing within the water storage has the potential to create noise and dust which may have a short-term detrimental effect on local fauna inhabiting surrounding habitat. In general, fauna will move away from unusual noise sources such as construction work. However, this may cause animals to leave their home ranges, disrupt breeding cycles and restrict foraging behaviours, if the noise continues for lengthy periods. The impacts from noise may extend several hundred metres from the source. At the cessation of construction activities, it is expected that fauna will eventually return. Restricting construction activities to daylight hours will minimise the impacts of noise on fauna. Noise control measures will be implemented as part of the Construction EMP and are detailed in Chapter 29.

Creation of dust will not significantly affect native fauna, although may indirectly result in the temporary exclusion of fauna from dusty areas. Folivores such as the Koala and Greater Glider may be impacted by heavy coatings of dust on vegetation rendering food sources unpalatable. Dust suppression along haul roads, access tracks and other construction areas will minimise impacts.

Vibration due to blasting and other construction activities is likely to impact on some groups of terrestrial vertebrates (e.g. snakes, which are sensitive to ground vibration). However, impacts are likely to be confined to a small radii around each blast area and are temporary in nature. Long- term adverse impacts of blasting are not expected.

Operation

Inundation and operation of the dam will not generate any significant noise, vibration or dust, apart from the occasional service vehicle, and therefore no operational impacts on fauna are anticipated.

11.2.1.7. Artificial night lighting

Construction

The dam construction will typically be during daytime hours (6am to 6pm), therefore there is unlikely to be much artificial night lighting required, except for illumination of the main site office and compound area for security purposes. Lumination may also be required during winter hours at the beginning and end of each day. This increase may result in the temporary shifting of some nocturnal fauna away from the construction area, although others will certainly benefit. For example, a diversity of microchiropteran bats will make consistent use of night lights as a foraging resource, with the lights acting as a point source for insect prey.

Operation

There will be minimal (if any) permanent lighting used during the operation of the dam. As such, long term impacts on fauna as a result of artificial night lighting are not expected.

11.2.2. Pipeline

The aspects of the pipeline construction and operation that have the potential to impact on terrestrial fauna species and habitat include:

- construction of the trunk pipeline from Nathan Dam to Dalby, pump stations and balancing storages at the dam and along the pipeline route, access roads and temporary stockpiles;
- clearing of vegetation within a 30 m wide pipeline corridor; and
- maintenance of the pipeline, including slashing of 15 m wide permanent easement and vehicular traffic along the access roads and easement.

11.2.2.1. Loss of fauna habitat

Design

The design of the pipeline has sought to minimise the impact on terrestrial vegetation and habitat through route selection. Recommendations from the flora and fauna field surveys where implemented to avoid areas of significant vegetation and habitat where possible.

Construction

The construction of the pipeline will result in the loss of 145.6 ha of remnant habitat and 40.9 ha of regrowth habitat for fauna. Clearing estimates are based on the maximum 30 m easement width required for construction but depending on terrain and adjacent land use it may be possible to reduce this to as little as 15 m in sensitive areas. The impact on habitat types is summarised in Table 11-21.

Table 11-21 Area of remnant habitat impacted by the pipeline

Habitat	REs	Remnant (ha)
Riparian woodlands	11.3.25	5.6
Open forest and woodland on alluvium	11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.14	21.1
Open forest and woodland on non-alluvium	11.10.7, 11.10.9, 11.4.3, 11.5.1, 11.5.21, 11.5.4, 11.7.4, 11.7.6, 11.9.10, 11.9.4a, 11.9.5, 11.9.6, 11.9.7, 11.9.10, 11.5.1, 11.7.2, 11.7.5, 11.7.7, 11.5.21, 11.7.5, 11.7.7, 11.5.1a	115.2
Natural grasslands	11.3.21	0.8
Total Remnant (ha)		**145.6**
Total Regrowth (ha)		**40.9**

Since the pipeline field survey there have been minor realignments made to the pipeline route. Areas of remnant habitat impacted are therefore based on a combination of Chenoweth RE mapping and DERM RE mapping. Additional areas will need to be surveyed for both vegetation and habitat during the approval process for the Project.

Additional habitat may be cleared for the construction of the pump stations, balancing storages, access roads and stockpiles/laydown areas. The pump stations and balancing storages will be located on land parcels that support patches of remnant vegetation. These areas will be surveyed once the precise footprint is confirmed during detailed design. The location of stockpiles and lay-down areas is more flexible and they will be located within previously cleared areas on private land (subject to landholders negotiations).

The pipeline follows existing easements where possible and avoids all habitat areas within State Forests, as well as significant habitats including Natural grasslands and Semi-evergreen vine thickets. The final pipeline design will also minimise impacts on areas of Brigalow habitat (Section 10.2). However, there will be some unavoidable loss of primarily open forest and woodland habitat on non-alluvium and within riparian zones where the pipeline crosses creeks. The impacts on fauna associated with pipeline construction are as follows:

- clearing of habitat along the easement including loss of hollow-bearing trees and nests, and disturbance to microhabitat features such as rocks, logs and other woody debris;
- unearthing of burrowing fauna during soil disturbance and trenching; and
- injury and mortality from fauna falling into the trench ('trenchfall') are being unable to escape.

The construction impacts associated with clearing of habitats for the dam and surrounds have been discussed in Section 11.2.1.1 and these impacts are similar with respect to clearing of the pipeline corridor. In general, there is abundant good quality habitat available adjacent to impact areas, and species are expected to be able to move into this habitat during construction. Within the pipeline corridor there is scope to reduce the amount of vegetation cleared by trimming of branches of significant trees (i.e. hollow-bearing or mature trees) rather than felling and reducing the clearing width in sensitive areas. Section 11.2.1.1 provides measures for the minimisation of impacts related to habitat clearance on terrestrial fauna. Specifically for the pipeline construction these include:

- engagement of a spotter-catcher;
- use of alternative clearing measures to ensure hollows are kept intact and placed in the neighbouring habitat; and
- stockpiling of felled vegetation to provide compensatory shelter sites.

Significant numbers of fauna historically become trapped within open pipeline trenches (Doody *et al.,* 2003; Wilson and Swan, 2004). Mortality could ensue from overheating, dehydration, predation and/or drowning. This impact has been acknowledged as a key environmental issue by the *Australian Pipeline Industry Association Code of Environmental Practice* (APIA, 2005). Modern trenching techniques (Chapter 2) have reduced the risk of trenchfall to fauna and the potential impacts are considered minimal.

Impacts of trenchfall will be minimised by adherence to recommendations in the APIA *Code of Environmental Practice* such as:

- minimising the period of time the trench is open, particularly in fauna habitat areas;
- constructing trench plugs with slopes less than 45° to provide exit ramps for fauna;
- installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas);
- branches, hessian sacks, ramped gangplanks or similar to be used to create 'ladders' to enable fauna to exit the trench; and
- surveillance of the open trench in sensitive areas and the removal of wildlife from the trench by appropriately trained personnel.

Although a 30 m wide easement is required for construction, only a 15 m wide easement is required for maintenance. The remaining 15 m width will be rehabilitated post-construction to re-establish the pre-construction ecosystem and it is expected that local fauna populations will be able to utilise this habitat in the medium term. Rehabilitation will progressively occur after construction and will include reinstatement and grading of topsoil, spreading of cleared vegetation (in the form of mulch and woody debris) and revegetation (seed mixtures and/or seedlings).

The offsets package will provide compensation for the residual loss of habitat (Section 10.2.4).

Operation

As the pipeline will be generally buried, there will be minimal long-term impacts on fauna from operation. The pipeline easement will be kept free of trees and large shrubs for maintenance and a weed management plan will be implemented.

11.2.2.2. Habitat fragmentation

Design

As discussed in Section 11.2.2.1, the pipeline alignment seeks to avoid or at least go around the edges of remnant and significant vegetation to minimise impacts from habitat fragmentation.

Construction

Construction of the pipeline has the potential to create a barrier to fauna movement by restricting access for some species across unfavourable habitat (i.e. cleared land).

The creation of a cleared easement through intact habitat patches also changes the structure and dynamics of the habitat and local fauna populations. The cleared easement essentially creates new edges to habitat patches which result in a suite of changes in the vicinity of the edges termed 'edge effects'. Edge effects are greatest within patches containing structurally complex vegetation such as vine thickets, brigalow communities and riparian zones. Edge effects can produce changes to plant species composition (including resources for fauna), prevent the movement of some species across the cleared easement and provide access for native and exotic predators and competitors that would otherwise not occur within the habitat type.

The majority of the pipeline alignment follows existing roads and easements, or occurs within pasture / grassland, where fragmentation has already occurred. Where habitat clearing is required to widen an existing easement, the additional clearing represents a cumulative impact because the gap between habitat patches becomes wider. During the field survey, alterations were made to the pipeline alignment, to avoid passing through intact habitat patches where possible.

Most of the impacts from habitat fragmentation will occur in the middle section of the pipeline, where the alignment deviates from the Warrego Highway and traverses large tracts of remnant vegetation which provide continuous linkages between Barakula SF to the north east with Binkey SF, Gurulmundi SF and Cherwondah SF to the south west.

Progressive rehabilitation of the construction easement immediately post-construction will provide cover for small terrestrial fauna species attempting to traverse the easement and will ensure that the pipeline remains permeable for dispersing fauna.

Operation

The fragmentation of habitat from clearing of the pipeline corridor has been discussed collectively with the construction impacts in the Section 11.2.2.2. Operational impacts over the medium to long-term on terrestrial fauna are considered to be minimal due to the rehabilitation and revegetation of the construction easement. However, a permanent easement will be kept free of vegetation (trees and shrubs) for pipeline maintenance. Within structurally complex vegetation the permanent easement may present a barrier to some fauna species, although the majority of species present are adapted to dispersal across open woodland habitats and are therefore likely to be tolerant of narrow canopy gaps. The easement is a permeable barrier, unlike a physical structure or large water body, and although it will be kept free of trees and shrubs, ground covers and woody debris (from clearing activities) will provide shelter for small fauna species crossing the gap. In some cases, the access track may be located outside the pipeline corridor due to local topographical constraints; however the width of the track will not present a significant barrier.

11.2.2.3. Impacts on fauna of conservation significance

Highly mobile threatened species that are likely to occur along the pipeline corridor including birds, bats and mammals are unlikely to be affected by the loss of habitat, as this will not create a barrier to the movement of these species. However, clearing of habitat has the potential to impact on tree roosting bats (i.e. Little Pied Bat and Eastern Long-eared Bat). This will be mitigated by engagement of a spotter-catcher during pipeline construction to identify any roosts and ensure bats are relocated into neighbouring habitat prior to clearing (Section 11.2.2.1).

Less mobile threatened species that are likely to occur along the pipeline corridor including amphibians and reptiles may be impacted by the unearthing of burrowing species (i.e. Rough-collared Frog, Five-clawed Worm Skink) or species that shelter in soil cracks (i.e. Ornamental Snake, Dunmall's Snake) or disturbance of ground habitat (i.e. Golden-tailed Gecko, Brigalow Scaly-foot, Common Death Adder, Yakka Skink). Use of the spotter-catcher will minimise impacts by identifying and relocating species into suitable habitat adjacent to the pipeline easement prior to clearing (Section 11.2.2.1). The impacts will be of a temporary nature, as the construction easement will be rehabilitated and the permanent easement will be covered by grass. These species are expected to be able to traverse narrow habitat gaps. The offsets package will provide compensation for the residual loss of habitat for threatened species (Section 10.2.4).

11.2.2.4. Impacts on migratory fauna

The pipeline corridor does not traverse any areas of important habitat for a migratory species, or an ecologically significant proportion of the population of a migratory species (within the meaning of the EPBC Act). As such, potential impacts on migratory fauna are considered to be insignificant.

11.2.2.5. Pest animals and diseases

It is considered unlikely that construction activities or operation will result in an increase in the numbers or distribution of vertebrate pests along the pipeline corridor because they readily access all areas now. Nevertheless, a Pest Management Plan will be prepared for the Project which outlines appropriate control measures.

11.2.2.6. Noise and dust

Construction of the pipeline will be restricted to daytime hours. Potential construction impacts from noise and dust on fauna and mitigation measures have been discussed in Section 11.2.1.6. Operational impacts will be minimal once the easement has been rehabilitated and the topsoil stabilised. Such measures are discussed in Chapters 17 and 19, respectively.

11.2.3. Associated infrastructure

The construction and operation of potentially impacts terrestrial fauna through the same mechanisms as other components of the Project but the locations and scale of potential impact vary.

11.2.3.1. Impacts on fauna habitat

The construction of new or upgraded roads will result in the loss of 25.82 ha of remnant habitat and 31.76 ha of non-remnant habitat for fauna within the dam study area. The impact on habitat types is summarised in Table 11-22.

Table 11-22 Area of remnant habitat impacted by the associated infrastructure (roads)

Habitat	Area (ha)
Riparian woodlands	1.4
Eucalypt alluvial woodlands	8.6
Eucalypt non-alluvial woodlands	15.2
Brigalow / Belah open forests	0.6
Wetlands / GAB springs	0.008
Total Remnant	**25.8**
Non-Remnant	**31.8**

The majority of road works will be within existing easements and clearing will be restricted to roadside verges. The extension of Glebe Weir Road will require some clearing of remnant open forest and woodland habitats, and will be offset by provision of vegetation and habitat offsets. Glebe Weir Road will be utilised as the main dam access road during construction. This will result in an increased risk of vehicle strikes with fauna crossing the road, particularly macropods. Vehicle speed should be limited within habitat areas during dusk and dawn when macropod activity is highest.

Potential sources of construction resources for the dam, pipeline and roads have been identified. SunWater anticipates purchasing materials from the approved operations. Utilisation of existing resources (i.e. rock quarries) will minimise impacts on local fauna. Potential clay borrow areas are located within the water storage. Any vegetation cleared for the clay borrow areas has already been considered as lost through clearing associated with the water storage.

The construction camp for the dam will be placed in cleared grazing land.

The recreation area will complement the existing environment, and construction will be conducted in a manner which minimises impact on remnant vegetation and significant habitat.

11.2.4. Impact assessment and residual risk

The methodology used for risk assessment and management is discussed in Section 1.8.

This section assesses the risks relevant to terrestrial fauna and summarises the mitigation measures to minimise those risks. Where significant residual risks remain after mitigation, offsets are described where practicable. Sunwater has developed an offsets package in recognition of Queensland and Australian Government offset policies (Section 10.4). In the case of fauna species and habitat this comprises specific habitat offsets under the NC Act and EPBC Act, where this is not specifically covered or mitigated in the vegetation offsets to be provided under the VM Act.

Unmitigated consequence and likelihood ratings for the identified hazards are shown with explanatory notes in Table 11-23. The risk assessment is of the Project as described in Chapter 2, in which SunWater has already incorporated a range of risk reduction and mitigation measures.

Table 11-23 presents the assessment of residual risks after mitigation.

Table 11-23 Terrestrial fauna risk assessment, dam and surrounds

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk			Offset
				C	L	Current Risk			C	L	Mitigated Risk	
Loss of 3655 ha of remnant habitat and 341 ha of non remnant habitat	Clearing and/or inundation of dam construction footprint and water storage.	Loss of fauna habitat for all native fauna.	Vegetation clearing and fauna relocation strategy including:	Moderate	Absolute	High	Weed and pest management to improve habitat condition. Revegetation around the northern margin of the water storage.	Slightly	Moderate	Absolute	High	Establish offset strategy early in project development.
	This extent of habitat clearing is unavoidable if the Project is to proceed.		- Fauna spotter/catcher									
			- Progressive vegetation clearing									
			- Relocate large woody debris and hollows									
Loss of a subpopulation of the critically endangered Boggomoss Snail. Loss of 0.75 ha of known habitat for the Boggomoss Snail.	Inundation of boggomoss habitat within the water storage.	Loss of Mt Rose subpopulation (350 individuals representing 1.2%).	Vegetation clearing and fauna relocation strategy.	Moderate	Absolute	High	Boggomoss Snail translocation plan	Significantly	Minor	Possible	Medium	Offsets strategy will include potential habitat for the Boggomoss Snail.
		Loss of only current boggomoss habitat (1.94%).					Implementation of aspects of the Boggomoss Snail Recovery Plan.	Moderately				
							Re-drafting the Recovery Plan.					

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk			Offset
				C	L	Current Risk			C	L	Mitigated Risk	
Degradation of downstream riparian habitat such that the riparian Bogoomoss Snail populations are impacted.	Flow regime change downstream.	Increase in low flows towards natural levels anticipated to maintain riparian habitat.	Maintain appropriate flow regime.	Minor	Possible	Medium	Maintain environmental flows during operation of the dam.	Significantly	Minor	Unlikely	Low	
		The reduction in overbank events may be beneficial in reducing the threat of flooding to the Boggomoss Snail.					Long-term monitoring of riparian habitat and remedial action if required.	Significantly				
Habitat fragmentation along Dawson River and tributaries as a result of the water storage.	Inundation of riparian and alluvial remnant vegetation.	Loss of fauna dispersal capability.	Vegetation clearing and fauna relocation strategy.	Moderate	Absolute	High	Re-establish riparian corridor around the water storage	Moderate	Moderate	Likely	High	Offset strategy to include linking the new riparian corridor to nearby habitat.
		Loss of genetic diversity if populations remain fragmented in the long term.										
Construction nuisance (noise, dust, vibration, artificial lighting).	Construction noise, dust, vibration and artificial lighting.	Temporary impacts on fauna adjacent to construction areas. Fauna are expected to return after construction.	Construction hours limited to daytime hours. Noise control measures. Dust control measures, i.e. dust suppression.	Minor	Unlikely	Low			Minor	Unlikely	Low	

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk			Offset
				C	L	Current Risk			C	L	Mitigated Risk	
	The impacts will occur over a period of 2-3 years.	Fauna dispersal away from adjacent habitat.	Fencing to exclude fauna from work areas.									
		Leave home ranges.										
		Disruption to breeding cycles.										
		Restriction in foraging behaviours.										

Table 11-24 Terrestrial fauna risk assessment, pipeline

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk			Offset
				C	L	Current Risk			C	L	Mitigated Risk	
Loss of 145.6 ha of remnant habitat and 40.9 ha of regrowth habitat for fauna within the pipeline corridor.	Clearing of 30m wide pipeline easement for construction.	Loss of fauna habitat for all native fauna.	Restrict clearing to 30m wide corridor and less in sensitive areas. Vegetation clearing and fauna relocation strategy: - Fauna spotter-catcher - Trim overhanging	Minor	Absolute	Medium	Avoid and realign pipeline around patches of significant habitat, where possible.	Significantly	Insignificant	Absolute	Low	Offsets strategy.
							Progressive rehabilitation of	Significantly				

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk			Offset
				C	L	Current Risk			C	L	Mitigated Risk	
			branches rather than tree removal. - Relocate large woody debris and hollows.				construction easement. Weed and Pest Management Plan to control weed invasion and vertebrate pests that may disperse through pipeline easement.	 Significantly				
Fragmentation of habitats by pipeline easement.	Clearing for pipeline construction.	Loss or reduced connectivity and restriction of fauna movement through middle section of the pipeline.	Restrict clearing to 30m wide corridor and less in sensitive areas.	Minor	Possible	Medium	Avoid and realign pipeline around patches of significant habitat, where possible.	Significantly	Insignificant	Unlikely	Low	
	The southern and northern sections of the pipeline is through pasture or beside existing roads/easements which have already caused fragmentation.	Indirect impacts on newly created edges of habitat - “edge effects”.	Vegetation clearing strategy.				Progressive rehabilitation of construction easement	Significantly				

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk			Offset
				C	L	Current Risk			C	L	Mitigated Risk	
	The easement is not an impermeable barrier and the majority of species inhabit open woodland and are able to tolerate canopy gaps.											
Fauna injury or mortality from trenchfall.	Excavation of trench for pipeline construction	Fauna injury or mortality, in particular on significant reptile species.	APIA recommendations to minimise risk of trenchfall.	Minor	Unlikely	Low			Minor	Unlikely	Low	
	Although unlikely, some fauna may fall into the open trench.	The open trench will be minimised as far as practicable.										

Hazards	Factors	Impacts	Project Description Controls & Standard Industry Practice	Risk with Controls			Additional Mitigation Measures	Mitigation Effectiveness	Residual Risk			Offset
				C	L	Current Risk			C	L	Mitigated Risk	
Construction nuisance.	Noise and dust	Nuisance to fauna which reside close to construction area.	Standard noise and dust control measures, i.e. dust suppression.	Minor	Unlikely	Low			Minor	Unlikely	Low	
	The impacts will occur over a very small area and a limited timeframe.	Noise and dust may result in short term impacts on fauna which reside in habitats adjacent to the pipeline easement.										

11.3. Cumulative impacts

While no projects are located directly within the dam and surrounds, a range of resource development and infrastructure projects are currently operating, or are planned within the wider region and along the pipeline route. These are listed in Section 28.2.10.1. Major projects in the region include Wandoan Coal Project, Surat Basin Railway and Surat Gas Project. Most of the Coal Seam Gas (CSG) projects are located in the Condamine catchment. Each of these projects are likely to have varying impacts on remnant vegetation and habitat, however to meet approval requirements under state and federal legislation will be mitigated and offset to ensure no net loss of significant vegetation (i.e. Endangered, Of Concern or Watercourse REs, threatened ecological communities) or habitat for threatened species within the region. Any impacts on threatened species would be required to be mitigated to an acceptable level, and it should be noted that the critically endangered Boggomoss Snail is not known to be affected by other planned projects.

With mitigation and offsets, the development of these projects is not expected to have a cumulative impact upon the terrestrial fauna of the Dawson Valley. The offsets strategy will aim to establish offsets immediately following project approval so that the period between impact and usable new habitat is as short as possible. It will aim to link the new riparian corridor with nearby habitat (i.e. Nathan Gorge, Precipice National Park, Spring Creek and Taroom Town Common) to increase connectivity and ensure that during any lag time suitable habitat is available in the surrounding area for relocated fauna to utilise.

11.4. Summary

This section has assessed the potential impact of the Project on terrestrial fauna. This assessment showed that:

- There will be a total loss of 3655 ha of remnant habitat and 341 ha or non-remnant habitat for all native fauna within the dam construction footprint and water storage. This will be minimised to some extent by not clearing vegetation within 1.5 m vertical below FSL in riparian zones, and implementing a vegetation clearing and fauna relocation strategy to assist fauna to move into adjacent suitable habitats and relocating habitat features. However, the residual impact is still high as the adjacent habitat is unlikely to have enough carrying capacity to support all the displaced fauna in the long term, including a number of threatened species. As it is not possible to fully mitigate this impact, this will be compensated by the rehabilitation and offset strategies (Section 10.4). Offsets (including revegetation) will be established around the water storage immediately after project approval so that the period between impact and usable new habitat is as short as possible.
- The water storage will fragment riparian habitats along the Dawson River (upstream and downstream of the storage) and reduce habitat connectivity along this east-west riparian corridor. As there are no alternative east-west corridors in the vicinity of the dam impact area, the impact from fragmentation of habitat is high. This will be mitigated by re-establishment of a riparian corridor at the edge of the water storage. Residual impact will be compensated by the offset strategy.
- The water storage will inundate 0.75 ha of known habitat for the critically endangered Boggomoss Snail at Mt Rose Station, resulting in the loss of one sub-population (350 individuals). Although this represents a small reduction in population size (1.2%) and a small loss of known habitat (1.9%), the loss is significant as it is the only remaining population that occurs in boggomoss habitat and the risk is high. A translocation plan will be implemented to collect and relocate as many snails as possible from the Mt Rose site to suitable sites outside the impact area. This will

reduce the residual risk to medium. Offsets will be established for the loss of GAB spring wetlands (which provide a form of Boggomoss Snail habitat).

- Without management, reduced flows have the potential to degrade downstream riparian habitat and thus impact on the five downstream populations of the Boggomoss Snail. This will be managed by increasing low flows from current levels during operation of the dam, which is anticipated to maintain riparian habitat. Therefore, the initial risk is medium. There will be a reduction in the bankfull and overbank (flooding) events however soil moisture level in the riparian habitat is likely controlled more often by cover, rainfall and temperature than by occasional flooding and reducing in flooding events is not anticipated to lead to any substantive change in the riparian habitat. To reduce any uncertainty, long-term monitoring of downstream riparian habitat will be undertaken. Should decreases in habitat health be observed then remedial measures will be developed, possibly including alterations to the operational flow regime. This will reduce the residual risk to low.
- There will be a loss of 145.6 ha of remnant habitat and 40.9 ha of regrowth habitat for fauna along the pipeline corridor, including potential habitat for a number of threatened species and fragmentation of habitat in the middle section of the pipeline where it traverses large tracts of remnant vegetation. With project controls, the initial impact from the loss and fragmentation of fauna habitat along the pipeline is medium. This will be mitigated by avoiding and realigning pipeline around patches of significant vegetation and habitat, and progressive rehabilitation of the pipeline easement post-construction. Although mitigation reduces the consequence, the impact is still medium. The residual impact will be compensated by offsets.
- Feasible mitigation actions are described and these will be reflected in the EMPs (Chapter 29) and as such are also included as Proponent Commitments (Appendix 30-A).
- Based on the risk assessment, impacts to terrestrial fauna can be effectively managed to acceptable levels. The loss of fauna habitat will be compensated by the offsets strategy.