Nathan Dam and Pipelines Project EIS

Pipeline Flora and Fauna Existing Environment

Prepared for:

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Contents

List of Tables

List of Figures

1 Sensitive Environmental Areas

This section addresses Section 3.3.1 of the Nathan Dam and Pipelines EIS Terms of Reference, as it applies to aquatic flora (macrophytes) and fauna (macroinvertebrates, fish, aquatic reptiles and aquatic mammals).

1.1 Flora

Freshwater Ecosystems

The Environmental Values of all waterways in Queensland are protected under the Environmental Protection (Water) Policy 1997 (EPP Water), and include the biological integrity of aquatic ecosystems. Protection of the health of natural ecosystems is a sought 'environmental outcome' of the *Water Resource (Fitzroy Basin) Plan 1999* (Fitzroy Basin WRP). The beds and banks of watercourses in Queensland are protected under the *Water Act 2000.*

Declared Fish Habitat Areas

Within the Fitzroy River estuary there is a Declared Fish Habitat Area (FHA) – Management level 'A' (DPI&F 2008b) (Figure 1.1). Management level 'A' is designed to protect critical fish habitat for the purpose of productive and sustainable fishing, short and long term, maintain the ecological character and integrity of undisturbed fisheries habitat and maintain the biodiversity of fisheries resources. The fisheries habitat values the declaration seeks to protect are: extensive saltpans; saline grasslands fed by mangrove lined creeks; closed mangrove forests of mixed-species dominated by *Avicennia marina*, *Rhizophora stylosa* and *Ceriops tagal*; mud and sand flats; rocky headlands and brackish lagoons (DPI&F 2008b). The nearest point of the Fitzroy River FHA is approximately 420 km downstream of the project area.

All marine plants are protected in Queensland under the *Fisheries Act 1994*, in recognition of their critical role in providing food and habitat to fisheries species.

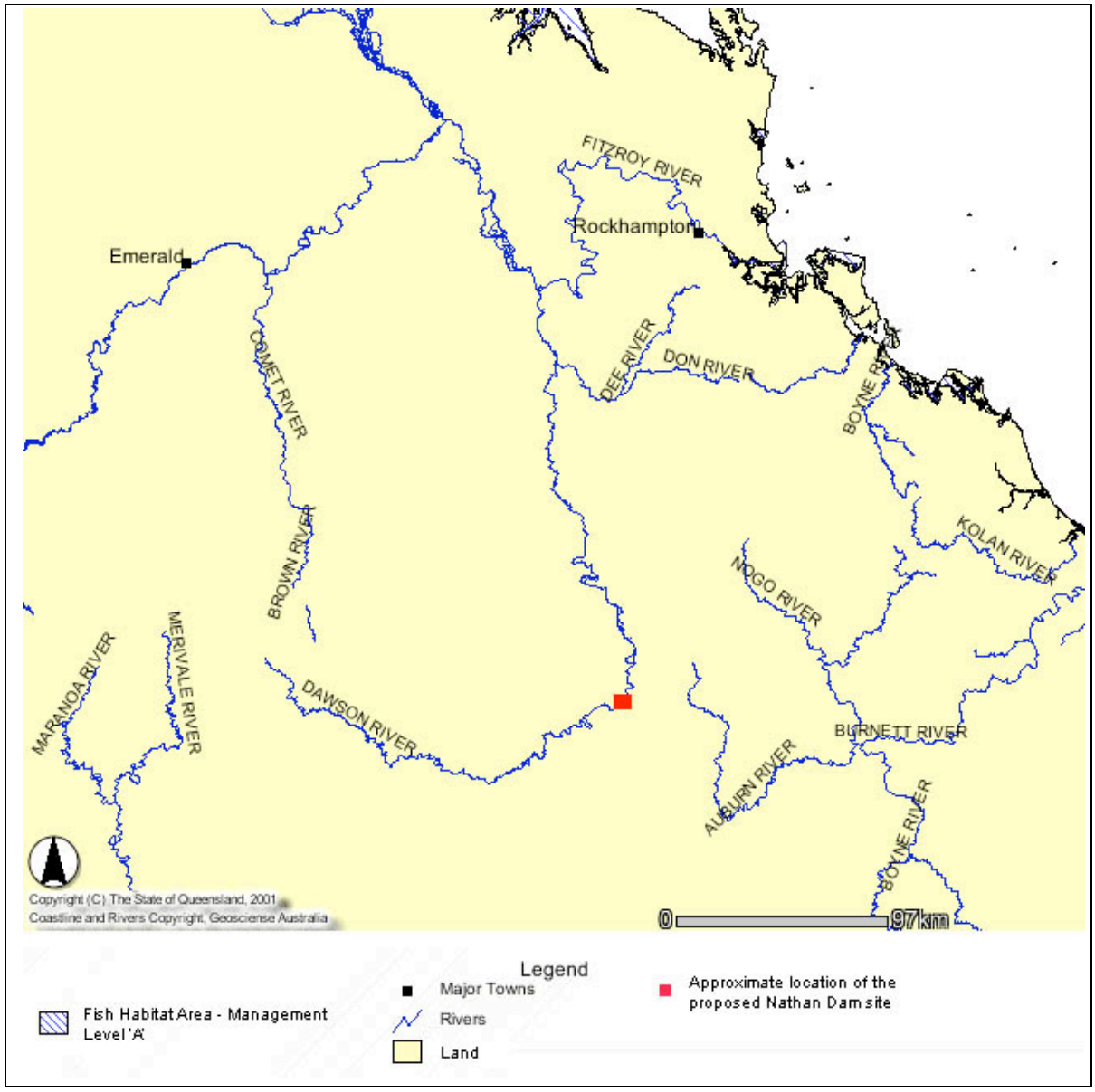

Figure 1.1 Fish Habitat Areas downstream of the proposed Nathan Dam site.

Wetlands of National Significance

The Palm Tree and Robinson Creeks wetlands are listed as Wetlands of National Significance in the *Directory of Important Wetlands* in *Australia* (Environment Australia 2001). These wetlands are located at least 4 km upstream of the full supply level (FSL) and 1 in 100 AEP peak flood level. The Fitzroy River Floodplain, Fitzroy River Delta and Great Barrier Reef Marine Park are also Wetlands of National Significance; they are approximately 400 km downstream of the project area (Figure 1.2).

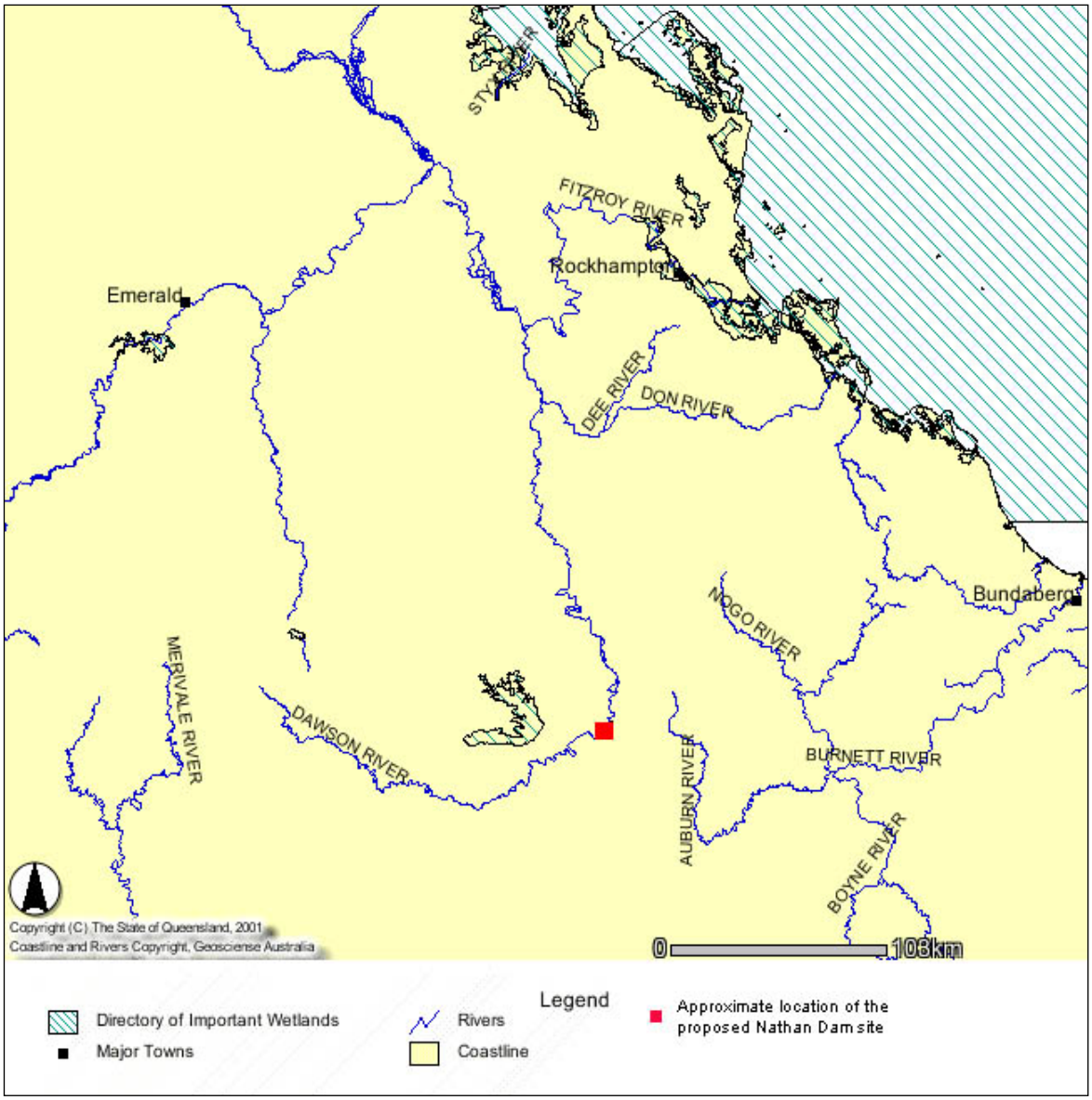

Figure 1.2 Wetlands of National Significance in the vicinity of the proposed Nathan Dam site.

Great Barrier Reef

The Fitzroy Basin drains to the Great Barrier Reef World Heritage Area (GBRWHA) and Great Barrier Reef Marine Park (GBRMP). The nearest point of the GBRWHA is approximately 470 km downstream of the project area (Figure 1.3).

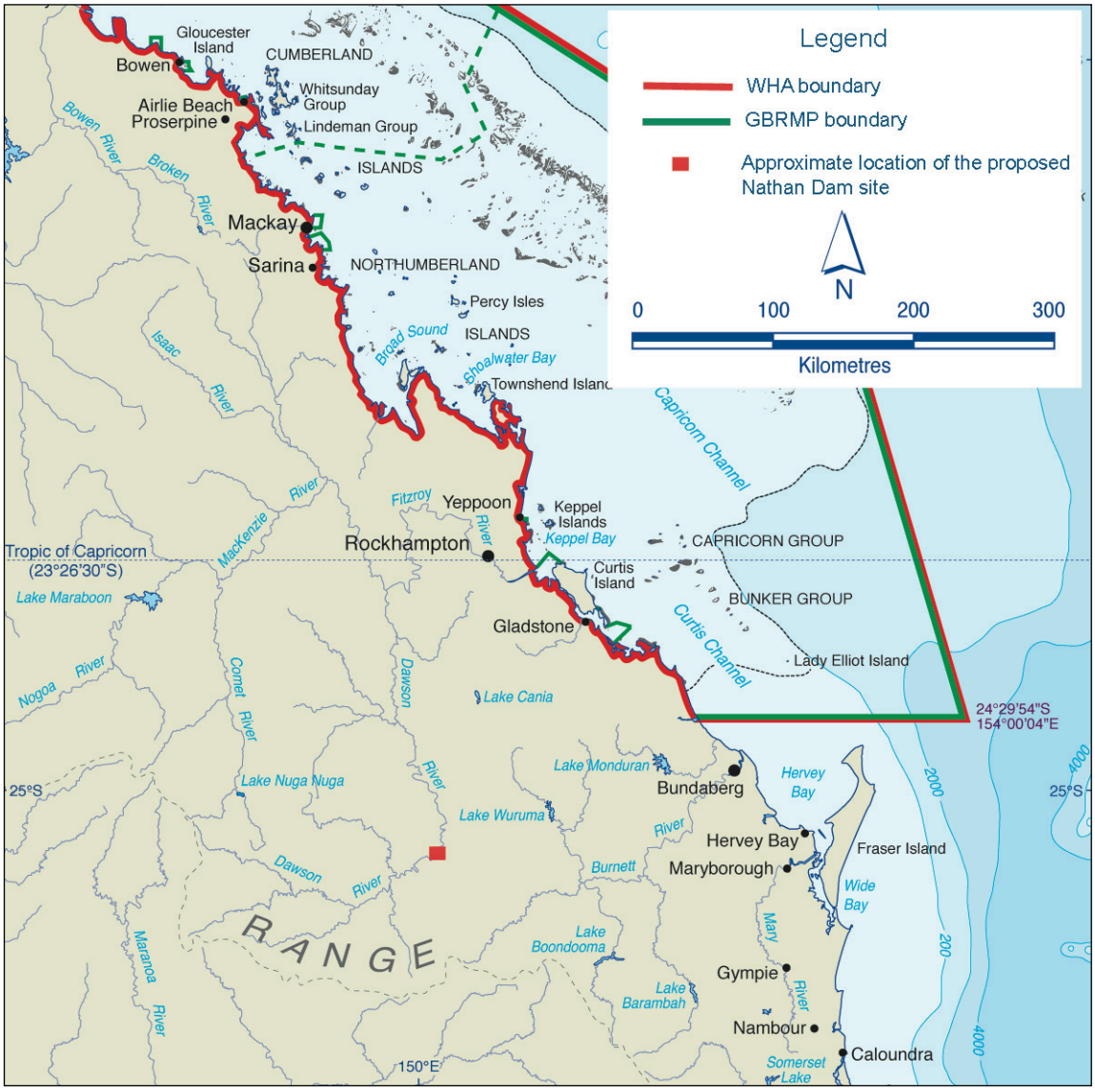

Figure 1.3 Great Barrier Reef Marine Park and World Heritage Area downstream of the proposed Nathan Dam site.

Wetlands of International Importance (Ramsar Wetlands)

There are no Ramsar wetlands in the project area. The Fitzroy River discharges to the ocean approximately 70 km south of Shoalwater and Corio Bays Area Ramsar site, a Wetland of International Importance (DEWHA 2008a). The Ramsar wetland is approximately 540 km downstream of the project area (Figure 1.4).

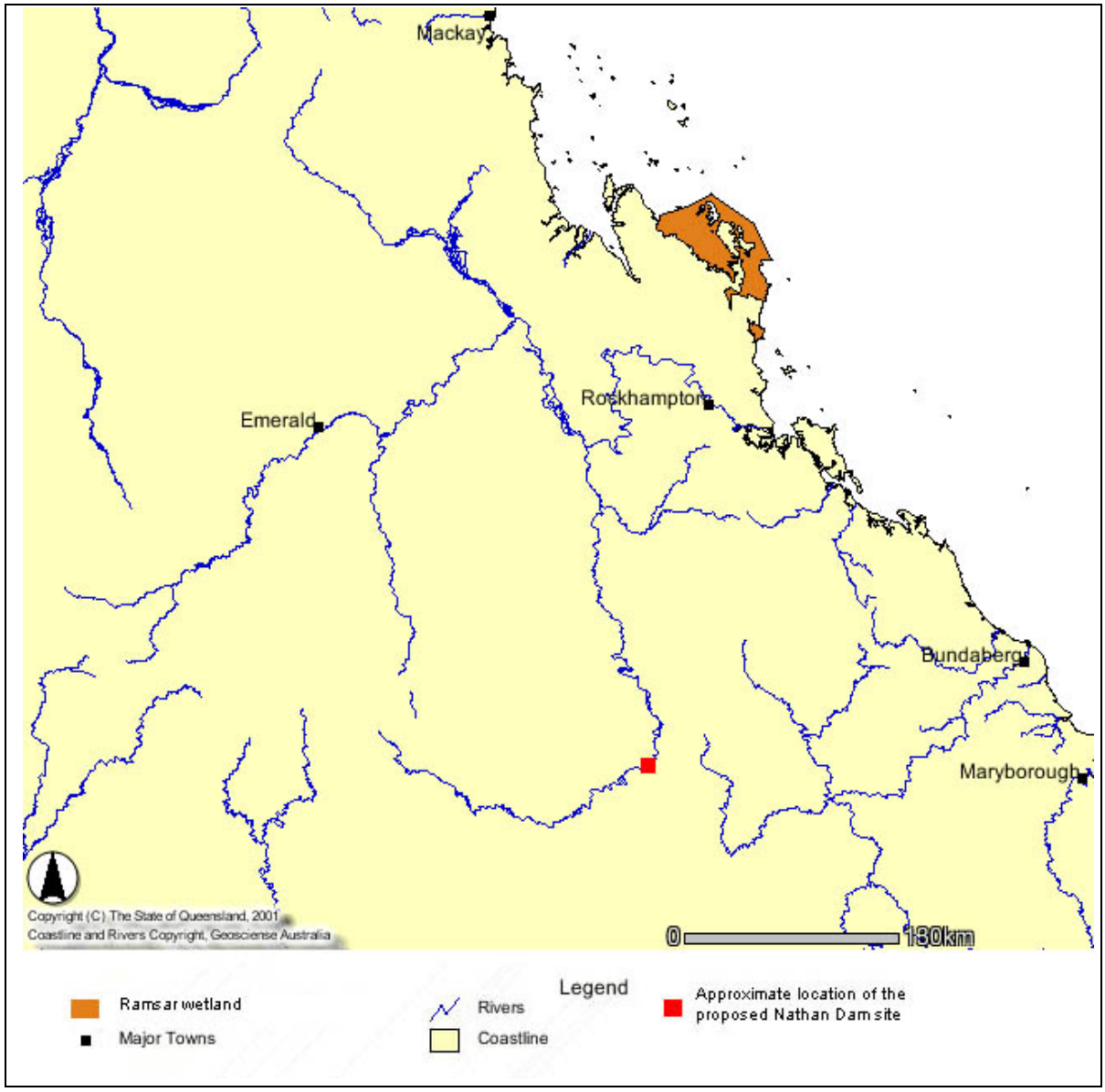

Figure 1.4 Ramsar wetlands downstream of the proposed Nathan Dam site.

Important Habitats of Protected Species

No aquatic flora species known in the region are listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the Queensland *Nature Conservation Act 1992* (NC Act) (as listed in the Nature Conservation (Wildlife) Regulation 2006 (NCWR)).

1.2 Fauna

Freshwater Ecosystems

For a description of freshwater Sensitive Environmental Areas relevant to this project, see Section 1.1.

Declared Fish Habitat Areas

Part of the Fitzroy River estuary, approximately 420 km downstream of the project area, is a declared Fish Habitat Area (see Section 1.1). The fisheries species that this area is designated to protect are: barramundi; banana prawns; king salmon; blue salmon; sea mullet; grunter; shark; and mud crab.

Wetlands of National Significance

There are Wetlands of National Significance approximately 400 km downstream of the project area (see Section 1.1).

Great Barrier Reef World Heritage Area

The World Heritage Area (GBRWHA) and Great Barrier Reef Marine Park (GBRMP) is approximately 470 km downstream of the project area (see Section 1.1).

Wetlands of International Importance (Ramsar Wetlands)

The Shoalwater and Corio Bays Area Ramsar site is approximately 540 km downstream of the project area (see Section 1.1).

Important Habitats of Protected Species

The Fitzroy River turtle (*Rheodytes leukops*) and the white-throated snapping turtle (*Elseya albagula*) are species of concern and have a known distribution that includes the Fitzroy Basin. Known habitats of these species are shown in Figure 1.5 and Figure 1.6. The Fitzroy River turtle is listed as 'vulnerable' both in Queensland (under the *Nature Conservation Act 1992* (NC Act), as listed in the Nature Conservation (Wildlife) Regulation 2006 (NCWR)) and nationally (under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

The white-throated snapping turtle (*Elseya albagula*) is listed as 'least concern' under the NCWR, but has been identified as a high priority for conservation in the EPA's species prioritisation framework. Information on the ecology of each of these species is included in the EIS.

Important habitats of estuarine and marine species that are listed under the EPBC Act or the NCWR are found within the Fitzroy Estuary FHA, the GBRWHA and / or the Shoalwater and Corio Bays Area Ramsar site (these areas are described above and in Section 1.1).

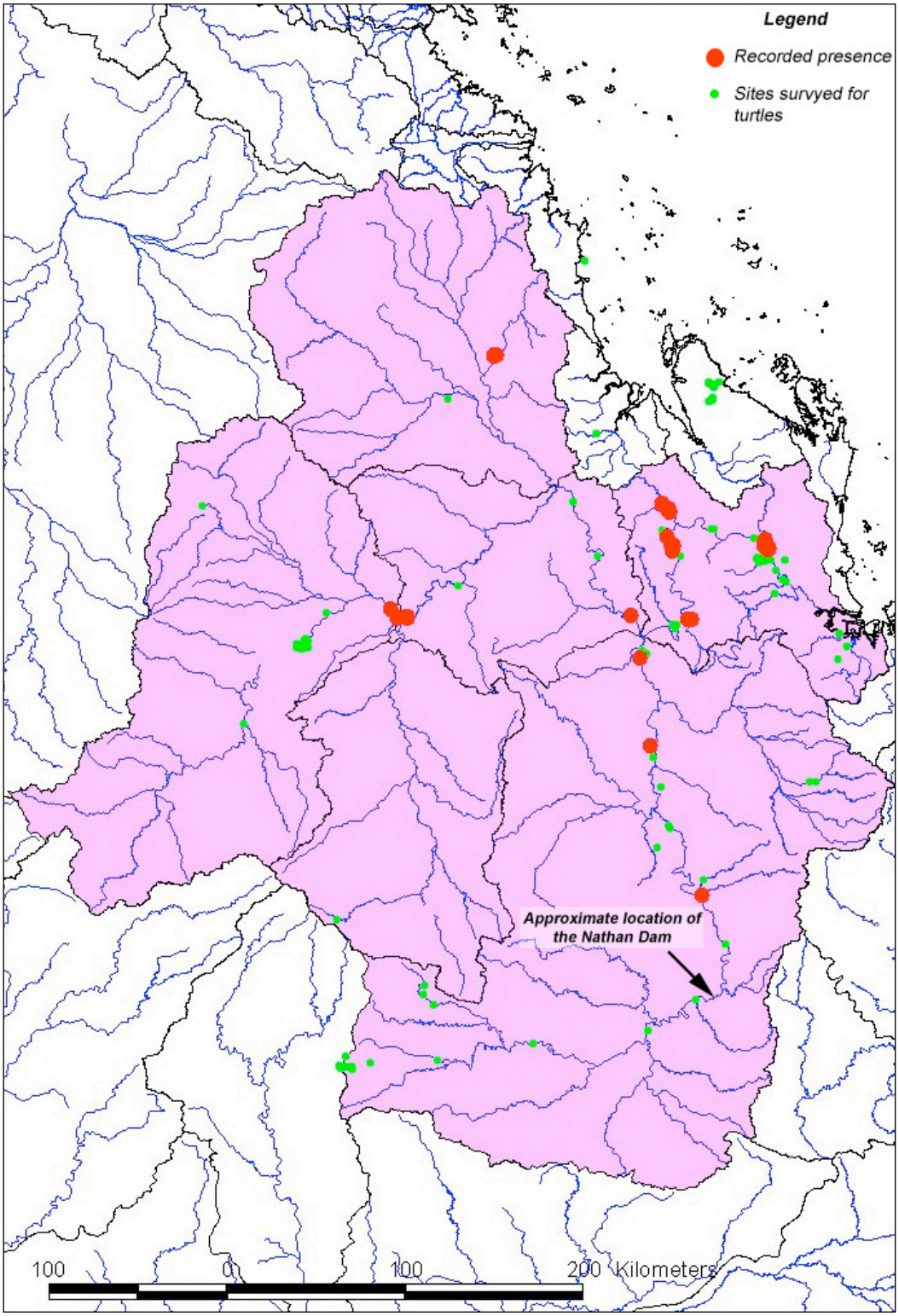

Figure 1.5 Recorded presence of the Fitzroy River turtle (*Rheodytes leukops*) in the Fitzroy Basin (Adapted from Limpus et al. 2007 and frc environmental 2009).

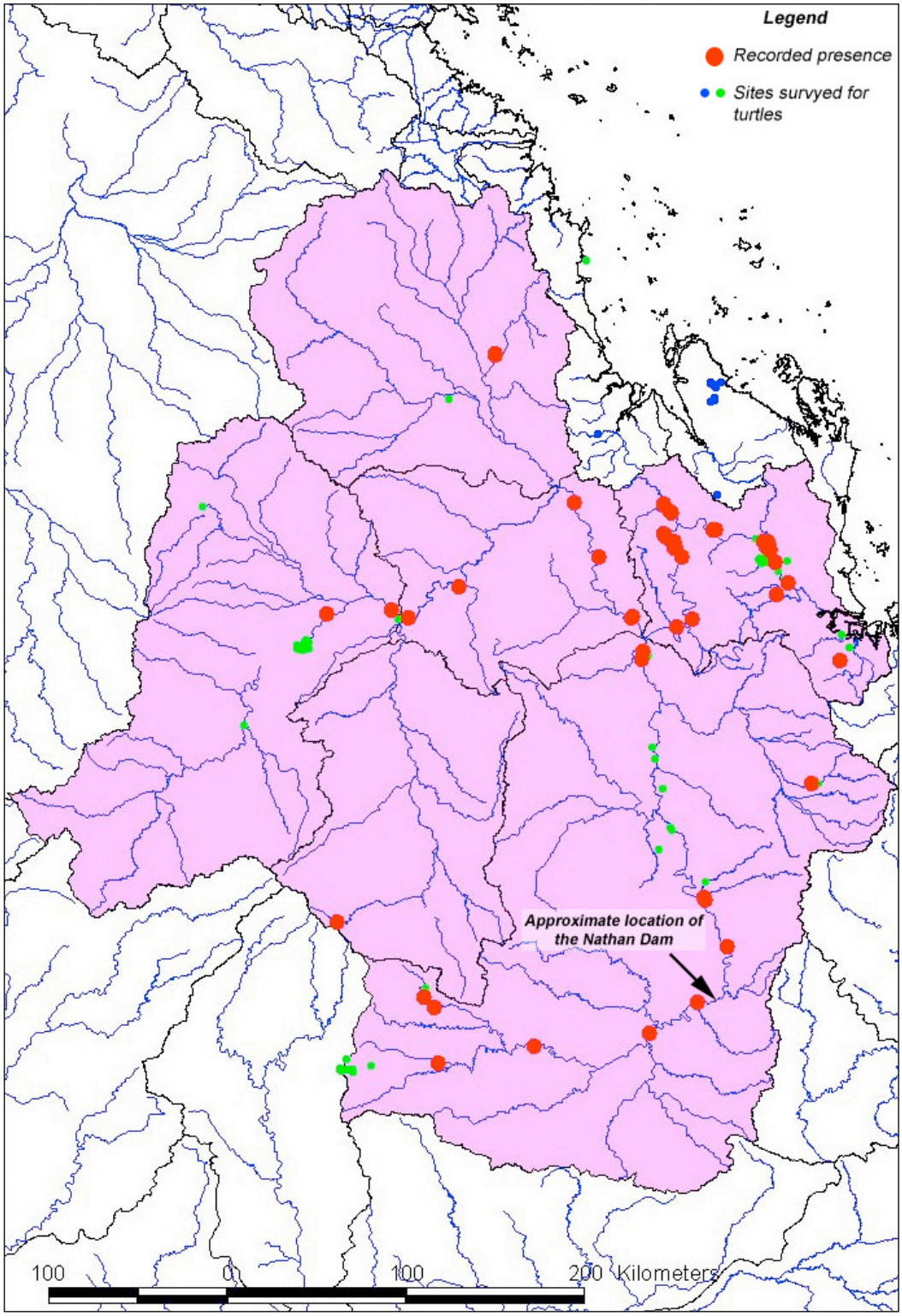

Figure 1.6 Recorded presence of the white-throated snapping turtle (*Elseya albagula*) in the Fitzroy Basin (Adapted from Limpus et al. 2007 and frc environmental 2009).

2 Description of Environmental Values

This section addresses Section 3.3.4.1 of the Nathan Dam and Pipelines EIS Terms of Reference, describing the aquatic flora and fauna present or likely to be present at any time during the year in the areas potentially affected by the project.

2.1 Flora

Regulatory Framework

Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The project has been declared a 'Controlled Action' under the EPBC Act. None of the controlling provisions for the project relate to aquatic flora in freshwater environments, although a number of marine-related provisions are relevant. These include the GBRWHA (also a National Heritage Place and a Commonwealth Marine Area). World heritage values protected under the EPBC Act that relate to the aquatic flora of (downstream) marine habitats include extensive *Halimeda* beds, a large diversity of flora and fauna, and habitats for species of conservation significance including seagrasses (15 species covering over 5, 000 km^2) and mangroves (37 species covering over 2, 070 km^2). The potential impacts of the project on the aquatic flora of the GBRWHA are discussed in Section 1.1.

The ecological character of the Shoalwater and Corio Bays Area Ramsar site is protected under the EPBC Act. Environmental values that contribute to the ecological character of the Shoalwater and Corio Bays Area Ramsar site include the diverse wetlands, which contain both tropical and subtropical species, and half of the wetland types found in Queensland. The potential impacts of the project on the aquatic flora of the Shoalwater and Corio Bays Area Ramsar site are discussed in Section 1.1.

Queensland Environmental Protection Act 1994

The environmental values of waterways in Queensland are protected under the Environmental Protection Act and the subordinate EPP (Water). Environmental values include the biological integrity of a modified aquatic ecosystem, which as discussed in the Queensland Water Quality Guidelines (EPA 2006) include biodiversity, plants and

ecological interactions. The aquatic flora of the study areas and downstream waters contribute to the biological integrity and ecological interactions in these waterways.

Queensland Land Protection (Pest and Stock Route Management) Act 2002

No declared noxious aquatic flora under the Land Protection Act have been identified within or are likely to occur in the project area, though they are known from the Fitzroy Basin. Similarly, no aquatic Weeds of National Significance (WONS) have been identified in, or are likely to occur in the project area.

Queensland Nature Conservation Act 1992

Eleocharis blakeana and *Fimbristylis vagans* have been recorded from, or are likely to occur in, the pipeline study area. These species are recorded as 'Rare' under the NC Act (as listed under the NCWR).

Eleocharis blakeana (family Cyperacea) grows in ephemeral waterways and is often associated with brigalow and belah woodland and on clay soils (Harden 1993). It has been recorded in the pipeline study area (National Herbarium of New South Wales 2009).

Fimbristylis vagans (fringing rush; family Cyperacea) is associated with clay pans, open sedge land and sparse-tussock grasslands on shallow alluvial sand plains (EPA 2005) but may also occur in other ecosystems (other species of *Fibristylis* are common in pastures of central Queensland) (Anderson 1993).

Queensland Water Act 2000

The Fitzroy Basin WRP has as a 'key outcome', the intent to provide adequate environmental flows for the protection of the health of natural ecosystems. Aquatic flora plays an integral role in maintaining the health and ecosystem functioning of aquatic ecosystems.

2.2 Fauna

Regulatory Framework

Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Controlling provisions for the project under the EPBC Act relate to listed threatened species, and a number of marine-related provisions. The Fitzroy River turtle *(Rheodytes leukops*) is listed as vulnerable under the EPBC Act, however they were not found in the study area during targeted surveys, and there is a low probability this species is present in the study area. *We will seek confirmation of this from Col Limpus.*

The Fitzroy River turtle has been recorded approximately 75 km downstream of the proposed dam site, and the study area provides limited suitable habitat for this species (see Section 5.2). A number of species listed as threatened, migratory or marine species are also likely to occur downstream of the project area (Table 2.1). Potential impacts to these species are discussed in the EIS.

Impacts to the GBRWHA and the Shoalwater and Corio Bays Area Ramsar site (which provide important habitat to a range of fauna species) are also regulated under the EPBC Act (see Section 1.1).

Queensland Environmental *Protection* Act 1994

The environmental values of waterways in Queensland are protected under the Environmental Protection Act and the Environmental Protection (Water) Policy 1997 (EPP Water). The aquatic fauna of the study areas and downstream waters contribute to the environmental values (biological integrity and ecological interactions) of these waterways (see Section 5).

Queensland Fisheries Act 1994

The primary objective of the *Fisheries Act 1994* (Fisheries Act) is to provide for the use, conservation and enhancement of the communities' fisheries resources and fish habitats. As it relates to the project, environmental values protected under the Act are:

- fish habitats
- fish movement and migration (i.e. regulation of waterway barriers), and

- commercial, recreational and indigenous fishing.

Queensland Nature Conservation Act 1992

The Fitzroy River turtle (*Rheodytes leukops*) is also protected as vulnerable under the *Nature Conservation Act 1992* (NC Act), as listed in the Nature Conservation (Wildlife) Regulation 2006 (NCWR). A range of species listed as threatened under the NCWR are also likely to occur downstream of the project area (Table 2.1).

Queensland Water Act 2000

The Fitzroy Basin WRP has, as a key outcome, the intent to provide adequate environmental flows for the protection of the health of natural ecosystems. Aquatic fauna plays an integral role on maintaining the health and ecosystem functioning of aquatic ecosystems.

Table 2.1 State and Commonwealth conservation status of conservationally significant species that may occur in the project area and downstream (DEWHA 2008; Limpus et al. 2007).

Family	Species	Common Name	NCWR*	EPBC Act**
Freshwater				
Chelidae	*Rheodytes leukops*	Fitzroy River turtle	V	V
	Elseya albagula	white-throated snapping turtle	LC	–
Marine				
Balaenidae	*Balaenoptera acutorostrata*	minke whale	LC	C
	Balaenoptera edeni	Bryde's whale	LC	M, C
	Balaenoptera musculus	blue whale	LC	E, M, C
	Eubalaena australis	southern right whale	LC	E, M, C
Balaenopteridae	*Megaptera novaeangliae*	humpback whale	V	V, M, C
Dermochelyidae	*Dermochelys coriacea*	leatherback turtle	E	V, M, O
Cheloniidae	*Chelonia mydas*	green turtle	V	V, M, O
	Caretta caretta	loggerhead turtle	E	E, M, O
	Eretmochelys imbricata	hawksbill turtle	V	V, M, O
	Lepidochelys olivaceae	olive Ridley turtle	E	E, M, O
	Natator depressa	flatback turtle	V	V, M, O
Crocodylidae	*Crocodylus porosus*	estuarine crocodile	V	M
Dugongidae	*Dugong dugon*	dugong	V	O, M
Delphinidae	*Delphinus delphis*	common dolphin	LC	C, O
	Grampus friseus	Risso's dolphin	LC	C, O
	Lagenorhynchus obscurus	dusky dolphin	LC	C, O
	*Orcaella heinsohni***	Australian snubfin dolphin	R	M, C
	Orcinus orca	killer whale	LC	M, C
	Stenella attenuata	spotted dolphin	LC	C, O
	Sousa chinensis	Indo-Pacific humpback dolphin	R	M, C
	Tursiops aduncus	spotted (inshore) bottlenose dolphin	LC	C
	Tursiops truncatus	bottlenose dolphin	LC	C, O
Muridae	*Xeromys myoides*	water mouse	V	V

* The status of species under the Queensland Nature Conservation (Wildlife) Regulation 2006: E – Endangered, R – Rare, V – Vulnerable, LC = least concern.

** The status of species under the Environmental Protection & Biodiversity Conservation Act 1999: E: Endangered, C – Cetacean, M – Migratory, O – Marine, V – Vulnerable.

*** Newly described species; status is for *Orcaella brevirostris*

3 Methodology

3.1 Survey Timing

One field survey (in the pre-wet season, 19th to the 24th of January 2009) was undertaken to describe the aquatic flora present in the freshwater habitats crossed by the proposed pipeline route.

3.2 Sites Surveyed

Eleven sites, ten within the Condamine River sub-catchment and one within the Fitzroy Basin (Juandah Creek), were chosen for survey along the proposed pipeline route. Habitat descriptions were completed at each site, while aquatic flora and fauna surveys were undertaken at six sites (Table 3.1 & Table 3.2; Figure 3.1 & Figure 3.2). One site (Two Mile Creek) was dry during the survey.

Sites surveyed were located as close as practical to the proposed pipeline crossing location, and all available habitats at each site were surveyed (during the survey, small and large isolated pools were the only habitat type present).

Within the pipeline study area, the watercourses surveyed were of two distinct types: large and small watercourses. The larger watercourses (Dogwood, Coolimboola, Rocky, Myall and Cooranga creeks and the Condamine River) had perennial waterbodies and an ephemeral flow regime. The other watercourses surveyed had intermittent or ephemeral waterbodies and an ephemeral flow regime. The creeks in the study area carry large flood flows. Due to the small number of sites surveyed (one) in the Fitzroy Basin, a comparison between watercourses of the two catchments was not made. A description of each site surveyed is presented in Table 3.2 below.

Table 3.1 Sites surveyed for aquatic habitat, flora and fauna in January 2009.

Site	Channel Name	Habitat surveys	Aquatic Flora Surveys	Macroinvertebrate Surveys	Aquatic Reptile Surveys	Fish Surveys
P1	Juandah Creek	✓	✓	✓		✓
P2	Two Mile Creek	✓				
P3	L Tree Creek	✓				
P4	Dogwood Creek	✓				
P5	Jingi Jingi Creek	✓				
P6	Columboola Creek	✓	✓	✓		✓
P7	Rocky Creek	✓	✓	✓		✓
P8	Condamine River	✓	✓	✓		✓
P9	Cooranga Creek	✓	✓	✓		✓
P10	Jimbour Creek	✓				
P11	Myall Creek	✓	✓	✓		✓

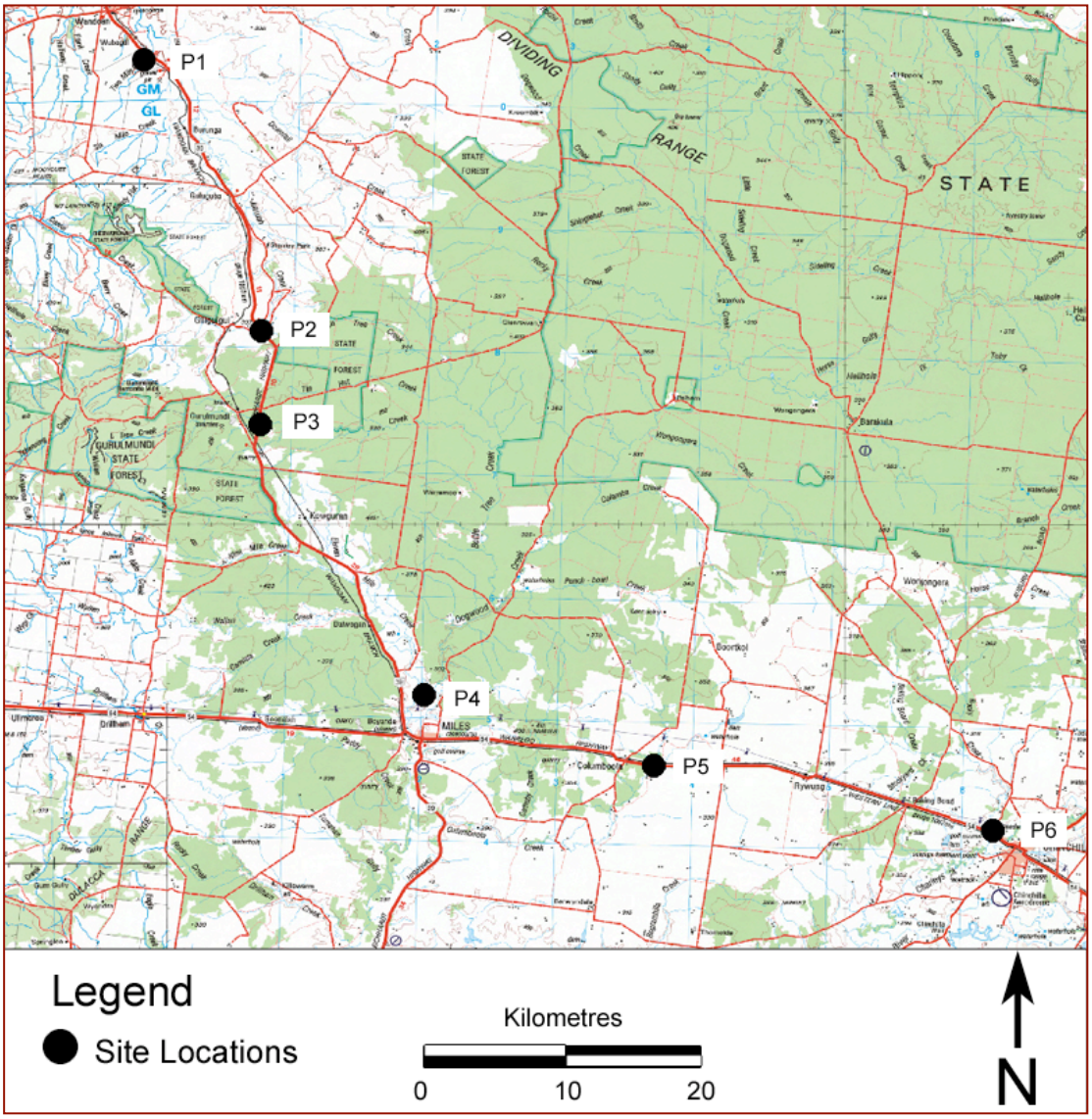

Figure 3.1 Sites surveyed within the pipeline study area (sites P1 to P6).

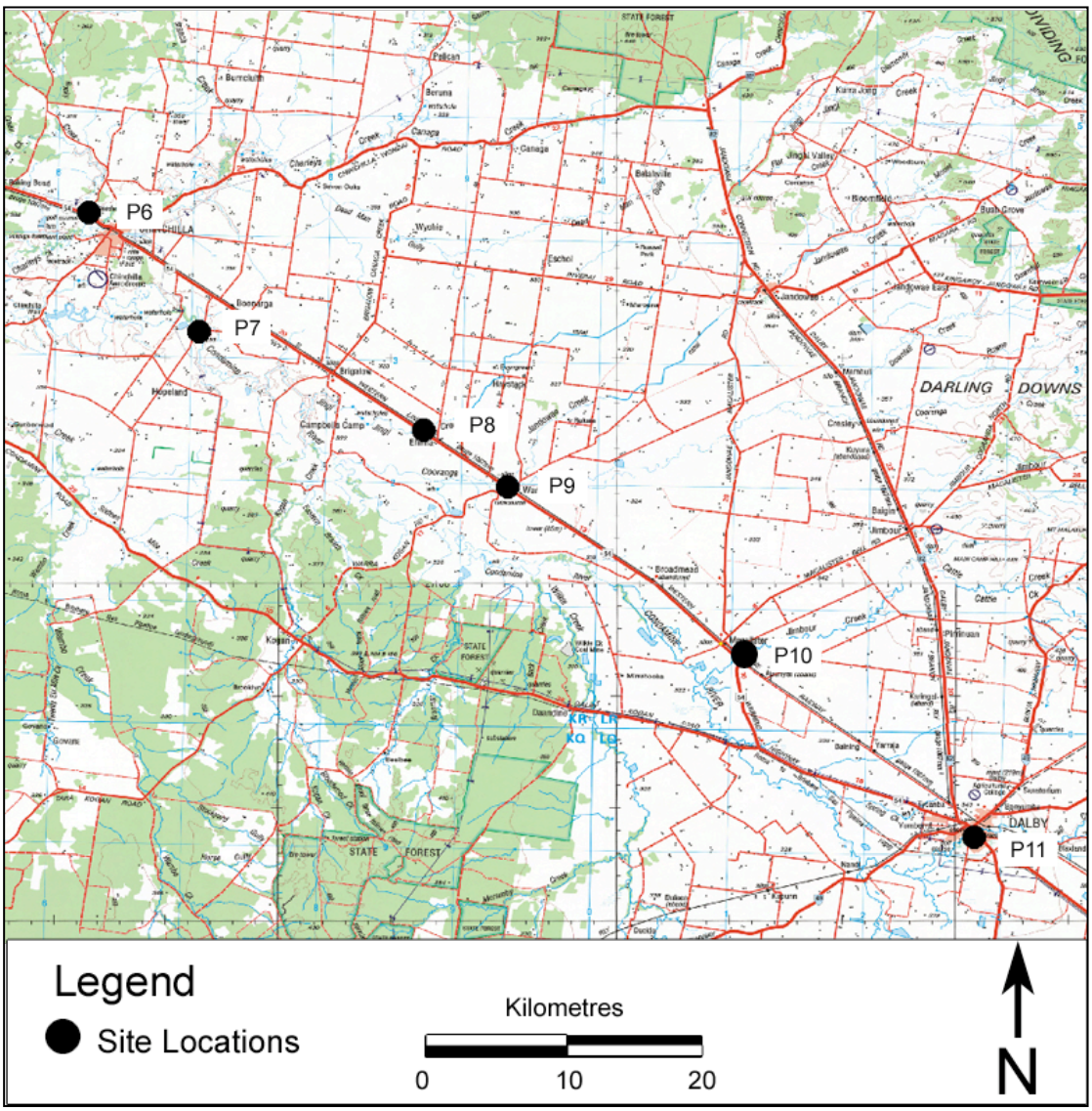

Figure 3.2 Sites surveyed within the pipeline study area (sites P6 to P11).

Table 3.2 Description of sites surveyed in the pipeline study area during the pre-wet season 2008.

Reach	Description	Photograph
Site P1 Juandah Creek	Juandah Creek comprised a relatively wide (~15 m), mostly dry channel with low (~1 m) stable banks. There were two small (<3 m long), isolated pools under the road crossing. Terrestrial grasses dominated bank vegetation and there was little erosion. The substrate was dominated by sand, with silt and gravel. The riparian vegetation was intact and comprised mostly of trees, sedges and grasses.	 Upstream through the channel (20-01-2009).
Site P2 Two Mile Creek	Two Mile Creek comprised a 10 m wide, dry channel. The channel bed was vegetated with terrestrial grasses, suggesting it has been dry for some time. The banks were relatively low (1.5 m). The riparian zone was narrow (~5 m) and comprised grasses, small trees (eucalyptus and acacia) and exotic thistles. There were grazing pastures on both banks.	 Downstream through the channel (20-01-2009).
Site P3 L Tree Creek	L Tree Creek comprised a 10 m wide channel with a series of shallow (<1 m), isolated pools. The channel bed was rocky, dominated by gravel and silt with some cobbles. The banks were approximately 2.5 m high with some erosion. At the downstream end of the site, the banks were steep and high (12 m) with sections of slumping gravel, sand and silt. The riparian vegetation was intact and dominated by tall trees, shrubs and grasses.	 Downstream through the channel (20-01-2009).

Reach	Description	Photograph
Site P4 Dogwood Creek	Dogwood Creek comprised a wide (20 m) channel with a large pool. The banks were relatively low and stable with little erosion. Tall trees, rushes and sedges, and grasses dominated the riparian vegetation; the left bank was cleared for a walking track. The bed was dominated by sand and silt with some gravel. Instream habitat comprised woody debris, exposed tree roots and bridge pylons.	 Upstream through the channel (19-01-2009).
Site P5 Jingi Jingi Creek	Jingi Jingi Creek comprised a very wide (200 m) mainly dry channel, with one small (10 m long), very shallow (<0.3 m) pool under the road crossing. Banks were stable and low with little erosion. The riparian vegetation had been largely cleared and was dominated by grasses, sedges and rushes, with patches of medium to tall trees. There was a dam 50 m downstream of the site.	 Upstream through the channel (23-01-2009).
Site P6 Coolumboola Creek	Coolumboola Creek comprised a relatively narrow (5 m) channel with two isolated pools. It had narrow, sloping banks, with some erosion. Instream habitat comprised woody debris, undercut banks and pylons from an old road crossing. The bed consisted of tightly compacted silt and sand. The riparian vegetation was intact and dominated by grasses and medium sized (10 – 30 m tall) trees.	 Upstream through the channel (19-01-2009).

Reach	Description	Photograph
Site P7 Rocky Creek	Rocky Creek comprised a wide (35 m) channel, with sloping relatively stable banks and a large pool. The substrate consisted of tightly packed silt with sand and gravel. Instream habitat was largely dominated by woody debris and overhanging vegetation. Riparian vegetation was intact and was dominated by grasses, tall trees (eucalyptus) and sedges.	 Upstream through the channel (21-01-2009).
Site P8 Condamine River	The Condamine River comprised a wide (35 m), deep (3.5 m) channel with wide (10 m) sloping banks. The substrate was dominated by packed silt / clay, with some sand. Instream habitat comprised woody debris, overhanging vegetation and aquatic vegetation. The riparian vegetation was moderately intact and dominated by grasses and tall trees (eucalyptus, casuarina and acacia). A multi-span bridge with instream pylons crossed the creek. There was agriculture and grazing on both banks.	 Downstream through the channel (23-01-2009).
Site P9 Cooranga Creek	Cooranga Creek comprised a 10 m wide channel, with low and relatively steep banks and three isolated pools. The substrate was comprised of tightly compacted silt/clay, with sand and gravel. Instream habitat was dominated by woody debris, algal clumps and overhanging vegetation. Grasses, sedges, and medium to tall trees dominated the riparian vegetation. A multi-span bridge crossed the creek at the downstream end of the site.	 Downstream through the channel (23-01-2009).

Reach	Description	Photograph
Site P10 Jimbour Creek	Jimbour Creek comprised a wide channel (25 m) and three small, isolated pools. The banks were low and sloping. The substrate consisted of silt/clay with sand and gravel, and rocks from bridge / road construction. Instream habitat was limited to cobbles. Grasses and medium sized trees dominated the riparian vegetation. A road and railway bridge crossed the creek at the downstream end of the site. The surrounding land use was grazing.	 Downstream through the channel (23-01-2009).
Site P11 Myall Creek	Myall Creek comprised a wide (20 m) channel with a large pool and vegetated island. The channel had low (1 m), moderately sloping, stable banks. The substrate comprised of tightly packed silt/clay with some sand. The riparian vegetation included grasses and small to medium sized trees. Both banks had been partially cleared for residential developments and parklands.	 Downstream through the channel (22-01-2009).

4 Flora

4.1 Limitations

Site selection for the pipeline study area was limited by access to private property and presence of water. All sites were located on public land (generally road reserve), as close as possible to the proposed pipeline route. Seasonal changes are predicted to be similar to those observed at dam area study sites and to that reported in the literature.

4.2 Distribution of Waterbody Types

Similar to watercourses in the dam and surrounds study area in the pre-wet season, smaller watercourses (Juandah, L Tree, Jingi Jingi and Jimbour creeks) contain only shallow pools, while larger watercourses (Dogwood, Coolumboola, Rocky, Cooranga and Myall creeks, and the Condamine River) have perennial pools of at least 1 m deep. It is likely that during periods of flow there are run, riffle and backwater habitats in some of the waterways, similar to those observed in the Dawson River in the dam and surrounds study area. Two Mile Creek was dry at the time of survey.

4.3 Extent and Location of Macrophytes

Twelve genera of macrophytes were recorded in the pipeline study area (Table 4.1), including two species of *Alternanthera*, two species of *Cyperus* and two species of *Persicaria*. Within the study area macrophyte richness was highest at the Condamine River (site P8) and lowest at Coolumboola Creek (site P6) (Figure 4.1).

Table 4.1 Macrophyte genus recorded at sites surveyed within the pipeline survey area.

Latin Name	Site					
	Fitzroy Basin	Condamine River Sub-catchment				
	P1	P6	P7	P8	P9	P11
FLOATING						
Azolla				✓		
Ludwiga			✓	✓		✓
Unknown waterlily						✓
EMERGENTS						
Alternanthera	✓	✓		✓	✓	✓
Cyperus	✓	✓		✓	✓	✓
Juncus	✓	✓	✓		✓	✓
Lomandra			✓	✓		✓
Marsilea				✓		
Paspalum	✓			✓		
Persicaria	✓			✓	✓	
Phragmites			✓			
Typha						✓
Urochloa				✓	✓	

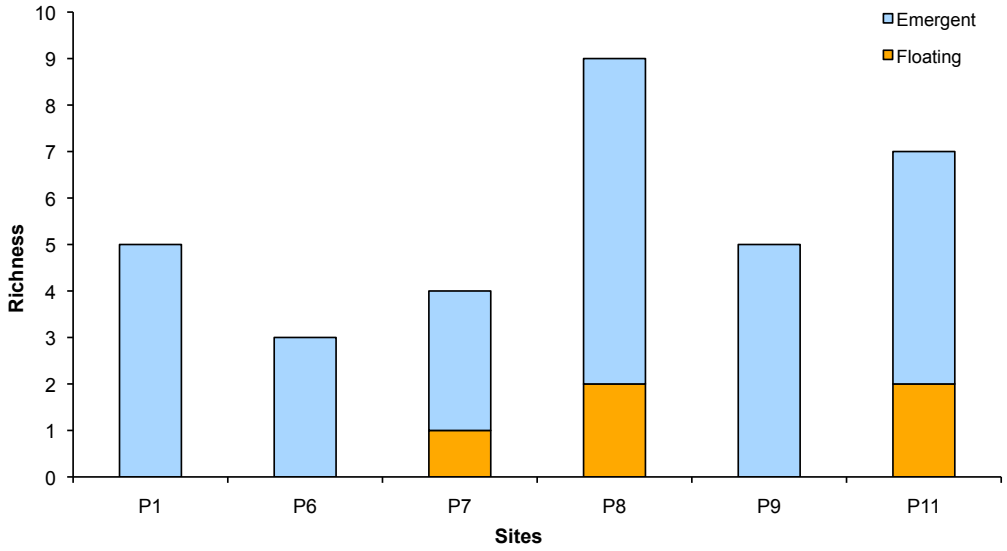

Figure 4.1 Richness of each macrophyte growth form at each site surveyed within the pipeline study area.

Macrophytes were generally sparse with less than 8% coverage at all sites surveyed (Figure 4.2). The highest macrophyte coverage was observed at Rocky Creek (site P7), while the lowest coverage was observed at Jundah Creek (site P1).

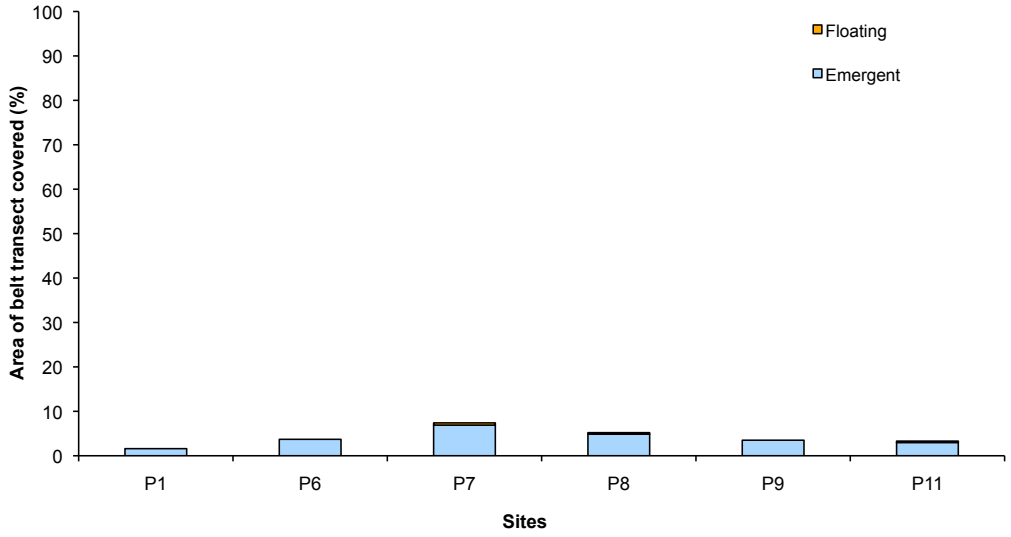

Figure 4.2 Percent coverage of each macrophyte growth form at each site surveyed within the pipeline study area.

Similar to watercourses in the dam and surrounds study area, emergent genera such as *Cyperus*, *Juncus* and *Persicaria* were the most common macrophytes throughout the study area. *Ludwigia* was the most common floating macrophyte, growing at three sites. No floating macrophytes were observed at Juandah Creek (site P1), within the Fitzroy Basin, or Coolumboola Creek (site P6) or Cooranga Creek (site P9) in the Condamine River sub-catchment.

4.4 Species of Conservation Significance

Eleocharis blakeana and *Fimbristylis vagans* (listed as rare under the NCWR) were not found during the field survey of the pipeline study area.

4.5 Declared Pest Plants and Weed Species

Two species of exotic macrophytes were observed within the pipeline survey sites (Table 4.2).

Table 4.2 Exotic macrophyte species recorded in the pipeline study area.

Latin name	Common name	Site		
		P6	P8	P9
Exotic Species				
Alternanthera philoxeroides	Alligator weed	✓		
Urochloa mutica	Para grass		✓	✓

4.6 Existing Impacts and Estimation of Natural State

There is insufficient historical data to reliably describe the natural state of aquatic flora in the waterways that may be impacted by the construction and operation of the proposed pipeline. However, similar to the dam and surrounds study area, development has likely resulted in a reduction in macrophyte diversity from the natural state. Aquatic weeds have colonised the pipeline study area, and weeds and agricultural land use have also impacted the riparian zone and surrounds.

5 Fauna

5.1 Limitations

Site selection for the pipeline study area was limited by access to private property and presence of water. All sites were located on public land (generally road reserve), as close as possible to the proposed pipeline route. Seasonal changes are predicted to be similar to those observed at dam area study sites and to that reported in the literature.

5.2 Aquatic Habitat

Distribution of Waterbody Formations

There were only pool habitats in the pipeline study area, at the time of survey.

Presence of Large Woody Debris Habitat

Large woody debris coverage varied between 0 and 45% (Figure 5.1) and was dominated by individual logs and log jams. Large woody debris coverage was highest at Rocky Creek (site P7), where the average canopy cover of the left and right bank was 85%.

Presence of Tree Root Habitat

There was tree root habitat at approximately half of the sites (Figure 5.2). Coverage was relatively low and ranged between 0 and 10%. Rocky Creek (site P7) had the highest coverage of tree root habitat.

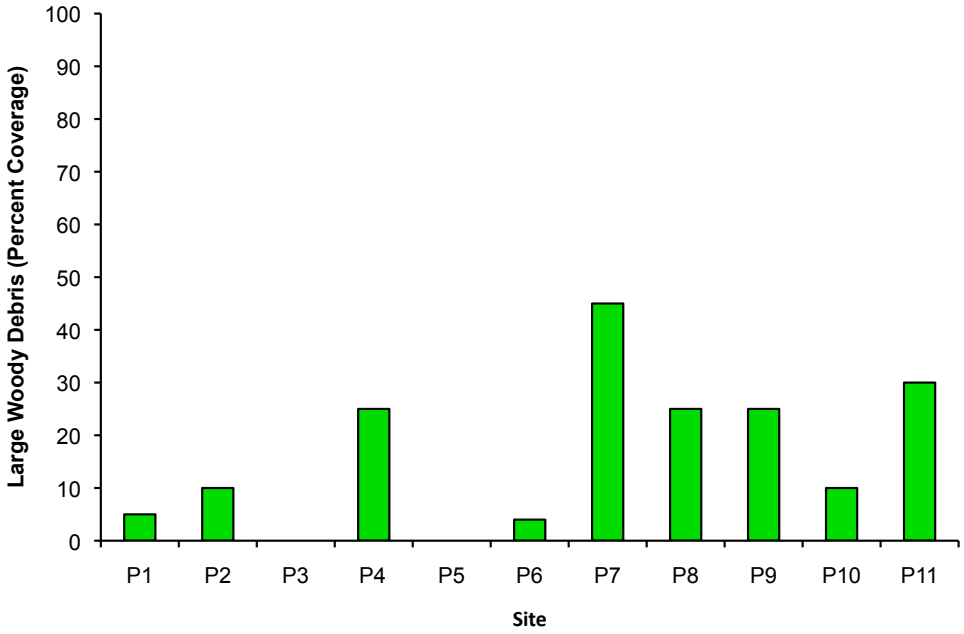

Figure 5.1 Percent coverage of large woody debris at each site surveyed.

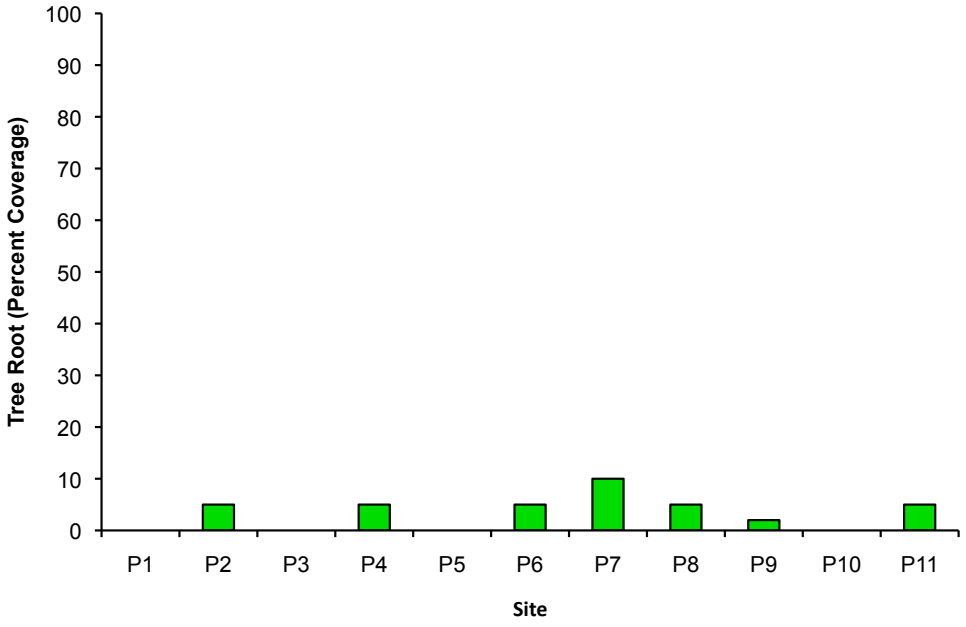

Figure 5.2 Percent coverage of tree root habitat at each site surveyed.

Presence of Edge Habitat

Edge habitats were typically comprised of terrestrial debris, overhanging vegetation, submerged tree roots and bare banks with boulders, cobbles and / or gravel. Overhanging banks provided edge habitat at L Tree Creek, Jingi Jingi Creek, Coolumboola Creek, Condamine River and Myall Creek (sites P3, P5, P6, P8 and P11, respectively).

Presence of Overhanging Vegetation Habitat

Overhanging vegetation covered some of the channel at most sites, except Jundah Creek (site P1) and Two Mile Creek (site P2) (Figure 5.3). Overhanging vegetation coverage ranged between 0 and 80%, and was highest at Coolumboola Creek (site P6).

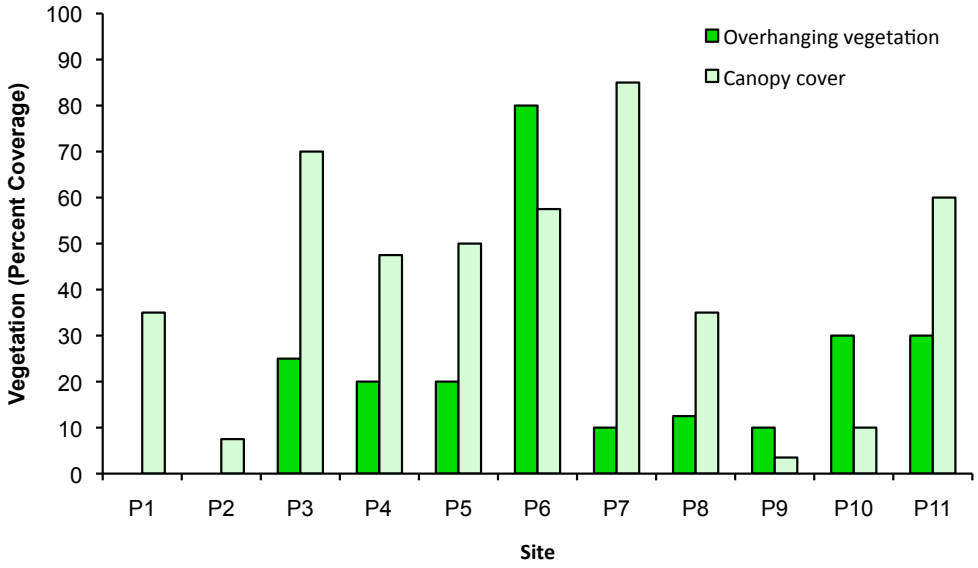

Figure 5.3 Percent coverage of overhanging vegetation at each site surveyed.

Sediment Type

Sediments at most sites were dominated by silt / clay (Figure 5.4); Two Mile Creek (site P2) sediments were solely made up of silt / clay. At Jundah Creek (site P1) sediment was dominated by sand, while at L Tree Creek (site P3) 80% of the sediment was comprised of sand, gravel, pebbles and cobbles.

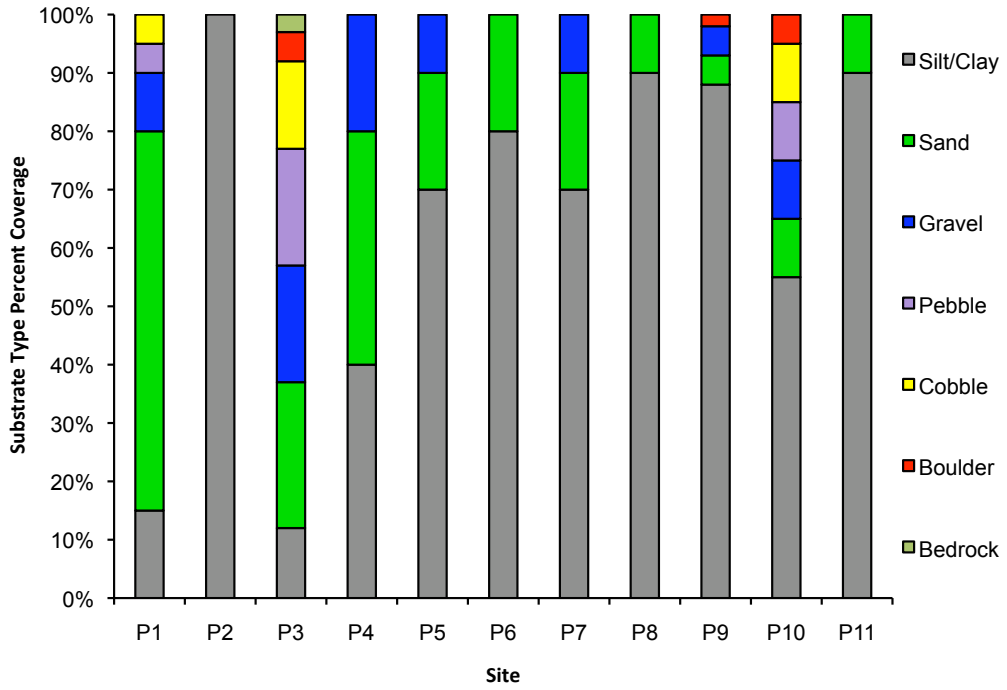

Figure 5.4 Percent coverage of substrate type at each site surveyed.

Sediment Bars

Sandy bars were observed at L Tree Creek (site P3) and Myall Creek (site P11), in the form of side / irregular bars and islands. These bars may provide nesting habitat for turtles during the dry season, when the bars are not inundated. There was no evidence of turtle nesting (tracks or excavation marks) during the survey.

River Profile

Average channel width was < 40 m at most sites, except Jingi Jingi Creek (site P5) where it was 200 m. Average wetted width was ≤ 30 m at all sites. Average lower bank width varied from 1 to 4 m wide, while average upper bank width varied from 3 to 15 m. Average lower bank height ranged from 0.3 to 2.3 m high, while average upper bank height ranged from 0.5 to 10 m.

Floodplain Wetlands

No floodplain wetlands were surveyed in the pipeline study area.

5.3 Macroinvertebrates

Taxonomic Richness and Abundance

Thirty six taxa (1,018 individuals) were recorded in the pipeline study area. Communities were dominated by non-biting midges (sub-families Chironominae and Tanypodinae), biting midges (family Ceratopogonidae), freshwater shrimps (family Atyidae) and the long-horned caddis fly (family Leptoceridae).

Mean taxonomic richness in bed habitat ranged between 2.2 and 7 families (Figure 5.5). It was highest at Jundah Creek (site P1) and lowest at Cooranga Creek (site P9). All four habitat types (bed, edge, macrophyte and tree root) were surveyed at Rocky Creek (site P7) only; richness was highest in macrophyte habitat and lowest in bed habitat.

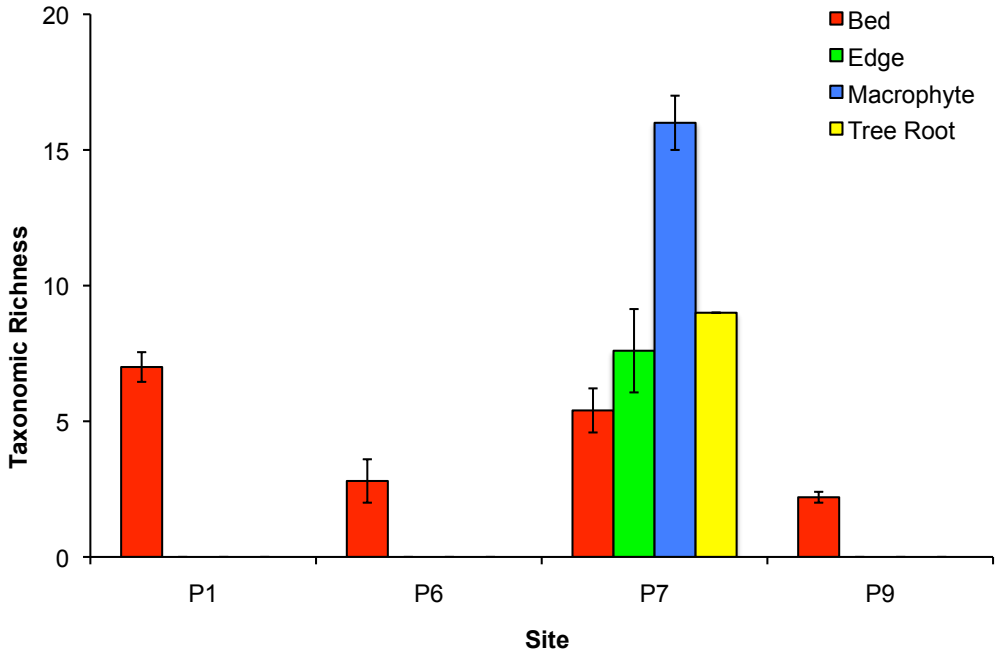

Figure 5.5 Mean taxonomic richness (± SE) of macroinvertebrate communities in habitat types sampled (bed, edge, macrophyte and tree root).

Mean macroinvertebrate abundance (total number of individuals captured) in bed habitat ranged between 3.8 and 52.3 individuals (Figure 5.6). Abundance was highest at Jundah Creek (site P1) and lowest at Cooranga Creek (site P9). At Rocky Creek (site P7) abundance was highest in macrophyte habitat and lowest in bed habitat.

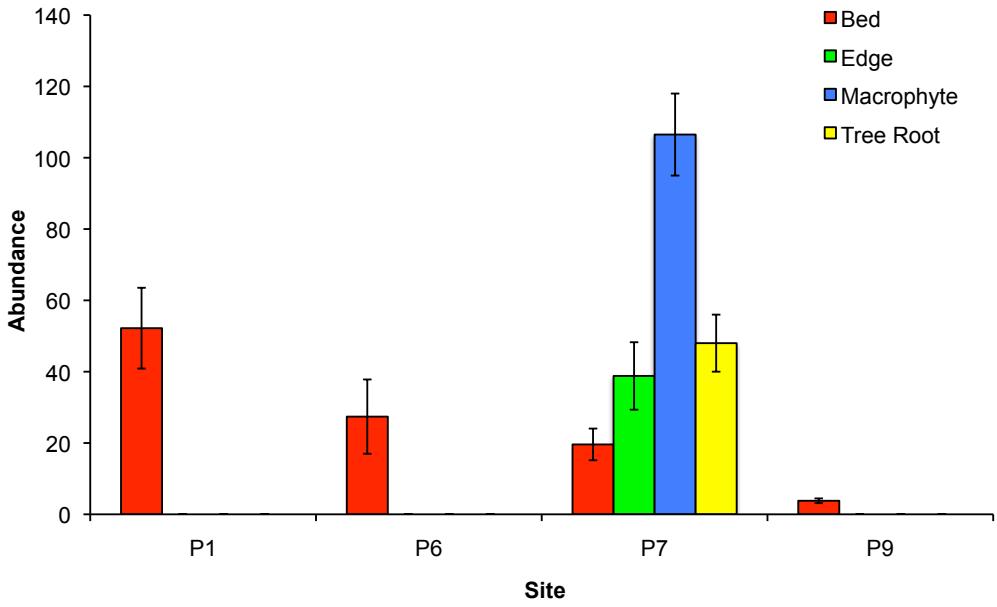

Figure 5.6 Mean abundance (± SE) of macroinvertebrate communities in habitat types sampled (bed, edge, macrophyte and tree root).

5.4 Fish and Fisheries

Community Composition and Richness

Fourteen species from eleven families (2,918 individuals) were recorded in the pipeline study area (Table 5.1). Communities were dominated by gudgeons (family Eleotridae, two species), spangled perch (family Terapontidae) and mosquito fish (family Poeciliidae). The most abundant species were mosquito fish (*Gambusia holbrooki)*, accounting for 31% of the catch; midgley's / western carp gudgeon (*Hypseleotris sp.*), accounting for 23% of the catch; and spangled perch (*Leioptherapon unicolor*), accounting for 12% of the catch.

Table 5.1 Fish recorded in the pipeline study area.

Family	Species	Common name	Site					
			Condamine River catchment					Fitzroy River catchment
			P6	P7	P8	P9	P11	P1
Ambassidae	*Ambassis agassizii*	Agazzi's glassfish	✓	✓				
Atherinidae	*Craterocephalus amniculus*	Darling River hardyhead		✓				
Clupeidae	*Nematalosa erebi*	bony bream		✓	✓		✓	
Cyprinidae	*Cyprinus carpio*	carp			✓		✓	
	Carassius auratus	gold fish		✓				
Eleotridae	*Hypseleotris galii*	firetail gudgeon	✓	✓	✓		✓	
	Hypseleotris sp.	Midgley's / western carp gudgeon	✓	✓	✓	✓	✓	
Melanotaeniidae	*Melanotaenia duboulayi*	crimson spotted rainbow		✓			✓	
Percichthyidae	*Macquaria ambigua*	golden perch		✓	✓			
Plotosidae	*Tandanus tandanus*	eel tailed catfish		✓				
	Neosilurus hyrtlii	Hyrtyl's catfish	✓					
Poeciliidae	*Gambusia holbrooki*	mosquito fish	✓	✓	✓	✓	✓	
Retropinnidae	*Retropinna semoni*	Australian smelt		✓				
Terapontidae	*Leiopotherapon unicolor*	spangled perch		✓	✓	✓	✓	✓
Total number of species present			**5**	**12**	**7**	**3**	**7**	**1**

All 14 species were captured in the Condamine River catchment. Spangled perch (*Leioptherapon unicolor*) was the only species captured in the Fitzroy River catchment (however data is available for only one site in the upper Fitzroy River catchment).

Communities were most diverse and abundant at Rocky Creek (site P8), with twelve species and 1,061 individuals captured at this site. Diversity and abundance was lowest at Jundah Creek (site P1).

Listed Threatened or Migratory Species, or Otherwise Significant Species

No listed rare or threatened, or noteworthy species were observed in the pipeline study area.

Fisheries

Within the pipeline study area, recreational fishing is likely to be primarily conducted by local residents, due to the remote location and lack of large waterbodies such as dams. There are several fish stocking programs managed by stocking groups in the Condamine catchment. Golden perch (*Macquaria ambigua*), silver perch (*Bidyanus bidyanus*) and Murray cod (*Maccullochella peelii*) are stocked into several waterways, including Chinchilla, Miles and Dalby weirs. There are no known commercial fisheries in the pipeline study area.

Introduced and Exotic Species

Three exotic species were captured in the Condamine River catchment: goldfish (*Carassius auratus*), carp (*Cyprinus carpio*) and mosquito fish (*Gambusia holbrooki*). Carp and mosquito fish are declared as noxious species in Queensland under the *Fisheries Regulation 2008*. No exotic species were recorded in the Fitzroy catchment, though goldfish and mosquito fish were recorded in the dam and surround study area.

5.5 Aquatic Reptiles

Turtles

Eleven Macquarie turtles (*Emydura macquarii*) were captured in the Condamine River catchment (Table 5.2). Turtles were captured at Rocky Creek, the Condamine River and Myall Creek, sites P7, P8 and P11, respectively. No turtles were recorded in the Fitzroy catchment, however it is likely that they are present due to the aquatic habitat that is available and there are no known barriers that could inhibit movement.

Crocodiles

The saltwater crocodile (*Crocodylus porosus*) and the freshwater crocodile (*Crocodylus johnstoni*) are highly unlikely to occur in the study area.

Table 5.2 Turtles (Emydura macquarii) recorded in the pipeline study area.

Site	Life History Stage			Total
	Juvenile	Intermediate	Adult	
P7		1	1	2
P8		2		2
P11	2	4	1	7

5.6 Aquatic Mammals

No aquatic mammals were noted in the study area, although platypus may occur within the study area and are discussed in Chapter 10.

5.7 Existing Impacts and Estimation of Natural Condition

Aquatic fauna communities of the pipeline study area may be slightly more impacted by non-water resource development, modification of habitats or the introduction of exotic species than their estimated natural condition.

6 References

Provided in the EIS.