D MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

D.1 Introduction

The Northern Pipeline Interconnector (NPI) Stage 2 Project was referred to the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA; formerly the Department of the Environment and Water Resources) in September 2007. On 24 October 2007, the Federal Minister determined that the project is a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as it was likely to have a significant impact on the following matters protected under that Act:

- listed threatened species and communities—ss. 18 and 18A; and
- listed migratory species—ss. 20 and 20A.

The aim of this appendix is to discuss matters of national environmental significance (MNES) protected under the EPBC Act. The report describes the relevant MNES in the study area and outlines how the project is likely to impact on these matters. Where appropriate, mitigation measures are presented that will be implemented as part of the project's environmental management to avoid or minimise the potential impacts.

D.2 Project Overview

The NPI (Stages 1 and 2) is a drought contingency project which will transport a target volume of 65 ML/d of treated potable water between the Sunshine Coast and Brisbane. The key components of the NPI Stage 2 project are as follows:

- 47.6 km of underground pipe between Cooroy and the termination point of NPI Stage 1 at Eudlo;
- a 5 ML balance tank;
- three new pump stations; and
- a new water quality management facility (WQMF) and upgrades to an existing facility at Landsborough; and

Figure D.1 shows the location of the proposed NPI Stage 2 pipeline and associated infrastructure.

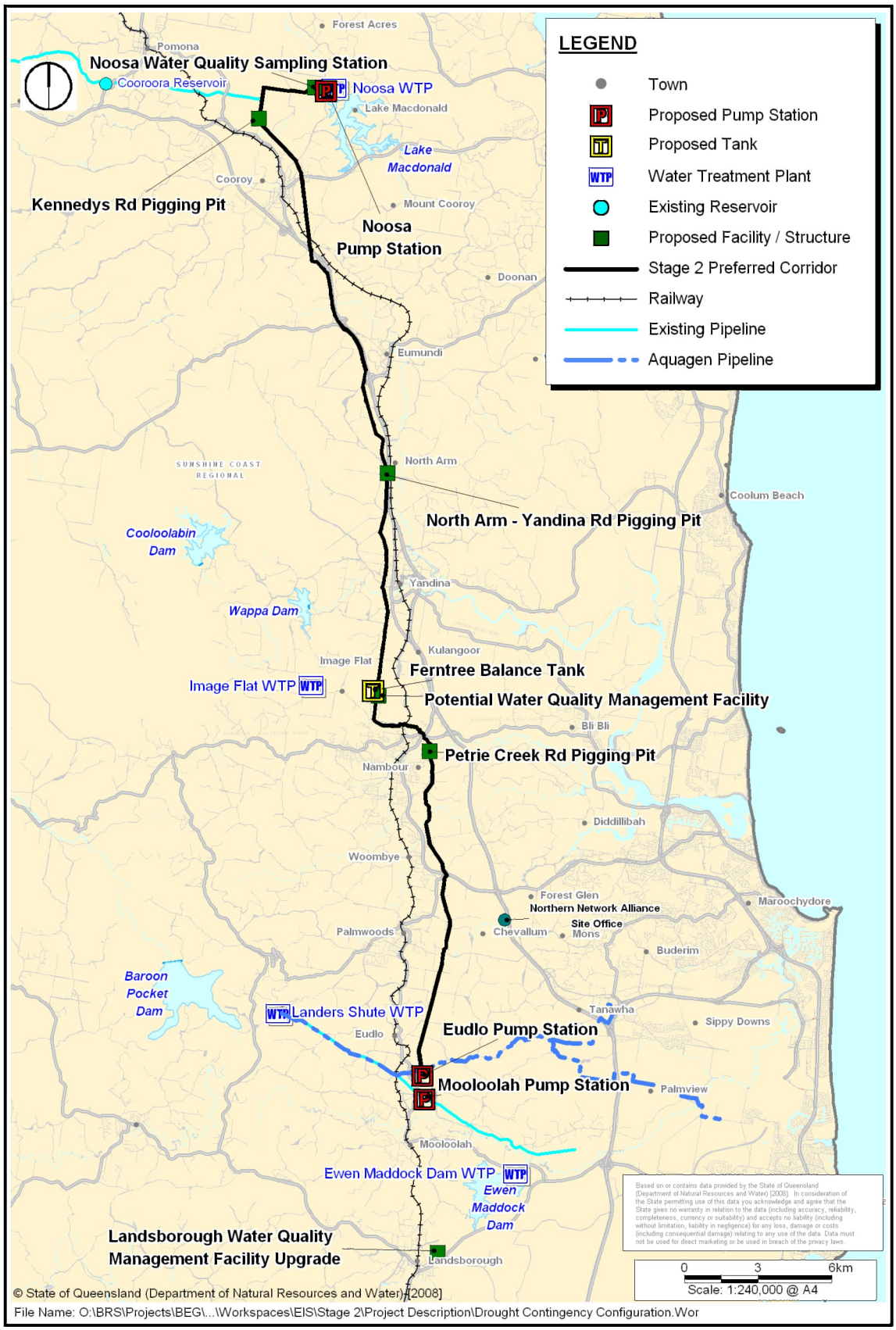

Figure D.1
NPI STAGE 2—DROUGHT CONTINGENCY CONFIGURATION

The project will mainly comprise a 30–40 m construction corridor. The majority of the route is located within existing road reserves or public utility easements, to minimise the impacts to native vegetation, habitat areas and affected landholders. In some sections of the corridor, the constraints imposed by engineering, topography, environment and geotechnical conditions have resulted in diversions from public utility easements or road reserves. At these locations a number of criteria have been used in finalising selection of the preferred route, including avoiding or minimising impacts upon areas of environmental significance such as, intact remnant vegetation or habitat for rare and threatened species.

Based on a 40 m wide construction corridor, the maximum area of remnant vegetation disturbed/cleared during construction will be approximately 20.5 ha (see Table D.1). These disturbances occur at several short sections of the corridor such that at any given location there will be a very localised loss of vegetation. The areas quoted are also conservative because in areas of high environmental value, such as narrow riparian fringing forests, every effort will be made to minimise the footprint to less than 20 m width, with follow-up revegetation using advanced growth specimens of key species lost in the construction program.

The figures in Table D.1 are based on the maximum corridor width of 40 m and on the right-of-way being total area of 183.94 ha (including facility areas). Regional ecosystems present as mixed communities (ie 12.3.1/12.3.2) have been calculated according to percentage dominance information provided in the Regional Ecosystem metadata (EPA 2007).

Table D.1 Estimated clearing areas of mapped remnant vegetation

Conservation status under *Vegetation Management Act 1999* (Qld)	Clearing area (ha)	% of right-of-way
'Endangered' regional ecosystems	2.15	1.17
'Of concern' regional ecosystems	6.19	3.37
'Not of concern' regional ecosystems	12.13	6.60
Totals	**20.47**	**11.13**

Target volumes for drought contingency flows

The completed NPI (Stage 1 and Stage 2) will supply a target volume of 65 ML/d of potable fresh water to existing storage facilities at Elimbah and Morayfield for distribution to localities in the greater Brisbane region. Successful completion of Stage 2 will include a number of integration works with NPI Stage 1 in order to operate the project as a whole. Further, the NPI Stage 2 will support the regional growth initiatives on the Sunshine Coast described by the QWC (QWC 2008).

Completion of the NPI Stage 1 at the end of 2008 will initially supply the full 65 ML/d drought contingency flows from Baroon Pocket Dam via the Landers Shute water treatment plant (WTP). Completion of Stage 2 will connect the NPI to additional existing water sources (supplying up to 18 ML/d), thereby reducing the reliance on water drawn from the Baroon Pocket Dam to supply drought contingency flows. The connection of Stage 2 to additional water sources therefore increases the security of water supply for the NPI. This is important to ensure a sustainable yield of water from existing sources until a future bulk supply is available on the Sunshine Coast.

Stage 2 Water Supply Strategy

The previous water supply strategy for NPI Stage 2 proposed the abstraction of approximately 40 ML/d of water from the Mary River which would be sought through new entitlements under the Water Resource (Mary Basin) Plan 2006 (Mary Basin WRP). As this proposed entitlement was not included within the establishment of the Mary Basin WRP, any impacts associated with the new allocation would require assessment against relevant state and federal environmental legislation.

A comprehensive description of the potential impacts on matters of national environmental significance (MNES) associated with this supply strategy was produced and is included Appendix H-6. The key findings of the report identified that:

- the extraction of 40 ML/d would not result in a significant change in the frequency or duration of flows predicted for seasonally high and low-flow periods in the Mary River; and
- under the 40 ML/d extraction scenario, the reduction in mean duration of flow providing for the '10 cm and 30 cm above cease to flow objectives' would not result in significant impacts on the ecological requirements of MNES.

Following the review of the previous water supply strategy for Stage 2, a new strategy (now the current water supply strategy) was proposed. The factors influencing the new water supply strategy included:

- improvements in the regional water supply situation following good rainfall over the summer of 2007–08 and in early June 2008, which resulted in spillway overflows at all Sunshine Coast dams;
- recent short-term water balance modelling completed by QWC, which showed that the transfer of 65 ML/d from Baroon Pocket Dam to the SEQ water grid was sustainable until the end of 2011; and
- enhancement of water supply security in SEQ through the completion of a number of key drought contingency projects by the end of 2008.

The Stage 2 water supply strategy proposes to transport water that is extracted from the Mary River under an existing utilised allocation (up to 55% utilised (NRW 2008)) and treated at the Noosa Water Treatment Plant. This allocation has been utilised by the (previous) Noosa Shire Council to supply local urban demand since the allocation was authorised in 2000.

The existing entitlement is comprised of 6500 ML/a (18 ML/d) interim water allocation (high priority) held by the SEQ Water Grid Manager (SEQWGM) within the Upper Mary River Water Supply Scheme. Impact assessment for the full use of the 6500 ML/a (18 ML/d) allocation occurred during the establishment of the Mary Basin WRP under the agreed WRP Process.

Under the currently proposed water supply strategy (ie utilisation of existing entitlements) NPI stage 2 will have the capacity to deliver up to 6500 ML/a (18 ML/d). The obvious advantages of this water supply strategy are:

- the impacts to the environmental values of this entitlement have been assessed and as a result the allocation was authorised under the Mary Basin WRP 2006;
- no new water entitlements are being sought and there are no resulting anticipated impacts on EVR species or MNES in the Mary River;
- water entitlements have been previously utilised and established under the WRP. This is consistent with the EFOs of the WRP;
- reduced reliance on Baroon Pocket Dam for drought contingency flows;
- no changes to the existing infrastructure on the Mary River; and
- able to be managed better from a risk management perspective, and therefore a more streamlined approvals process.

D.3 Impacts on Matters of National Environmental Significance

In consultation with the Department of Infrastructure and Planning (DIP) and Commonwealth DEWHA, it was determined that the environmental impact assessment should address the potential impact on:

- listed threatened and migratory species expected to use habitat within and immediately adjacent to the corridor for nesting, breeding and foraging; and
- listed threatened and migratory species that live in or rely upon riparian and aquatic environments that may be affected by waterway crossings and harvesting of water from the Mary River.

This assessment has been prepared following the Significant Impact Guidelines formulated by DEWHA, which outline criteria to assess whether an action is likely to have a significant impact on MNES. DEWHA defines a significant impact as 'an impact which is important, notable or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends on the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts' (DEH 2006).

A significant impact is considered likely if it has a 'real or not remote chance or possibility' of occurring. The significant impact criteria for listed threatened and migratory species are summarised in Table D.2. The species of interest were determined through a search of the EPBC Online Protected Matters search tool and desktop assessment including interrogation of regional data bases of flora and fauna records held by Government agencies and other research organisation. Outcomes of this multi-species comparative process are summarised in the relevant sections below where this process is described in greater detail.

For the purposes of database searches conducted during the desktop assessment, the project area was defined using the following coordinates:

Decimal degrees

- Latitude: –26.3722 to –26.7543; and
- Longitude: 152.868 to 153.05.

Degrees minutes seconds

- Latitude: 26° 22' 19.92" S to 26° 45' 15.48" S; and
- Longitude: 152° 52' 4.8" E to 153° 3' 4.09" E.

This document addresses only those EPBC-listed species included in the terms of reference (TOR) for the Stage 2 project; however, the potential presence of other significant species is noted. These are addressed in the main EIS text, with information derived from consultant fauna and flora reports (Appendix H).

Table D.2 EPBC significant impact guidelines

Matter of national environmental significance	Significant impact criteria
Listed threatened species (endangered)	An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will: ▪ lead to a long-term decrease in the size of a population; ▪ reduce the area of occupancy of the species; ▪ fragment an existing population into two or more populations; ▪ adversely affect habitat critical to the survival of a species; ▪ disrupt the breeding cycle of a population; ▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; ▪ result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat; ▪ introduce disease that may cause the species to decline; or ▪ interfere with the recovery of the species.
Listed threatened species (vulnerable)	An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will: ▪ lead to a long-term decrease in the size of an important population of a species; ▪ reduce the area of occupancy of an important population; ▪ fragment an existing important population into two or more populations; ▪ adversely affect habitat critical to the survival of a species; ▪ disrupt the breeding cycle of an important population; ▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; ▪ result in invasive species that are harmful to an vulnerable species becoming established in the vulnerable species' habitat; ▪ introduce disease that may cause the species to decline; or ▪ interfere with the recovery of the species.

Table D.2 (continued)

Matter of national environmental significance	Significant impact criteria
Listed migratory species	An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will: ▪ substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species; ▪ result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or ▪ seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Existing environmental values in the study area have been described based upon a combination of desktop and field surveys to determine the threatened and migratory species likely to occur in the project area. Desktop surveys included a review of:

- aerial photography of the proposed corridor and surrounds;
- regional ecosystem (RE) mapping provided by the Queensland Environmental Protection Agency (EPA);
- search results from the EPBC Online Protected Matters search tool, EPA Wildlife Online, the Queensland Herbarium, Birds Australia and Queensland Museum databases;
- previous ecological studies in the local area;
- discussions with state and local government personnel with specific knowledge of the species and environments in the project area; and
- relevant publications and literature.

Field surveys have been undertaken by a number of specialist consultants with knowledge of the project area. These include:

- Landscape Assessment Management and Rehabilitation (terrestrial flora);
- Biodiversity Assessment and Management (terrestrial fauna);
- Queensland Fauna Consultancy (terrestrial and aquatic fauna); and
- Hydrobiology (aquatic fauna).

Detailed descriptions of these species of flora and fauna of high ecological significance are contained in the sections following together with notes of their specific characteristics and management strategies to mitigate impacts relating to the pipeline construction program.

D.4 Listed Threatened Terrestrial flora

Listed threatened terrestrial flora species were identified through database searches, with assessment of the proposed corridor conducted by a local botanist during October 2007 and February 2008 (see Figure D.2). The flora assessment process included review of current aerial photography to determine the extent of different vegetation types within the corridor. This was followed by vehicle and foot traverses of the corridor to confirm and describe remnant vegetation, regrowth and rural landscapes. This process enabled the assessment of distribution of regional ecosystem (RE) types and identification of rare and threatened flora species.

In some locations, where a number of corridor routes are currently being investigated, only preliminary environmental investigations have been conducted (see Figure D.2). These investigations have identified regional ecosystems of conservation significance and significant flora species or potential habitat. The results of these preliminary investigations are included in the following relevant sections; however, further site-specific investigations will be conducted as appropriate as part of finalising the selection of a least impact route at particularly sensitive locations.

Field surveys recorded a number of vegetation communities within the corridor, which can be broadly grouped into the following types:

- intact vine forest remnants (RE 12.3.1/12.3.2) known to provide habitat for a number of rare and threatened rainforest species. This RE often occurs near waterways, minor gullies and depressions;
- large tracts of tall open eucalypt forests persisting along coastal ridges, developing a vine forest understorey on lower slopes and in gullies; and
- isolated areas of Melaleuca wetland in riparian depressions around Eudlo Creek and tributaries.

Based on this information, and the habitat requirements of key plant species, an assessment of likelihood of occurrence was determined for each species of high environmental significance (see Table D.3). Those species potentially impacted by the Stage 2 project are discussed in detail below. Known distribution records for listed terrestrial flora species are shown in Figure D.3.

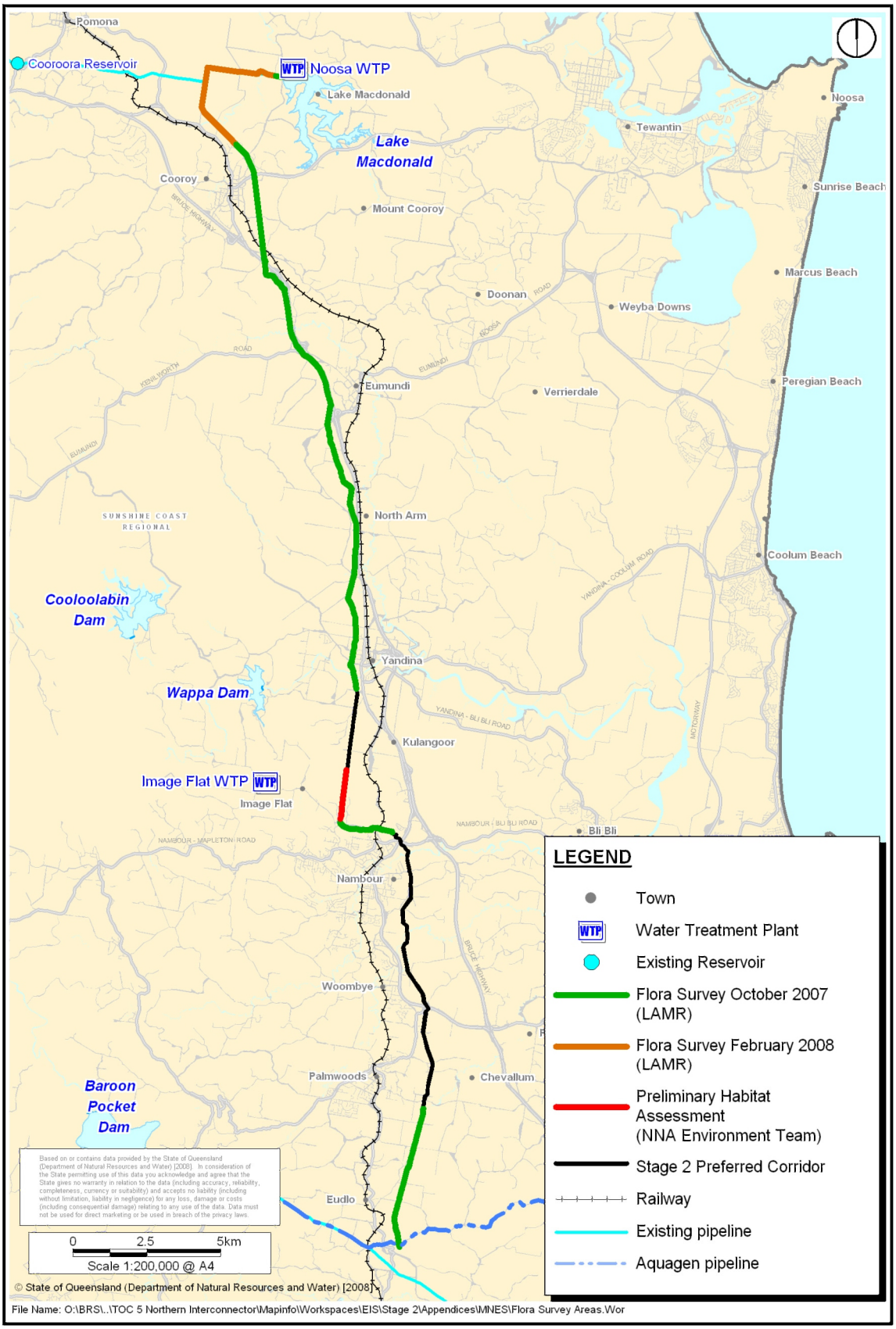

Figure D.2
NPI STAGE 2—FLORA SURVEY LOCATIONS

Table D.3 Listed terrestrial flora species potentially occurring within the project area

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Acacia attenuata	Whipstick Wattle	Vulnerable	Occurs on flats, low rises and at the edge of wallum swamps. Also occurs in *Eucalyptus racemosa* woodlands (RE 12.9-10.14)	**Low**—small area of suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. Closest known record of this species is approximately 1.5 km to the west of the proposed corridor at Eumundi
Allocasuarina emuina	Emu Mountain She-oak	Endangered	Occurs within montane shrublands on rocks of igneous origin (RE 12.8.19)	**Low**— no suitable habitat identified during field investigations. No known records within the project area
Allocasuarina thalassoscopia	–	Endangered	Occurs within montane shrublands on rocks of igneous origin (RE 12.8.19)	**Low**— no suitable habitat identified during field investigations. No known records within the project area
Baloghia marmorata	Marbled Baloghia	Vulnerable	Occurs in notophyll vine forest (RE 12.12.16)	**Low**—suitable habitat recorded adjacent to corridor, but not within the vegetation clearing footprint. Species not identified during field investigations
Bosistoa selwynii	Heart-leaved Bosistoa	Vulnerable	Occurs in riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 & RE 12.11.11)	**Low**—potential habitat recorded adjacent to the corridor, but species not identified during field investigations. No known records within the project area
Bosistoa transversa	Three-leaved Bosistoa	Vulnerable	Occurs in riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 & RE 12.11.11)	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. No known records within the project area

Table D.3 (continued)

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Bulbophyllum globuliforme	Miniature Moss-orchid	Vulnerable	Occurs in Araucarian vine forest (RE 12.11.10 & RE 12.11.11) on the upper branches of Hoop Pine	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. No known records within the project area
Cryptocarya foetida	Stinking Cryptocarya, Stinking Laurel	Vulnerable	Found in simple notophyll vine forest and gully vine forest on igneous rocks (RE 12.12.1)	**Low**—suitable habitat not identified during field investigations. Closest known record of this species is approximately 2.5 km west of the proposed corridor, north of Nambour
Eucalyptus conglomerata	Swamp Stringybark	Endangered	Occurs within Banksia woodland on coastal alluvial plains (RE 12.3.14)	**Low**—suitable habitat not identified during field investigations. No known records within the project area
Floydia praealta	Possum Nut, Beefwood	Vulnerable	Occurs in riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 & RE 12.11.11)	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. No known records within the project area
Graptophyllum reticulatum	Veiny Graptophyllum	Endangered	Known from remnant rainforest (RE 12.11.10/RE 12.12.16) on the Sunshine Coast	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. Closest known record of this species is approximately 2.5 km east of the proposed corridor, on the South Maroochy River

Table D.3 (continued)

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Macadamia ternifolia	Small-fruited Queensland Nut	Vulnerable	Occurs in riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 & RE 12.11.11) between Kin Kin and Pine River	**Moderate**—known records from Eerwah Vale and Eumundi. Not identified during field investigation. Further field investigation may be required for any corridor refinements/options if suitable habitat present, or known records within close proximity (Refer to Section D.4.4)
Macadamia tetraphylla	Rough-shelled Macadamia	Vulnerable	Found in complex to simple notophyll vine forest on alluvial plains (RE 12.3.1) and on igneous rocks (RE 12.12.16)	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. Known distribution is outside of project area—from Coomera River southwards
Phaius australis	Lesser Swamp-orchid	Endangered	Occurs within Melaleuca open forest on alluvial plains (RE 12.3.5). Known from remnant vegetation around Wappa Dam.	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. Closest known record of this species is approximately 3 km west of the proposed corridor at Wappa Dam
Phaius tancarvilleae	Swamp Lily, Greater Swamp-orchid	Endangered	Occurs in moist to wet habitats, particularly near permanent swamps, localised depressions and soaks. Known from north-eastern Queensland to north-eastern New South Wales.	**Present**—recorded in and adjacent to riparian vine forest at Paynters Creek (northern section). Further field investigation to be conducted for corridor refinements/options (Refer to Section D.4.2)

Table D.3 (continued)

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Plectranthus torrenticola	–	Endangered	Occurs in gullies and on rocky outcrops in heathland and along rainforest margins. Records from junction of Maroochy and North Maroochy Rivers.	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. Closest known record of this species is approximately 2.5 km east of the proposed corridor along the Maroochy River
Pouteria eerwah	Shiny-leaved Condoo, Black Plum	Endangered	Occurs in Araucarian vine forest (RE 12.11.10/12.11.11) and montane heath (RE 12.8.19). Records from North Arm.	**Low**—suitable habitat not identified during field investigations. Closest known record of this species is approximately 2.5 km west of North Arm and the proposed corridor
Prasophyllum wallum	–	Vulnerable	Found in open or dry heaths on dunes and beaches (RE 12.2.13)	**Low**—suitable habitat not identified during field investigations. Closest known record of this species is from Coolum, outside of the project area
Prostanthera palustris (*Prostanthera* sp. Bundjalong Nat. Pk; *Prostanthera* sp. Mt Tinbeerwah)	Swamp Mint Bush	Vulnerable	Occurs in coastal, wet heathland dominated by *Banksia* and *Allocasuarina* species.	**Low**—suitable habitat does not occur. The closest known record of this species is approximately 1 km from the proposed corridor adjacent at Lake Macdonald
Romnalda strobilacea	–	Vulnerable	Occurs in riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 & RE 12.11.11)	**Low**—suitable habitat recorded adjacent to the corridor, but species not identified during field investigations. Closest known record of this species is approximately 5 km west of the proposed corridor at Wappa Dam

Table D.3 (continued)

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Syzygium hodgkinsoniae	Smooth-bark Rose Apple, Red Lilly Pilly	Vulnerable	Occurs in fringing rainforest on deep alluvial soils in Moreton and Wide Bay districts.	**Moderate**—known records from Eudlo Creek but not recorded within proposed corridor. Further field investigation may be required for any corridor refinements/options if suitable habitat present, or known records within close proximity (Refer to Section D.4.5)
Triunia robusta	Glossy Spice Bush	Endangered	Occurs in understorey of sub-coastal rainforest on the Sunshine Coast. Known from a number of locations within the study area.	**Moderate**—known records from North Maroochy River but not recorded within proposed corridor. Further field investigation may be required for any corridor refinements/options if suitable habitat present, or known records within close proximity (Refer to Section D.4.3)
Xanthostemon oppositifolius	Southern Penda	Vulnerable	Occurs in riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 & RE 12.11.11)	**Present**—recorded in riparian vine forest at several locations around Six Mile Creek and Lake Macdonald. Further field investigation required if any corridor refinements/options (Refer to section D.4.1)
Zieria sp. Brolga Park	–	Endangered	Restricted to the Sunshine Coast hinterland where it is known from one population in Triunia National Park.	**Low**—no known populations occur near the proposed corridor. Only one known population on the Sunshine Coast located more than 5 km to the west of the proposed corridor.

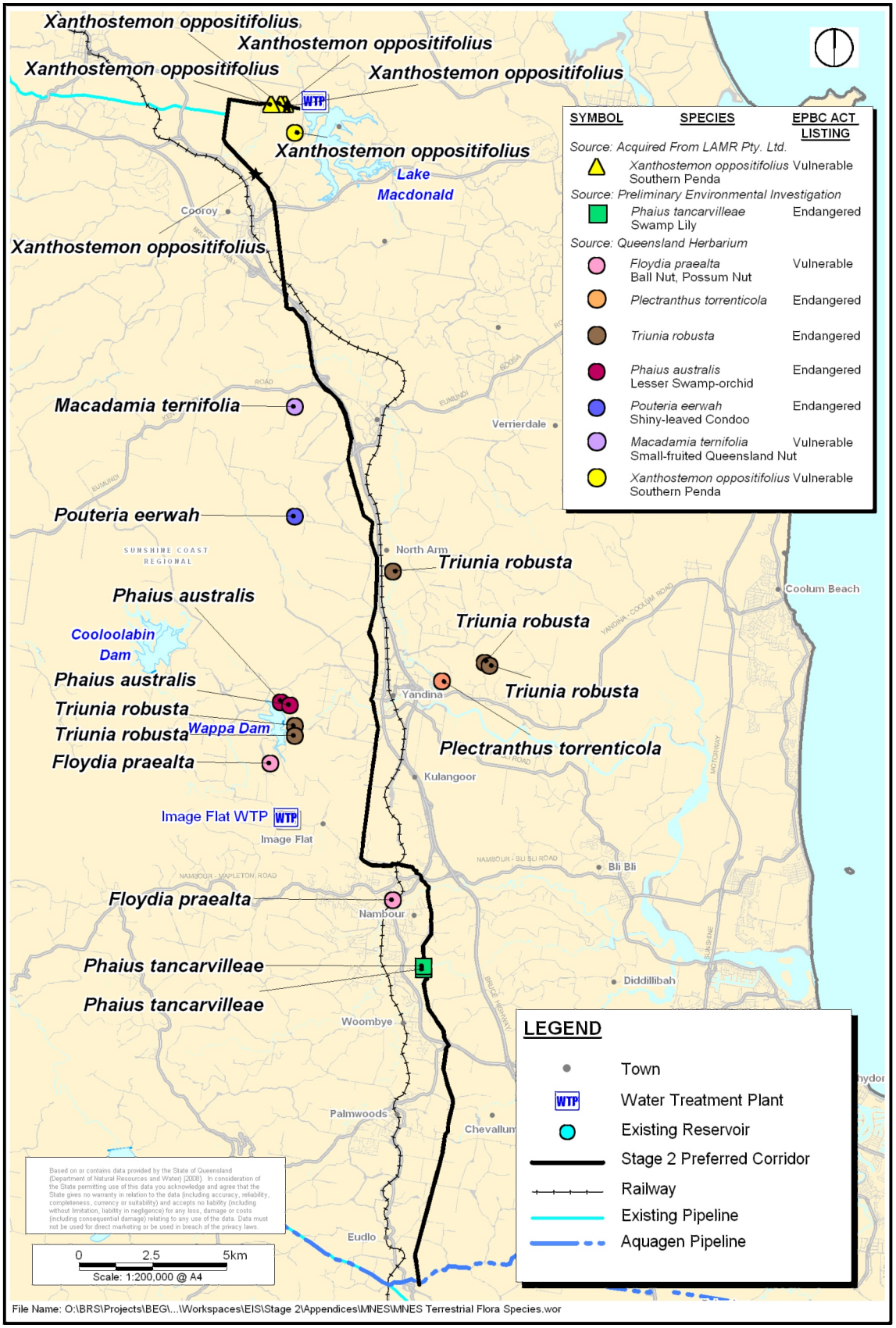

Figure D.3
MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (FLORA)

D.4.1 *Xanthostemon oppositifolius*, Southern Penda (Vulnerable)

Distribution and Ecology

Xanthostemon oppositifolius is known from Papua New Guinea and Australia. The Australian populations are restricted to south-east Queensland (Eddowes 1998). This rainforest tree occurs in riparian communities, Araucarian vine forests and notophyll vine forests. As very few mature individuals of this species remain, there is limited information available regarding the species' distribution and ecology, although the species is known to flower in winter–spring (Stanley & Ross 2002). Other populations within the Mary River catchment are known from around Kin Kin, where its distribution has been restricted as a result of clearing for dairy farming (Megan Thomas, Queensland Herbarium, pers. comm.).

Within the study area, *X. oppositifolius* individuals have been observed at Six Mile Creek adjacent to the edges of remnant vegetation patches bordering cleared rural residential land (Mike Olsen, pers. comm.). The major threat to this species is habitat loss and degradation from clearing for timber resources and urban development (Eddowes 1998). There are no formal recovery plans for this species in Australia; however, the EPBC Act and the *Queensland Nature Conservation Act 1992* (NCA) provide legislative protection from inappropriate development, or where significant populations of the species are present.

Potential Impacts on Populations in the Study Area

Xanthostemon oppositifolius was recorded at a number of locations supporting riparian vine forest (RE 12.3.1) at Lake Macdonald and Six Mile Creek (main channel and left branch). An assessment of potential impacts is provided at Table D.4. Where clearing of riparian vegetation is required, individual trees may be removed as a result. Potential impact mitigation measures include:

- undertaking detailed survey, prior to construction, to map the location of trees within and adjacent to the corridor;
- providing specimens, ecological information and GPS coordinates to the Queensland Herbarium for incorporation in the HERBRECS database;
- ensuring that refinements to the corridor avoid or limit the number of individual trees removed from the work area—currently undertaking detailed mapping for this species by taking GPS locations of individual plants within or directly adjacent to the proposed corridor. This mapping will be used for detailed refinements to the corridor alignment;
- ensuring refinements to the alignment of pipe within the corridor avoid individual trees;
- using a constrained corridor (less than 30 m) to minimise the damage to individual trees and their habitat; and
- translocating and/or propagating individual trees for use in revegetation efforts where trees cannot be avoided.

As *X. oppositifolius* is locally abundant adjacent to existing disturbed areas, the localised scale and duration of the disturbance associated with the proposed project is unlikely to result in a significant impact for the species.

Table D.4 Assessment of significant impact for *Xanthostemon oppositifolius* (Vulnerable)

Will the proposed works …	*Xanthostemon oppositifolius*
▪ lead to a long-term decrease in the size of an important population?	The removal of individual trees has the potential to lead to a minor decline in the number of mature plants in the population. However, the implementation of the mitigation measures outlined above and, in particular, the propagation of this species for revegetation works will enhance recruitment. Therefore, the proposed action is not likely to lead to a long-term decrease for *X. oppositifolius* populations.
▪ reduce the area of occupancy for the species?	The proposed action has some potential to reduce the area of occupancy for the species. Implementation of the mitigation measures outlined above will ensure that this reduction is minimised to the greatest extent possible.
▪ fragment an existing population into two or more populations?	The proposed action has the potential to fragment existing populations of this species on a local scale, but is unlikely to result in an ecologically significant impact.
▪ adversely affect habitat critical to the survival of the species?	In the first instance, the corridor follows cleared easement/existing disturbed areas where possible, minimising impacts on critical habitat. All waterway crossings will be restricted to a maximum width of 30 m (and typically 20–25 m) within a linear riparian corridor. This represents a small proportion of the available habitat along each of the waterways described and would not significantly reduce the area of occupancy for the species.
▪ disrupt the breeding cycle of the population?	The proposed action is unlikely to disrupt the breeding cycle of the population. Juveniles of this species have been observed to establish adjacent to cleared or disturbed areas at Six Mile Creek (left branch), and are locally abundant along this reach. This species will be propagated for use in revegetation of local environments and will therefore have improved recruitment outcomes.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The affected area for all waterway crossings will be restricted to a maximum width of 30 m (and typically 20–25 m) within a linear riparian corridor. This represents a small proportion of the available habitat along each of the waterways described and would not significantly reduce the area of occupancy for the species. With revegetation and planting out of juveniles into disturbed areas, losses will be offset in the medium to longer term.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	Clearing of closed-canopy vine forest habitats for this species has the potential to allow increased levels of weed invasion. Minimising disturbance areas and controlling smothering legumes will be required for up to 5 years until regrowth shading effects naturally limits the intensification of edge effects on the species' habitat.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	There is no recovery plan in place for this species. However, every effort will be made to minimise the impact, include this species in local revegetation efforts and to provide population data and specimens to the Queensland Herbarium for inclusion in the HERBRECS database.

Summary of Impact Assessment

The above impact assessment indicates that the proposed action will not have a significant impact on populations of *X. oppositifolius*. All impacts associated with the proposed action will be temporary and localised and will be confined to existing cleared or disturbed areas where possible. Restricting the width of the corridor, propagation, translocation and effective management of revegetation efforts will assist in avoiding any long-term impacts for populations of *X. oppositifolius* in the project area.

D.4.2 Phaius tancarvilleae (Endangered)

Distribution and Ecology

Phaius tancarvilleae is an endangered orchid that occurs in moist or wet habitats from north-eastern Queensland to north-eastern New South Wales (Jones 1993). This species is also known from New Guinea, Indonesia, Malaysia, India and China (Jones 1993). *Phaius tancarvilleae* grows in permanent swamps where it may occur on extensive patches in black peaty soil. It also occurs in localised depressions and soaks in open forest and grassland (Jones 1993).

Phaius tancarvilleae has four to seven dark green, lanceolate leaves (to 1.25 m) with a flower stem to 2 m tall. This orchid flowers in spring to early summer (Stanley & Ross 2002), presenting up to 16 showy flowers with brick-red petals and purple, red and yellow labella. The major threats to *P. tancarvilleae* are land clearing and the illegal collection of plants.

Potential Impacts on Populations in the Study Area

Two *P. tancarvilleae* plants were recorded adjacent on the margins of cleared easement at Paynters Creek within close proximity of the proposed corridor. While the proposed corridor does not traverse this area, *P. tancarvilleae* may occur at other locations along Paynters Creek where further corridor investigation is to be undertaken. An assessment of the potential impacts is provided at Table D.5. Potential impact mitigation measures include:

- undertaking detailed survey to map the location of this species within and adjacent to the corridor;
- providing specimens, ecological information and GPS coordinates to the Queensland Herbarium for incorporation in the HERBRECS database;
- ensuring that refinements to the corridor avoid or limit the number of individual trees removed from the work area—currently undertaking detailed mapping for this species by taking GPS locations of individual plants within or directly adjacent to proposed corridor. This mapping will be used for detailed refinements to the corridor alignment;
- ensuring refinements to the alignment of pipe within the corridor avoid individual plants;
- using a constrained corridor (less than 30 m) to minimise the damage to individual plants and their habitat; and
- translocating and/or propagating individual plants for use in revegetation efforts where trees cannot be avoided.

Table D.5 Assessment of significant impact for *Phaius tancarvilleae* (Endangered)

Will the proposed works …	*Phaius tancarvilleae*
▪ lead to a long-term decrease in the population?	The removal of individual plants has the potential to lead to minor declines in the number of mature plants in a population. Subject to the implementation of the mitigation measures outlined above, no long-term population decreases are expected.
▪ reduce the area of occupancy for the species?	The proposed action has some potential to reduce the area of occupancy for the species within a localised area. Implementing the mitigation measures above will ensure this reduction is minimised to the greatest extent.
▪ fragment an existing population into two or more populations?	The proposed action has the potential to fragment existing populations on a local scale, but this is not likely to result in ecologically significant impacts for the species as local populations are widely dispersed and naturally fragmented due to specific habitat needs.
▪ adversely affect habitat critical to the survival of the species?	Where appropriate, the corridor can be constrained to less than 30 m. Impacts on habitat for the species are likely to be localised and temporary. The proposed action will not result in the long-term adverse effects to critical habitat for the species.
▪ disrupt the breeding cycle of the population?	The proposed action is unlikely to disrupt the breeding cycle of the population. The individuals recorded at Paynters Creek were located on the margins of cleared easement. This species may be propagated for use in revegetation along Paynters Creek, which would improve recruitment.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed action has some potential to impact habitat of this species. However, implementation of the above outline mitigation measures will ensure that any potential impacts will not result in the decline of populations of *P. tancarvilleae*.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	The proposed action will not result in any invasive species becoming established in habitat for this species.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	Subject to the implementation of appropriate mitigation measures, the proposed action will not interfere with the recovery of this species.

Summary of Impact Assessment

The proposed action will not have significant impacts on populations of *P. tancarvilleae* within the project area. Impacts for this species are expected to be temporary and localised and can be avoided or mitigated. Detailed mapping showing the location of *P. tancarvilleae* individuals will be used to refine the corridor route to minimise impacts to populations and suitable habitat.

D.4.3 Triunia robusta (Endangered)

Distribution and Ecology

Triunia robusta is a rare endemic understorey rainforest species that was thought to be extinct until recently, when it was recorded from sub-coastal rainforest on the Sunshine Coast. The species is largely restricted to the Maroochy River catchment, where it occurs in small compact stands in complex notophyll vine forest on river terraces where soils are highly fertile. A recent study reported 11 populations comprising a total of 877 plants (Shapcott 2002).

Potential Impacts on Populations in the Study Area

Triunia robusta is known to occur within riparian vine forest (RE 12.3.1) along the North Maroochy River. This species was identified as having potential to occur within the project area; however, known populations generally occur further to the east and to the west of the proposed corridor and no individuals were recorded during the field survey. The construction and operation of the pipeline will have no impact on the current known distribution of this species. Further field investigation will be conducted for corridor route refinements where suitable habitat for *Triunia robusta* is present, or where there are known records of this species within close proximity to the proposed corridor. Individuals of this species will be avoided in the first instance. Any potential impacts will be minimised and mitigated through the use of a constrained corridor (less than 30 m) and translocation and/or propagation of individual plants for use in revegetation efforts, where this species cannot be avoided.

D.4.4 Macadamia ternifolia, Small-fruited Queensland Nut (Vulnerable)

Distribution and Ecology

Macadamia ternifolia is a small tree found in subtropical rainforest within south-east Queensland. The species is known from riparian rainforest and Araucarian vine forest communities east of the Great Dividing Range, from Kin Kin in the north to Pine River in the south (Stanley & Ross 2002). Threats to this species are predominantly related to the loss of suitable habitat as a result of clearing for agriculture and urban development. However, invasive weeds such as Lantana (*Lantana camara*) and Camphor Laurel (*Cinnamomum camphora*), which form dense thickets or have invasive root systems, also threaten species of the *Macadamia* genus.

Potential Impacts on Populations in the Study Area

This species was identified as having potential to occur within the project area; however, the closest record for this species was to the west of the alignment at Eerwah Vale. As such, the construction and operation of the NPI Stage 2 is not likely to have significant impacts upon this species. If required, further field investigation will be undertaken in areas where the corridor route has been refined to confirm the presence/absence of *Macadamia ternifolia*. If confirmed along the proposed corridor, individuals of this species will be avoided in the first instance. Potential impacts will be minimised and mitigated by:

- using a constrained corridor (less than 30 m) to avoid damage to individual trees and suitable habitat; and
- translocating and/or propagating individual trees for use in revegetation efforts where trees cannot be avoided.

D.4.5 Syzygium hodgkinsoniae, Smooth-bark Rose Apple, Red Lilly Pilly (Vulnerable)

Distribution and Ecology

Syzygium hodgkinsoniae is a tree species growing up to 11 m in height and occurring between Gympie in south-east Queensland to the Richmond River in north-east New South Wales (DEC 2005). This species is found in fringing rainforest communities in the coastal areas of the Moreton and Wide Bay districts, and generally occurs in low-altitude, complex notophyll vine forest (Stanley & Ross 2002).

Potential Impacts on Populations in the Study Area

Syzygium hodgkinsoniae is known to occur within riparian vine forest understorey (RE 12.3.2) along Eudlo Creek (LAMR 2007). This species was identified as having potential to occur within the study area; however, it was not recorded during the field survey. Further field investigation will be conducted for corridor route refinements where suitable habitat for *Triunia robusta* is present, or where there are known records of this species within close proximity to the proposed corridor. Individuals of this species will be avoided in the first instance. Any potential impacts will be minimised and mitigated through the use of a constrained corridor (less than 30 m) and translocation and/or propagation of individual plants for use in revegetation efforts, where this species cannot be avoided.

D.5 Listed Threatened Terrestrial Fauna

Listed threatened terrestrial fauna species were identified through database searches in the first instance. Potential habitat areas were identified from aerial photography of the proposed route and visited by qualified fauna consultants to conduct a series of fauna and habitat assessments over six days and two nights during October and November 2007 (BAAM), and 5.5 days during January and February 2008 (QFC). In total, 23 work days of field time were expended plus 10 work hours of night-time investigations. The sites surveyed during these investigations are shown in Figure D.4.

Preliminary environmental investigations have been conducted in some locations where a number of corridor routes are currently being investigated (see Figure D.4). These investigations have identified potential suitable habitat areas for significant species. The results of these preliminary investigations are included in the following relevant sections; however, further investigations will be conducted as appropriate.

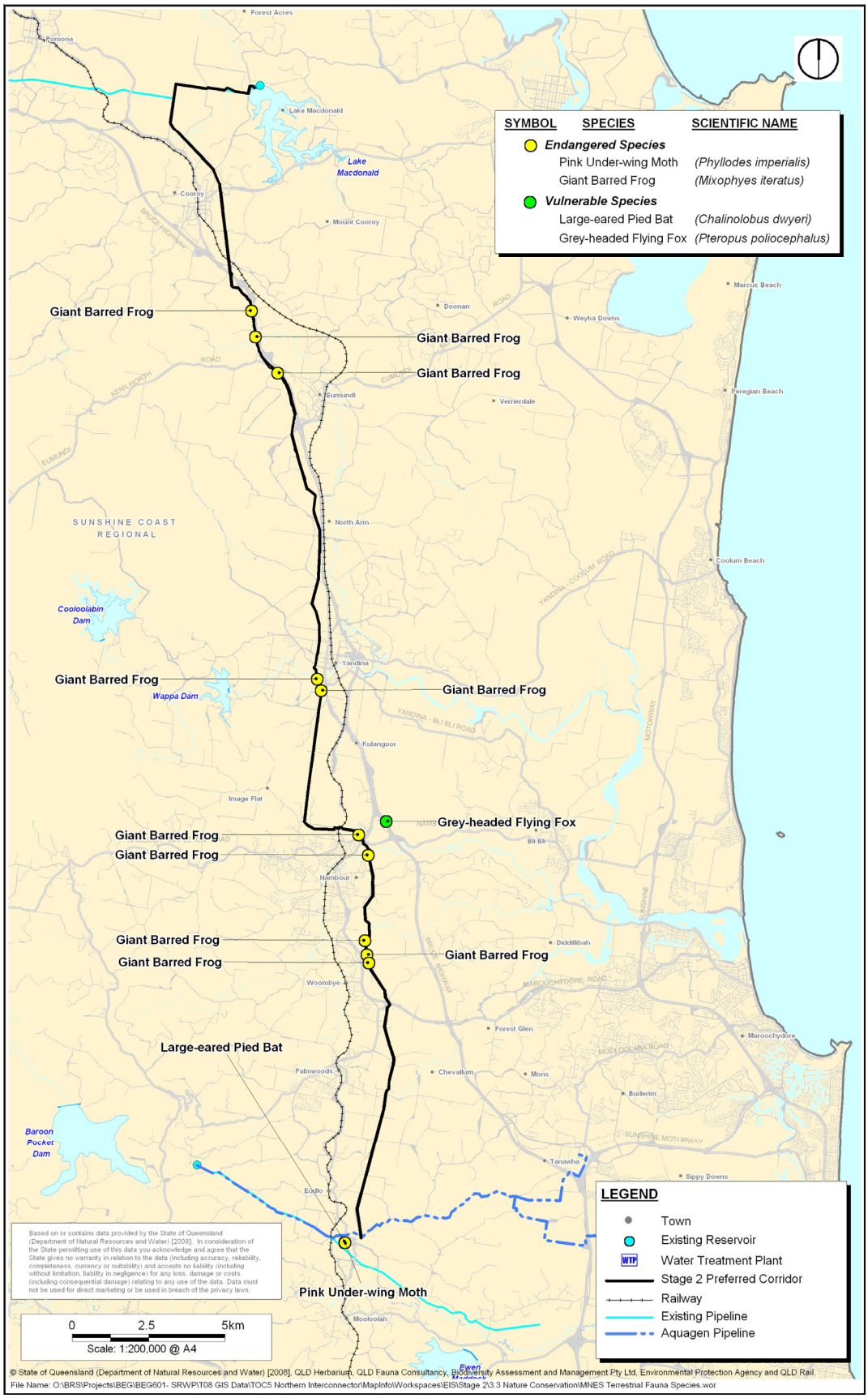

Figure D.4
NPI STAGE 2—TERRESTRIAL FAUNA SURVEY LOCATIONS

Field investigations recorded a range of habitat types in the project area. These are:

- narrow bands of vine forest along coastal waterways, sometimes with eucalypt emergents;
- patches of lowland gallery rainforest of reasonable size;
- contiguous areas of eucalypt forest along coastal ridges, with vine forest understorey on the lower slopes and in wetter gullies, providing habitat and movement corridors for a range of species;
- dams with varying degrees of disturbance and fringing vegetation providing habitat for amphibians, semi-aquatic and migratory bird species; and
- hollow-bearing trees which provide suitable nesting habitat for birds, arboreal mammals and insectivorous bat species.

Based on this information, and the ecological requirements of key fauna species, a likelihood of impact was determined for each species (see Table D.5). Species potentially impacted by the Stage 2 project are discussed in detail below. Known and potential habitat areas for listed terrestrial fauna species are shown in Figure D.5.

Table D.5 Listed terrestrial fauna species potentially occurring within the project area

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	It is thought that it forages for small insects in a range of vegetation types, including rainforest, open eucalypt forest and on sandstone outcrops. Natural roosts may be located on sandstone outcrops, with disused mine shafts, caves, tree hollows and rock overhangs also recorded as roosting sites.	**Moderate**—potential roosting sites identified within close proximity to the proposed corridor at Nobels Road; however, not identified during field survey. Further field investigation may be required for any corridor refinements/options if suitable habitat present, or known records within close proximity (Refer to Section D.5.3)
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	Vulnerable	Fossorial skink, burrowing in moist soil, litter and rotten logs. Known from south-east Queensland to Wide Bay region.	**Low**—no suitable habitat recorded. No known records within the project area—closest records from the Cooloola region
Cyclopsitta diophthalma coxeni	Coxen's Fig Parrot	Endangered	Known to inhabit rainforests and adjacent habitats, feeding on figs and other fruit trees in a range of environments. Extremely rare or extinct in the project area.	**Low**—species not detected during field survey. Species is extremely rare or extinct within the area. Not likely to occur within the project area
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	Known from open forests and woodland especially near rivers, wetlands and rainforest fringes. Wide-ranging and highly mobile species.	**Low**—species not detected during field survey. Wide-ranging species may utilise habitats within the project area, although low likelihood of occurrence
Lathamus discolor	Swift Parrot	Endangered	Known to utilise seasonally flowering, tall eucalypt forest. Migrates to mainland Australia during autumn and winter to feed—east coast and south-eastern Australia.	**Low**—no suitable habitat recorded along the proposed alignment. Species not detected during field survey. Not likely to occur within the project area
Litoria olongburensis	Wallum Sedge Frog	Vulnerable	An 'acid' frog that inhabits ephemeral and semi-permanent swamps in undisturbed coastal wallum with low pH (Ingram & Corben 1975).	**Low**—no suitable habitat recorded along the proposed alignment. Species not detected during field survey. Not likely to occur within the project area

Table D.5 (continued)

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Mixophyes iteratus	Giant Barred Frog	Endangered	Deep, slow-flowing creeks with overhanging banks in riparian vine forest habitat. Most movements restricted to within 20 m of the stream. Breeding occurs in spring and summer, often on leaf litter near streams and ponds.	**High**—suitable habitat identified at a number of locations including Mount Combe Creek, Sandy Creek, North Maroochy River, Paynters, Petrie and Tuckers Creeks. Known from the similar habitats in the district. (Refer to Section D.5.1)
Phyllodes imperialis (southern subspecies)	Pink Underwing Moth	Endangered	Species distribution is dependent on its larval food plant, *Carronia multisepalea* where it grows in a collapsed shrub-like form. Preferred habitat in lower montane rainforests.	**Moderate**—*C. multisepalea* present in gullies in close proximity to the proposed corridor. Further field investigation may be required for any corridor refinements/options if suitable habitat present, or known records within close proximity (Refer to Section D.5.2)
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Canopy-feeding frugivore and nectivore, utilising a range of habitat types for foraging. Congregates in large camps until late summer, migrating up to 750 km during winter.	**Moderate**—known to occur in large camp near Cooney Road, Nambour. Potential to utilise foraging resources within the project area (Refer to Section D.5.4)
Turnix melanogaster	Black-breasted Button Quail	Vulnerable	Cryptic, ground-dwelling species recorded from scattered localities in south-east Queensland. Generally found within thick, dense vegetation.	**Low**—no known populations within study area and no evidence of characteristic leaf litter scrapings recorded during field survey. Not likely to occur within the project area
Xeromys myoides	Water Mouse	Vulnerable	Occurs in mangroves, adjacent sedgeland communities and freshwater lagoons close to foredunes (Van Dyck 1997).	**Low**—no suitable habitat recorded. No known records within the project area—closest records from the Cooloola region

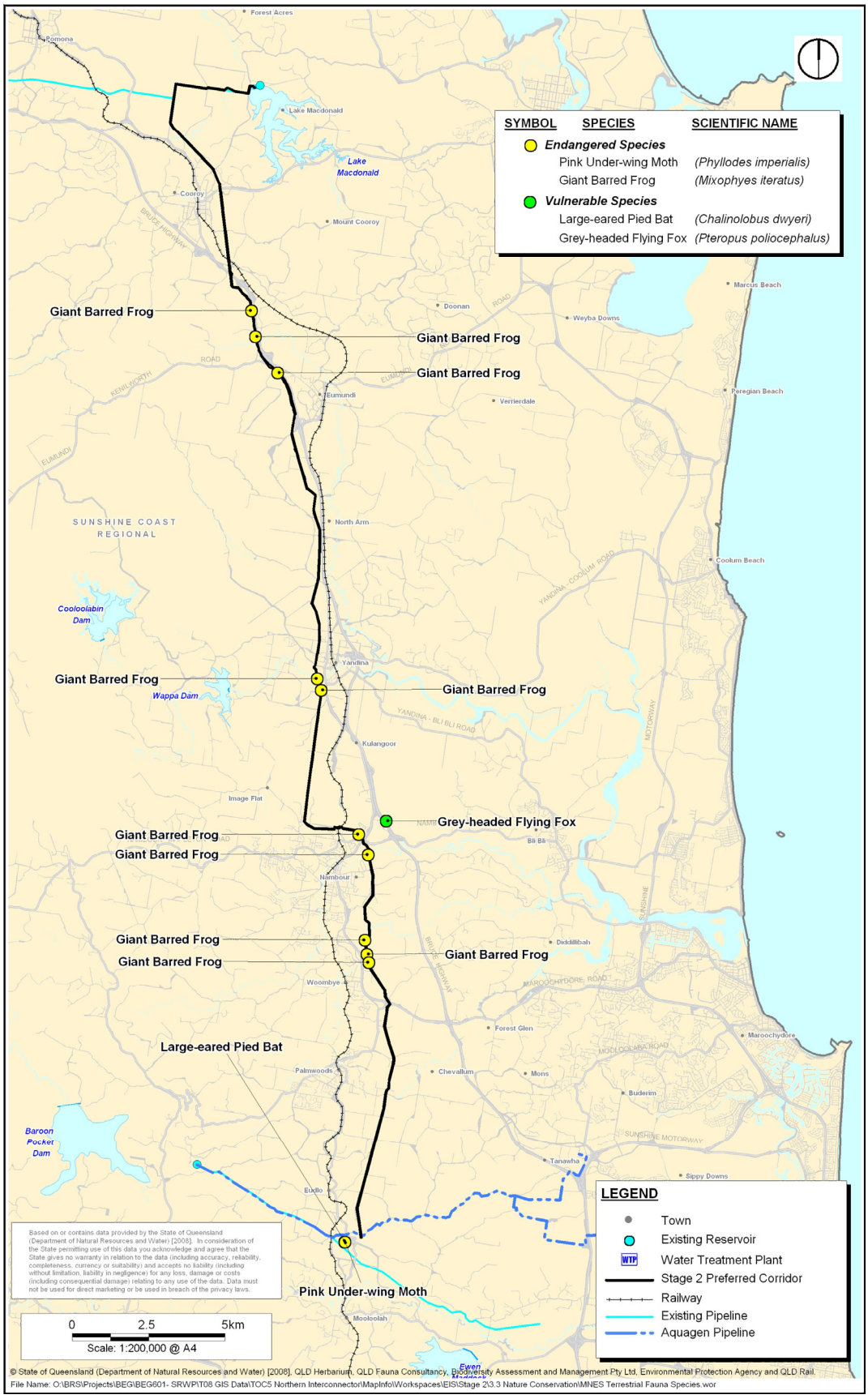

Figure D.5
MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (FAUNA)

D.5.1 *Mixophyes iteratus, Giant Barred Frog, Southern Barred Frog (Endangered)*

Current Distribution

Historical distributions of the Giant Barred Frog extended from west Sydney to the Conondale Ranges, north-west of Brisbane. It is now extinct in much of its southern range and has suffered serious reductions elsewhere (Lemckert & Brassil 2000). In south-east Queensland, remaining populations of the species are found at scattered locations in the Mary River catchment area, and south to the Coomera River in Nerang (Hines et al. 2002).

Ecology and Threatening Processes

Mixophyes iteratus is a large, ground-dwelling frog found in areas of moist hardwood forest and rainforest. While adults may undertake nightly movements of up to 100 m, most movements are generally restricted to an area 20 m either side of a stream (Lemckert & Brassil 2000). Habitat critical to the survival of the species is found along permanent freshwater streams from 0–700 m altitude in rainforest and other forest communities of the McPherson, Main, D'Aguilar, Blackall and Conondale ranges.

Critical habitat also includes narrow riparian rainforest remnants along the Maroochy and Mary rivers and their tributaries (Hines et al. 2002). Recent surveys of the Mary River catchments undertaken for the Traveston Crossing Dam noted that populations are concentrated within the eastern tributaries, including Belli Creek, Happy Jack Creek, Skyring Creek. Individuals were also recorded on one western tributary—the Coonoon Gibber Creek (SKM 2007). Surveys undertaken for the NPI Stage 1 also confirmed this species at the Mooloolah River and Mellum Creek in Caloundra Shire and Wararba Creek in Caboolture Shire (Bryan Robinson, pers comm. 2007).

Mixophyes iteratus breeds in permanent streams, with males calling from the forest floor or crevices under rocks, banks or overhanging tree roots during the warmer months (September to April) (Hines et al. 2002). Eggs are deposited out of water, under overhanging banks or on steep banks of large pools (Hero et al. 2002). Tadpoles grow to a large size (up to 100 mm), taking at least 12 months to reach metamorphosis (Lemckert & Brassil 2000).

Many sites where *M. iteratus* is known to occur are in the lower reaches of streams that have been affected by major disturbances such as clearing, timber harvesting and urban development (Hines et al. 2002). It has previously been found that the species is less abundant in recently logged areas and at sites where there was little undisturbed forest (Lemckert 1999). Chytrid fungus has also been proposed as one of the major threatening processes to the persistence of Australian frog species (Hines et al. 2002).

Potential Impacts on Populations in the Study Area

Fauna surveys identified the presence of suitable riparian rainforest habitat (RE 12.3.1) for *M. iteratus* at six locations within the project area. These sites were Mount Combe Creek, Sandy Creek, the North Maroochy River and unnamed creek to the north, Paynters Creek, Petrie Creek and Tuckers Creek. At these locations, the greatest potential impacts would result from the clearing of riparian vegetation and disturbance of the stream banks to trench

across the waterway (see Table D.6). Indirect impacts may also occur from increased turbidity as a result of sediment release into waterways. These impacts will be mitigated by:

- undertaking detailed survey to confirm the presence of this species at identified locations;
- if *M. iteratus* is confirmed at a waterway within the proposed corridor, establishing monitoring programs and conducting surveys to establish a baseline relative abundance for the species at each confirmed location;
- appropriate scheduling of waterway crossings and construction near important habitat areas to avoid breeding and high-flow periods;
- minimising the disturbance area for all significant waterway crossings;
- implementing appropriate sediment and erosion control for all works, stockpiles etc. adjacent to waterways;
- reinstating banks as close as possible to original contours and replacing structural habitat features such as woody debris and overhanging vegetation within the corridor;
- commencing revegetation activities as soon as practicable following construction to minimise the intensification of edge effects and to minimise disturbance due to weed invasion; and
- using native, local pioneer species in sensitive areas, as these species close the canopy and reduce light penetration more efficiently than slower growing canopy species.

Table D.6 Assessment of significant impact for Giant Barred Frog (Endangered)

Will the proposed works…	Giant Barred Frog
▪ lead to a long-term decrease in the population?	Suitable habitat was identified at the waterway crossing locations; however, the presence of this species was not confirmed due to high flow conditions at the time of survey. The lower abundance of this species in disturbed areas is noted; however, all the habitats identified are narrow riparian remnants within highly modified environments, rather than intact upland streams. The proposed disturbance area at these sites is often confined to existing disturbed easements and the proposed action is not expected to result in a long-term decrease of the population.
▪ reduce the area of occupancy for the species?	The affected area for all waterway crossings will be restricted to a maximum width of 30 m (and typically 20–25 m) within a linear riparian corridor. This represents a small proportion of the available habitat along each of the waterways described and would not significantly reduce the area of occupancy for the species.
▪ fragment an existing population into two or more populations?	The proposed corridor is generally located within existing cleared easement, minimising the clearing extent of riparian vegetation habitat. Given mitigation strategies outlined above, the proposed project is unlikely to fragment existing populations.
▪ adversely affect habitat critical to the survival of the species?	Lowland riparian vine forest of the type found in the project area has been identified as critical habitat for this species. The pipeline corridor is generally restricted to the existing cleared easement to minimise disturbance to intact vine forest habitat. Adverse effects on this habitat will therefore be localised, temporary and largely restricted to the existing disturbed edges.

Table D.6 (continued)

Will the proposed works …	Giant Barred Frog
▪ disrupt the breeding cycle of the population?	Potential disruption to breeding cycles could occur from direct impacts (ie physical disturbance to waterways during breeding times) or indirect impacts (ie impacts on water quality affecting egg deposition and tadpoles). Wherever possible, works in critical habitat areas will be undertaken between March and August to avoid peak breeding times. These impacts may also be minimised by adopting the strategies outlined above.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	Adverse effects on this habitat will be localised and temporary, with an ultimate exclusion area for deep rooted vegetation 10–15 m wide above the pipe. The proposed corridor is typically located within existing cleared easement. The proposed action is unlikely to affect adequate habitat to result in significant species decline.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	There are no specific invasive species associated with the decline of *M. iteratus*. Disturbance of closed canopy vine forest may increase as a result of edge effects; however, this is unlikely to be significant.
▪ introduce disease that may cause the species to decline?	Chytrid fungus has been identified as a potential cause of decline for many frog species. The disease is spread by direct contact with fluid containing spores, which may include transportation of moist sediments, water and contaminated surfaces (ie boots, hands, livestock, machinery) and the movement of frogs from one area to another. Avoidance strategies will be addressed in sensitive area plans (SAPs) where this species occurs.
▪ interfere with the recovery of the species?	The proposed action will not interfere with the recovery of the species. Restoration efforts will focus on replacing suitable habitat features, and monitoring programs implemented for significant habitat areas.

Summary of Impact Assessment

The proposed action will not have significant impacts on populations of *M. iteratus* within the project area. The majority of waterway crossings that have been identified as potential *M. iteratus* habitat are located within existing disturbed areas, with potential impacts to habitat expected to be localised and temporary. Implementation of appropriate crossing methodologies, appropriate scheduling of waterway crossings and population monitoring will minimise and mitigate potential impacts to *M. iteratus* populations within the project area.

D.5.2 Phyllodes imperialis (southern subspecies), Pink Underwing Moth (Endangered)

Current Distribution

Phyllodes imperialis is distributed from Nambour to northern NSW and occurs in undisturbed old growth subtropical rainforest below 600 m altitude. The southern subspecies is known from five locations in lower montane rainforests, four of which are in south-east Queensland (Don Sands, pers comm.). Only one location, Mary Cairncross Park (approximately 10 km west of the pipeline corridor) is confirmed breeding habitat for *P. imperialis*.

Ecology and Threatening Processes

Breeding habitat for *P. imperialis* is thought to be restricted to areas where its larval food plant, *Carronia multisepalea*, grows in a collapsed shrub-like form in undisturbed old growth subtropical rainforest. Adults are also thought to require the darkness supplied by the vine and rainforest vegetation in order to breed. The vine does occur in habitats other than old growth rainforest, but usually adopts an upright form in these types of vegetation communities. The southern subspecies has not been recorded from rainforest habitats supporting the upright form of the vine.

Potential Impacts on Populations in the Study Area

The presence of *Carronia multisepalea* was recorded during field survey in gullies near Nobels Road. At the time of survey, the form of the vine was not recorded (ie upright or collapsed), and additional work is required to determine the potential presence of *P. imperialis* at this site. However, the site is not known to support populations of *P. imperialis*, with populations recorded in only five locations in south-east Queensland (DEW 2007).

No direct impacts on potential habitat are expected to occur as no vegetation will be cleared from the gullies at Nobels Road. Any potential impacts would occur indirectly as a result of earthworks and construction along the ridgeline (see Table D.7). Potential for impacts may include excessive sediment washing into gullies with the potential to damage vines such as *C. multisepalea* if present; however, this is best managed through the design of earthworks and the installation of suitable sediment and erosion control measures. These impacts may be mitigated by:

- undertaking detailed survey to confirm the presence of this species at the identified location;
- confirming the presence/absence of food plant *C. multisepalea*, recording GPS locations of individuals and mapping suitable habitat areas;
- preparing a species rehabilitation plan for propagating this plant species within suitable habitats adjacent to the corridor to assist in long-term maintenance of *P. imperialis* in the region; and
- implementing appropriate sediment and erosion controls for all works, stockpiles etc.

Table D.7 Assessment of significant impact for Pink Underwing Moth (Endangered)

Will the proposed works …	Pink Underwing Moth
▪ lead to a long-term decrease in the population?	The proposed action will not bring about any long-term decline in the population of this species.
▪ reduce the area of occupancy for the species?	There will be no direct impacts on any suitable habitat for this species. Subject to appropriate management of construction and earthworks along the ridgeline, indirect impacts on the gullies supporting the larval food plant are unlikely.

Table D.7 (continued)

Will the proposed works …	Pink Underwing Moth
▪ fragment an existing population into two or more populations?	The proposed action will not fragment any existing populations of this highly mobile species.
▪ adversely affect habitat critical to the survival of the species?	This site does not support any known populations of *Phyllodes imperialis*, with only five locations recorded in south-east Queensland. Further, there will be no direct impacts on significant habitat areas.
▪ disrupt the breeding cycle of the population?	This site does not support any known populations of *P. imperialis*, with only five locations recorded in south-east Queensland. Further, there will be no direct impacts on potential breeding habitat in the gullies around the site.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	Mary Caincross Park is the closest confirmed significant habitat area—approximately 10 km west of the proposed pipeline corridor. The proposed action is not expected to cause the decline of the species.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	The proposed action will not result in any invasive species becoming established in habitat for this species.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	Subject to the implementation of appropriate mitigation measures, the proposed action will not interfere with the recovery of this species.

Summary of Impact Assessment

The proposed action will not have significant impacts on populations of *P. imperialis* within the project area. No direct impacts on species or species' habitat are expected to occur as a result of the proposed action. Further field investigation to confirm the presence/absence of *P. imperialis* and *C. multisepalea* in the gullies adjacent to the proposed corridor will assist in developing an appropriate construction management plans for this area.

D.5.3 Chalinolobus dwyeri, Large-eared Pied Bat (Vulnerable)

Current Distribution

The Large-eared Pied Bat inhabits a range of coastal and inland habitats and is most commonly recorded from dry eucalypt forests and woodlands. It may also be found in rainforest and wet sclerophyll margins. It is uncertain whether this species is common east of the Great Dividing Range. It has been recorded from scattered localities as far south as Nowra in coastal New South Wales and on the Blackdown Tableland, west of Rockhampton (Parnaby 1992; Hoye & Dwyer 1995). The only known recent records in Queensland are

from the Border Ranges, the Main Range, Gambubal State Forest, Wivenhoe Dam and Moogerah Dam (Duncan et al. 1999).

Ecology and Threatening Processes

In south-east Queensland the species has primarily been recorded in higher altitude moist tall open forest adjacent to rainforest. Little is known about the roosting requirements and foraging habits of this species, but natural roosts may depend heavily on sandstone outcrops. It has been found roosting in disused mine shafts, caves, overhangs and disused Fairy Martin (*Hirundo ariel*) nests (Schulz 1998). It also possibly roosts in tree hollows. Females give birth during November and December and are known to raise their young in maternity roosts of between 20 and 40 females in roof domes of sandstone caves, returning to the same cave over many years (DEC 2005).

Destruction of or interference with subterranean roosts is a confirmed threat, for example from flooding, mining operations or recreational caving activities. Other possible threats include clearing and isolation of foraging habitat near cliffs, caves and old mine workings for agriculture and development, impact of forestry operations and predation by feral animals.

Potential Impacts on Populations in the Study Area

Potential habitat for this species has been identified near Nobels Road. While acknowledging that the ecology and habitat requirements of this species are uncertain, *Chalinolobus dwyeri* has previously been associated with roosting habitats in caves and cave-like structures. However, there is some potential for this species to use tree hollows in the clearing area as roosting sites. The major potential for impact therefore relates to the removal of hollow-bearing trees (see Table D.8). This impact may be mitigated by implementing the following measures:

- undertaking detailed survey to identify potential roosting habitats in the clearance area;
- minimising the extent of disturbance and retaining hollow-bearing trees wherever possible;
- conducting pre-start checks for arboreal fauna prior to removal of significant trees; and
- relocating tree hollows to other trees at the site to limit the loss of roosting habitat or provision of bat boxes within suitable habitat.

Table D.8 Assessment of significant impact for Large-eared Pied Bat (Vulnerable)

Will the proposed works …	Large-eared Pied Bat
▪ lead to a long-term decrease in the population?	*Chalinolobus dwyeri* has previously been associated with roosting habitats in caves and cave-like structures. However, the loss of tree hollows, which may be used as roosting habitat, has the potential to lead to a long-term decrease in the population.
▪ reduce the area of occupancy for the species?	*C. dwyeri* has previously been associated with roosting habitats in caves and cave-like structures. However, the loss of tree hollows has the potential to reduce the area of occupancy for this species.
▪ fragment an existing population into two or more populations?	This species is highly mobile and adequate vegetation will remain to facilitate movement between populations through this corridor.

Table D.8 (continued)

Will the proposed works …	Large-eared Pied Bat
▪ adversely affect habitat critical to the survival of the species?	There are no known records of this species from the surrounding area and, while suitable habitat exists at the site, it is unlikely that is critical habitat for *C. dwyeri*.
▪ disrupt the breeding cycle of the population?	*C. dwyeri* has previously been associated with roosting habitats in caves and cave-like structures. However, these structures do not occur along the corridor route and secondary habitat losses such as the loss of tree hollows is considered to present a very minor potential risk to disruption of the breeding cycle of any local populations of this species.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed action will not affect any significant habitat areas for this species.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	The proposed action will not result in any invasive species becoming established in habitat for this species.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	Subject to the implementation of appropriate mitigation measures, the proposed action is unlikely to interfere with the recovery of this species.

Summary of Impact Assessment

While the ecology and habitat requirements of this species are uncertain, it is recognised that *C. dweryi* may utilise tree hollows as roosting habitat. Removal of hollow-bearing trees will be avoided wherever possible, and relocation of tree-hollows and/or the provision of bat boxes will ensure that potential impacts associated with the proposed action are not significant. Disturbance to areas supporting *C. dwyeri* will be avoided during breeding season to prevent negative impacts on the breeding success of the species.

Potential impacts associated with the proposed action are expected to be temporary and localised and are not likely to result in significant impacts for populations of *C. dwyeri* within the project area.

D.5.4 Pteropus poliocephalus, Grey-headed Flying-fox (Vulnerable)

Current Distribution

The Grey-headed Flying-fox is endemic to Australia and has a distribution extending from Bundaberg to Melbourne (TSSC 2007). Historical records suggest they have declined in Brisbane, although they remain abundant and widespread, and are regularly recorded from gardens and parks across the city, particularly during eucalypt flowering (TSSC 2007).

Regular or frequently used camps have been located between Rockhampton and Mallacoota in Victoria.

Ecology and Threatening Processes

Two habitat characteristics are important for the Grey-headed Flying-fox: foraging resources and camping sites. As this species is a canopy-feeding frugivore and nectarivore, they utilise a range of vegetation types including rainforests, open eucalypt forests, woodlands, Melaleuca swamps and Banksia woodlands (BAAM 2007).

Camps are commonly within dense vegetation close to water, primarily rainforest patches, stands of Melaleuca, mangroves or riparian vegetation (Nelson 1965). The species congregates in large camps of up to 200,000 individuals from early through to late summer. Adults normally disperse during the winter and can migrate up to 750 km as individuals or small groups, with the young forming winter camps (Churchill 1998). Breeding occurs during the spring months (October to November) when food resources are at their most plentiful.

The Grey-headed Flying-fox is a highly mobile species and is able to adapt in response to changes in its habitat and surrounding environment. At non-permanent roost sites, the species has been able to respond rapidly to the presence/absence of food availability (TSSC 2007). Temporally and spatially reliable food resources for the Grey-headed Flying-fox are restricted to a number of coastal vegetation communities in northern New South Wales and Queensland (Duncan et al. 1999; TSSC 2007). These vegetation communities help to provide a reliable food resource for the species during winter; however, coastal areas have been targeted for intensive urban development and these significant habitat areas are under threat (Duncan et al. 1999).

Potential Impacts on Populations in the Study Area

The Grey-headed Flying-fox is known to occur in a large camp adjacent to the Bruce Highway to the east of Nambour, approximately 1 km from the proposed corridor. The proposed works will have no impact on the camp itself; however, vegetation clearance within the local area has the potential to result in the temporary loss of local foraging resources, particularly flowering eucalypts and other nectar-producing species. The use of existing cleared easements for the pipeline corridor significantly minimises the extent of vegetation clearing that would otherwise be required. At a landscape scale, the extent of clearing proposed will not be significant in terms of the availability of foraging resources for this species (see Table D.9).

Potential impacts associated with the removal of food trees may be mitigated in the following ways:

- refinements to the corridor that avoid or limit the number of individual trees removed from the work area;
- use of a constrained corridor (less than 30 m) to minimise damage to foraging resources for this species, as appropriate; and
- propagation of flowering eucalypts for use in revegetation efforts where removal of trees cannot be avoided.

Table D.9 Assessment of significant impact for Grey-headed Flying-fox (Vulnerable)

Will the proposed works …	Grey-headed Flying-fox
▪ lead to a long-term decrease in the population?	The proposed action will not bring about any long-term decline in the population of this species.
▪ reduce the area of occupancy for the species?	The proposed action will not reduce the area of occupancy for the species.
▪ fragment an existing population into two or more populations?	The proposed action will not fragment any existing populations of this highly mobile species.
▪ adversely affect habitat critical to the survival of the species?	The proposed action will not significantly affect critical habitat for this species.
▪ disrupt the breeding cycle of the population?	The proposed action will not affect the breeding cycle for this species.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed action will not affect any significant habitat areas for this species.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	The proposed action will not result in any invasive species becoming established in habitat for this species.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	Subject to the implementation of appropriate mitigation measures, and given the high mobility of this species, the proposed action is unlikely to interfere with the recovery of this species.

Summary of Impact Assessment

The proposed action is not expected to have a significant impact on the Grey-headed Flying-fox populations or suitable habitat. No impacts to the known bat camp near Cooney Road will occur, and no habitat critical to the Grey-headed Flying-fox will be affected.

D.6 Listed Threatened Aquatic fauna

Introduction

The NPI Stage 2 project will traverse waterways associated with both the Mary River and Maroochy River catchments. The great majority of the route and associated construction footprint will be located within the Maroochy River catchment with the pipeline crossing the following sub-catchments: Eudlo Creek, Petrie Creek, Paynters Creek, and the North and

South Maroochy rivers. Within the south eastern corner of the Mary River catchment, the Stage 2 pipeline crosses Six Mile Creek. Potential impacts of the NPI Stage 2 on aquatic habitats and their associated fauna assemblages that could arise from the construction of waterway crossings would be related to direct physical changes to stream morphology and changes to water quality.

Water Resource Planning Process

The potential impacts on aquatic environments associated with the proposed NPI Stage 2 water supply strategy (ie utilisation of spare capacity water under existing entitlements) have been previously assessed as part of the Water Resource Planning Process. Under this process an independent Technical Advisory Panel provides advice, to the Department of Natural Resources and Water, on the potential flow-related environmental impacts of taking water from the Mary Basin.

The environmental assessments undertaken by the Technical Advisory Panel are used to develop the Environmental Flow Objectives (EFOs) of the WRP, and consists of three main phases:

- current condition assessment of the existing environment,
- development of an environmental flow assessment framework, and
- assessment of the likely environmental implications of possible future water resource management scenarios.

The Technical Advisory Panel assessed the implications of full water resource development in the Mary Basin (the full development scenario) to the current use scenario. This advice was a key input into the formulation of the outcomes and objectives of the WRP, including the EFOs which are included in the WRP. These EFOs seek to protect environmental assets of the Mary Basin including the Lungfish, Mary River Cod and Mary River Turtle (and other MNES).

The Technical Advisory Panel (TAP) recommended the suite of performance indicators to be used in the Mary Basin WRP 2006, as they were considered to best represent key attributes of the flow regime, including low, medium and high flows and flow seasonality. These EFOs established in the WRP seek to minimise changes to important characteristics of the flow regime, including flow variability and seasonality and have been set in accordance with precautionary principles.

Water Supply Impact Assessment

Assessment of potential impacts on MNES has been prepared following the Significant Impact Guidelines formulated by DEWHA. In addition to these guidelines, a buffering capacity of 40 ML/d above the full resource development scenario for the Mary Basin (as established under the WRP) was included in the overall assessment of impacts (see Appendix H-6). Whilst exceeding the assessment required for the proposed water supply strategy (ie 6500 ML/a (18 ML/d)), this level of assessment provides a greater level of confidence in determining the magnitude of impacts relative to unseasonal fluctuations and extreme events within the Mary Basin. This satisfies the objectives of both the Water Resource (Mary Basin) Plan 2006 (Mary Basin WRP) and the established environmental flow

objectives (EFOs), and the provisions determining the significance of impacts on MNES under the EPBC Act.

The following sections detail the findings of this assessment. Mitigation measures outlined are consistent with the EFOs established under the Mary Basin WRP as well as to avoid impacts on MNES under the EPBC Act.

Listed Species

Listed aquatic fauna species with the potential to occur in the project area were initially identified through database searches and literature reviews. Initial investigations confirmed four EPBC-listed fish species and one listed reptile species. While three of the four fish species are known from streams elsewhere in south-east Queensland, within the project area these species are only known to occur in streams of the Mary catchment (see Table D.10).

For the purposes of this assessment of MNES, the area of interest was restricted to Six Mile Creek and its tributaries (left branch and anabranch), in particular, the riparian and in-stream habitat features at waterway crossing points. Physical disturbance to riparian and aquatic habitat features was assessed using field survey data collected at proposed crossing points on Six Mile Creek. This included descriptions of hydraulic habitat type (ie pools, riffles), in-stream structural features such as snags, riparian vegetation and canopy cover and physico-chemical water quality parameters.

Aquatic Habitat Features

Potential aquatic habitats were identified from aerial photography, with field visits to larger waterways in the Six Mile Creek system traversed by the pipeline to inspect present conditions at, and immediately upstream and downstream of, waterway crossing points. All waterways within the area of interest are permanent lowland freshwater systems and support riparian vegetation of varying quality. An important feature of the study area is the dominance of fringing riparian vine forest (RE 12.3.1) at Six Mile Creek.

Low light levels under the dense vine forest canopy generally exclude weed species from the riparian zone and shade streams from direct sunlight, thereby regulating water temperature and restricting the establishment of aquatic flora species. These riparian fringing forest communities are also an important source of woody debris and overhanging vegetation litter, which contribute to in-stream structural habitat features and food supply.

Table D.10 Listed aquatic fauna species potentially occurring within the project area

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Elusor macrurus	Mary River Turtle	Endangered	Endemic to the Mary River system, with populations known to occur in major tributaries including Yabba and Tinana Creeks. Occurs in flowing, well-oxygenated sections of streams to allow cloacal respiration. Food resources include macrophytes and macroinvertebrates.	**Moderate**—not detected during field survey. Potential suitable habitat identified in the main channel of Six Mile Creek. Not previously recorded in Six Mile Creek although may occur in the mid to lower reaches of the main channel. Known to occur in the Mary River at and downstream of the existing Coles Crossing extraction point (Refer to section D.6.1)
Maccullochella peelii mariensis	Mary River Cod	Endangered	Endemic to the Mary River system, with known populations restricted to sub-catchment refuges including Six Mile Creek. Prefer deep, shaded slow-flowing pools with abundant submerged large woody debris.	**Moderate**—established populations likely in the mid to lower reaches of Six Mile Creek. Suitable habitat identified during field survey in the main channel of Six Mile Creek, and sub-optimal habitat in Six Mile Creek left branch. Known to occur in the Mary River at and downstream of the existing Coles Crossing extraction point (Refer to section D.6.2)
Nannoperca oxleyana	Oxleyan Pygmy Perch	Endangered	Coastal waterways and lakes with darkly tannin-stained, dystrophic water, riparian cover and extensive macrophyte and/or leaf litter cover. Most frequently observed in areas of low water velocity, mud and sand substrates in moderate depths.	**Moderate**—slow-flow conditions and pH levels in Six Mile Creek (left branch) fall within the preferred range, with sufficient leaf litter to act as an alternative source of cover in the absence of macrophyte growth. Potential sub-optimal habitat areas within the left branch of Six Mile Creek (Refer to section D.6.3)

Table D.10 Listed aquatic fauna species potentially occurring within the project area

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Neoceratodus forsteri	Australian Lungfish	Vulnerable	Natural distribution restricted to Mary and Burnett Rivers, with translocated populations in North Pine and Brisbane Rivers. Adults prefer deep pools (3–10 m) with submerged structure for shelter. Lungfish spawn in slow-flowing reaches of shallow to moderate depth where macrophyte cover exceeds 70%.	**Moderate**—species not detected during field survey; however, occasional records from main channel of Six Mile Creek. Known to occur in the Mary River at and downstream of the existing Coles Crossing extraction point (Refer to section D.6.4)
Pseudomugil mellis	Honey Blue-eye	Endangered	Coastal wallum waterways and lakes, characterised by dystrophic, acidic, darkly stained waters with siliceous sand substrates and abundant submerged and emergent vegetation.	**Low**—while slow flow conditions and pH levels fall within the preferred range, Six Mile Creek lacks adequate macrophyte cover to support this species and it is considered unlikely to occur

D.6.1 *Elusor macrurus, Mary River Turtle (Endangered)*

Current Distribution

The Mary River Turtle is endemic to the Mary River catchment and is known primarily from large tributaries, including Yabba and Tinana creeks (EES 2006; DEW 2007). Core habitat for the Mary River Turtle is known to occur in the middle to upper reaches of the Mary River main channel.

Ecology and Threatening Processes

Cloacal respiration allows the Mary River turtle to breathe while submerged, and it typically occurs in well-oxygenated sections of streams in riffles and shallower stretches, alternating with deeper, flowing pools. Juveniles have been found to occur at various water depths in rocky areas with sand or gravel on the river bed, and adults can occur between less than 1 m and 5 m. Preferred habitat for adults of this species includes deep pools with logs and fringing macrophyte beds to provide shelter and protection from predation (DEW 2007). Mary River Turtles also commonly emerge to bask on protruding rocks and logs (SKM 2007).

The Mary River turtle reaches sexual maturity at approximately 25 years for females and 30 years for males. Nests of the Mary River Turtle are located above water level and are found in sandy, sparsely vegetated banks on both steep and shallow slopes (SKM 2007). Nesting occurs between mid-October and late November. *Elusor macrurus* has a low reproductive rate, laying one clutch (12–25 eggs) per season (EES 2006). Natural incubation periods are around 50 days, with hatchlings emerging between December and February (SKM 2007).

Major pressures on this species include disruption during to breeding success (particularly predation of eggs and hatchlings), and declines in water quality associated with increased run-off, siltation, pollution and changes in flow rates. Removal of riparian vegetation also reduces the supply of logs and other woody debris as structural habitat features in the in-stream environment (EPA 2007).

Potential Impacts—Waterway Crossings

Field investigations were conducted to determine the habitat suitability for the Mary River Turtle at all potential crossings of Six Mile Creek and its tributaries, which are the only waterways within the Mary River catchment where pipeline crossings are proposed. The Mary River Turtle is unlikely to occur at the crossing of the main channel of Six Mile Creek due to an observed lack of connective habitat (QFC 2007). Sub-optimal habitat for the species exists at the left branch crossing point, although this reach is not likely to support significant numbers of the turtle. While the construction of waterway crossings has the potential to temporarily increase the transport of sediment downstream, no significant impacts are expected for the species as the waterway crossing locations are unlikely to support large numbers of turtles. Any potential impacts (eg infilling of deep pools or impacts on water quality) will be localised and temporary in nature (see Table D.11).

Potential Impacts-Water Extraction From The Mary River (Existing Entitlements)

Impact assessment on the extraction of 40 ML/d under the 'full resource development' scenario for the Mary Basin indicated that any potential impacts downstream of the current extraction point at Coles Crossing would be temporally limited to the dry season (August-November) (Hydrobiology 2008b). The potential impacts identified were associated with the reduction of riffle habitat availability and pool drawdown. These impacts, however, were not considered to significantly influence MNES or critical habitat for EVR species.

The results of impact assessment for the extraction of water under a new entitlement (ie 40 ML/d scenario) indicated there were no significant impacts on populations of the Mary River turtle or critical habitat (Hydrobiology 2008b). Using this impact assessment as a basis for comparing full use of the 6500 ML/a (18 ML/d) entitlement, there remains very low likelihood of impact on this species or its habitat. This is further supported by the WRP process which has established EFOs to mitigate any impacts on EVR or MNES species, even under the 'full resource development' scenario where all of the entitlements and allocations are assumed to be fully utilised.

Mitigation strategies to be implemented include:

- undertaking detailed survey to confirm the presence of this species in proximity to proposed crossings of Six Mile Creek;
- minimising the disturbance area for all significant waterway crossings;
- implementing appropriate sediment and erosion control for all works, stockpiles and bunds adjacent to waterways;
- minimising clearing of riparian vegetation and replacing in-stream structural habitat features such as hollow logs;
- ensuring that storage and loading areas for fuels and chemicals are bunded and located away from waterways; and
- development and implementation of a habitat monitoring program for the main channel of the Mary River, downstream of the existing extraction location at Coles Crossing to monitor changes in habitat condition and availability (particularly during the 'dry' period of August–November).

Table D.11 Assessment of significant impact for Mary River Turtle (Endangered)

Will the proposed works …	Mary River Turtle
▪ lead to a long-term decrease in the population?	While this species may occur in the lower reaches of Six Mile Creek's main channel, the upper reaches are not expected to support significant populations of Mary River turtle. As impacts associated with crossing construction are restricted in temporal and spatial extent, these works will not lead to a long-term decrease in the population. No significant impacts are expected to occur as a result of the project's proposed water supply strategy.

Table D.11 (continued)

Will the proposed works …	Mary River Turtle
▪ reduce the area of occupancy for the species?	Potential temporary reduction in sub-optimal habitat at crossing locations. No long-term reductions in area of occupancy for the species are expected to occur. No significant reductions in habitat within the Mary River are expected at or below the point of extraction of the entitlement.
▪ fragment an existing population into two or more populations?	The proposed action is not expected to result in fragmentation of existing populations of this species.
▪ adversely affect habitat critical to the survival of the species?	No critical habitat has been recorded at or adjacent to proposed waterway crossing points. No loss of critical habitat is anticipated for this species. Potential for temporary reduction in flows over riffle zones that connect deep pool habitats. This may occur during dry periods or low flow events. No long-term impacts on critical habitat within the Mary River are expected to occur.
▪ disrupt the breeding cycle of the population?	The proposed action is not expected to disrupt the breeding cycle of the population.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed action will result in localised and temporary impacts on secondary habitat in Six Mile Creek. Mary River turtle populations are not likely to decline as a result of short-term habitat modification in this reach. Potential for there to be a decrease in the quality and availability of riffle habitat during low flow and dry periods; however, this is not expected to result in a decline in this species.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	Cabomba is known to occur in Lake Macdonald and Six Mile Creek. Infestations of this weed can choke waterways and impact on the physico-chemical characteristics of waterways which could affect this species. A weed management plan will be implemented to ensure there is no introduction or further spread of this weed as a result of construction works.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	Subject to the implementation of appropriate mitigation measures, the proposed action is unlikely to interfere with the recovery of this species. There is the potential to improve ecological understanding of habitat requirements for species at and below the extraction point at Coles Crossing as a result of the implementation of the proposed habitat monitoring program.

Summary of Impact Assessment

The proposed action will result in temporary and localised impacts on sub-optimal habitat for the Mary River Turtle within the main channel of Six Mile Creek (Hydrobiology 2008a). No significant long-term impacts are expected to result on either populations of this species or its habitat within the Mary River as a result of the full use of the existing allocation. There is a potential for short-term reduction of flows over riffle habitat which connects deep pool habitat

within the Mary River. These reductions would likely be temporally restricted to the seasonal dry period of August to November. With the implementation of appropriate mitigation measures, as outlined above, no significant impacts are expected for this species as a result of the Six Mile Creek crossing or the proposed water supply strategy.

D.6.2 Maccullochella peelii mariensis, Mary River Cod (Endangered)

Current Distribution

The Mary River Cod is endemic to the Mary River system but has recently been stocked in other systems to provide a recreational species for anglers. Historically, the Mary River Cod was thought to be distributed throughout most of the main channel and tributaries, but the known current distribution is only about 170 km out of a presumed 700 km stream length (Hydrobiology 2008a).

The Gerry Cook Hatchery located at Lake Macdonald currently provides broodstock for the Mary River Cod restocking efforts associated with the species' recovery plan. Fingerlings produced at the hatchery have been stocked in impoundments and waterways within the Mary River system—for conservation purposes and also for recreational fishing (Simpson & Jackson 1996).

Major residual populations occur in Obi Obi Creek, Six Mile Creek downstream of Lake Macdonald and Tinana-Coondoo creek, with reported potential breeding populations in two other small tributaries of the Mary River. Populations in other parts of the catchment are thought to be patchy, although recent studies for the Traveston Crossing Dam EIS (SKM 2007) observed a number of individuals in the upper reaches of the main channel. This suggests that populations in the main channel may be larger than previously reported (Hydrobiology 2008a).

Ecology and Threatening Processes

Mary River Cod are typically found in high gradient upland streams ranging to large, slow-flowing pools in lowland areas. This species prefers deep, shaded, slow-flowing pools with abundant submerged large woody debris or other structural features, such as bedrock and undercut banks (Hydrobiology 2008a).

Mary River cod typically occupy restricted home ranges throughout the year and show strong site fidelity, with records of individuals returning to the same logpile after absences of more than three months (Simpson & Mapleston 2002). When occupying their home range, this species are often found no more than 2 m from large woody debris, except when patrolling between snags.

Some individuals of this species are known to utilise periods of high flow to disperse to other habitats. Mary River cod do not undertake movements for the express purpose of spawning, but movements may increase their likelihood of encountering a mate (Jamie Corfield, pers comm.). These movements can be in the order of tens of kilometres and generally occur during autumn-winter months; however, no coordinated movement in a particular direction has been observed.

The decline of Mary River cod populations has been largely attributed to human-induced changes to suitable habitat areas, particularly through the infilling of deep pools as a result of bed and bank erosion and loss of riparian vegetation, which contributes to increased sedimentation and a reduction of snag habitat for this species (Simpson & Jackson 1996). Impacts of degraded water quality, particularly with respect to temperature and dissolved oxygen levels, are also known to have affected Mary River cod populations.

Potential Impacts—Waterway Crossings

The field survey identified potential suitable habitat for Mary River cod in the main branch of Six Mile Creek. The crossing location on the main channel of Six Mile Creek represents suitable habitat for the Mary River Cod, although significant populations of this species are known to occur further downstream in the mid to lower reaches of Six Mile Creek (Hydrobiology 2008a). The left branch of Six Mile Creek supported sub-optimal habitat and is unlikely to support substantial cod populations due to the lack of deep pool habitat. However, it is possible that juvenile cod may use non-optimal habitat in the study reach to escape predation from adults—behaviour which has been observed in other creek systems in the catchment (Bob Simpson, pers. comm.).

Pipeline construction will be restricted to a narrow corridor with a corresponding zone of disturbance being within a very limited area of impact. Physical impacts such as increased sediment mobilisation could extend downstream from crossing points, but would be largely short-lived and restricted in terms of spatial extent (Hydrobiology 2008a).

Other potential impacts include the direct removal of structural habitat features during construction, pool infilling due to increased sediment mobilisation and temporary barriers to fish movement. The proposed crossing method, trenching, has been chosen specifically to limit the duration and area of disruption and thus minimise potential impacts upon the Mary River cod.

Potential Impacts—Water Extraction from the Mary River (Existing Entitlement)

Impact assessment on the 'full resource development' scenario for the Mary Basin indicated that any potential impacts downstream of the current extraction point at Coles Crossing would be temporally limited to the dry season (August–November) (Hydrobiology 2008b). This is likely to occur under any water supply strategy as it is inherent in the natural seasonal flow dynamics of the system. Using a precautionary approach, impact assessment was conducted to include the previous 40 ML/d scenario, which is a level above the assumed full resource development and is beyond the impact assessment required for the full utilisation of the existing entitlement for 6500 ML/a (18 ML/d).

Modelling results indicate that sufficient base flow would be maintained under the proposed scenario to top up water levels in deep pool habitat, but that there could be a reduction in the duration of volumes providing for 30 cm above cease-to-flow levels at drier times of the year. This is unlikely to affect small cod, but may restrict the movement capacity of larger individuals. It is not clear whether this is likely to be ecologically significant; however, a monitoring program will be implemented to identify changes in critical habitat features.

No long-term significant impacts are expected upon Mary River cod populations within the study reaches (see Table D.12).

Mitigation strategies to be implemented include:

- undertaking detailed survey to confirm the presence of this species at identified locations;
- where the presence of cod is confirmed, undertaking crossing construction outside the May–June and September–November periods when cod are most likely to be moving through the catchment waterways;
- avoiding construction at crossing points during high rainfall periods;
- minimising the disturbance area at all significant waterway crossings;
- implementing appropriate sediment and erosion control for all works, stockpiles etc. adjacent to waterways;
- reinstating banks as close as possible to original contours and replacing structural habitat features such as woody debris and overhanging vegetation within the corridor; and
- development and implementation of a habitat monitoring program for the main channel of the Mary River, downstream of the existing extraction location at Coles Crossing to monitor changes in habitat condition and availability (particularly during the 'dry' period of August-November).

Table D.12 Assessment of significant impact for Mary River Cod (Endangered)

Will the proposed works …	Mary River Cod
▪ lead to a long-term decrease in the population?	Waterway crossings are typically located in areas which are unlikely to support substantial populations of Mary River cod. Impacts associated with crossing construction will be localised and temporary and are not expected to lead to a long-term decrease in populations of this species. No significant long-term impacts are expected for populations of this species as a result of the proposed water supply strategy.
▪ reduce the area of occupancy for the species?	Adverse impacts on cod habitat will be localised and temporary and will not reduce the area of occupancy for the species.
▪ fragment an existing population into two or more populations?	Temporary barriers to fish movement may be created during construction. These will be short-lived (1–2 days). Construction works will not lead to permanent fragmentation of existing populations in Six Mile Creek. The project is not likely to fragment populations within the main channel of the Mary River at or downstream of the existing extraction point at Coles Crossing.
▪ adversely affect habitat critical to the survival of the species?	Waterway crossings are located in areas which are unlikely to support substantial populations of Mary River cod. No adverse impacts for critical habitat are expected. The project is not expected to adversely affect deep pool habitat; however, may temporarily restrict movement of large cod between pool habitats in the dry period (August-November) and will not affect the survival of the species.

Table D.12 (continued)

Will the proposed works …	Mary River Cod
▪ disrupt the breeding cycle of the population?	Temporary barriers to fish movement as a result of crossing construction are short duration transient effects and are not expected to disrupt the breeding cycle of Mary River cod in the lower reaches of Six Mile Creek and wider Mary River. Potential restriction of movement of large cod between deep pool habitat during the dry period will not disrupt the breeding cycle of the species at or downstream of the existing extraction point at Coles Crossing. This will not disrupt the normal breeding cycle for this species.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The adverse impacts on the habitat of this species' outlined above will not lead to the decline of cod populations in the Mary River or Six Mile Creek as potential impacts are localised and temporary.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	Cabomba is known to occur in Lake Macdonald and Six Mile Creek. Infestations of this weed can choke waterways and impact on the physico-chemical characteristics of waterways in a way that adversely impacts cod. A weed management plan will be implemented to ensure there is no introduction or further spread of this weed as a result of construction works.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	With the implementation of appropriate mitigation measures, the proposed action is unlikely to interfere with the recovery of this species. There is the potential to improve ecological understanding of habitat requirements for species at and below the extraction point at Coles Crossing as a result of the implementation of the proposed habitat monitoring program.

Summary of Impact Assessment

The proposed action will result in temporary and localised impacts in Six Mile Creek main channel and left branch. The crossing location on the left branch of Six Mile Creek does not provide critical habitat for the Mary River Cod as it lacks deep pools (closest deep pools are approximately 1 km downstream of crossing location) (Hydrobiology 2008a). Habitat within the left branch represents sub-optimal habitat (Hydrobiology 2008a) and is unlikely to support significant populations of Mary River Cod. Within the Mary River, the proposed action has the potential to restrict the movement of large cod between deep pools during the dry period (August–November). Under the full resource development scenario, assessed for the WRP process, this will not result in significant long-term impacts on this species or its critical habitat at or downstream of the existing extraction point on the Mary River.

With the implementation of appropriate mitigation measures when undertaking the Six Mile Creek crossings (left branch and main channel), impacts will be transient and have no medium or longer term significance to populations of the Mary River Cod in this waterway.

D.6.3 Nannoperca oxleyana, Oxleyan Pygmy Perch (Endangered)

Current Distribution

The Oxleyan Pygmy Perch has a highly restricted and patchy mainland distribution, occurring between Coondoo and Tinana creeks in south-east Queensland and in coastal northern NSW. Pygmy perch have been recorded in approximately 20 locations in south-east Queensland, including tributaries of the Mary River, the Noosa River and Mellum and Bluegum creeks near the Glasshouse Mountains (DPI 2005). None of the waterways containing known populations have direct connectivity to waterways in the project area.

Ecology and Threatening Processes

The Oxleyan Pygmy Perch is generally restricted to streams, swampy areas and lakes in coastal wallum. Waterways in coastal wallum are generally acidic and have high organic content derived from leachates from swamps and riparian vegetation, particularly Melaleucas.

However, the Oxleyan Pygmy Perch has also been found in sites with different characteristics, including intermediate forest/heath community and littoral rainforest/ Melaleuca swamp (DPI 2005).

Potential Impacts

The physico-chemical qualities recorded from Six Mile Creek (left branch) were within the tolerance range for the Oxleyan Pygmy Perch, and this reach also features slow-flowing shallow water and leaf habitat that this species is known to use. Although this species has not previously been recorded in this part of the catchment, this may be due to limited sampling effort and for the purposes of this assessment, the species is assumed to occur in the study area. The Oxleyan Pygmy Perch does not undertake large-scale movements for spawning and will not be impacted by temporary barriers during construction. Further, elevated turbidity levels which may impact on primary production in other systems are not an issue in this reach due to the absence of natural macrophyte cover.

This species is highly unlikely to occur within the main branch of Six Mile Creek due to a lack of suitable habitat (Hydrobiology 2008a). An assessment of impacts for the Oxleyan Pygmy Perch is provided in Table D.13. Potential mitigation strategies which may be implemented include:

- undertaking detailed survey to confirm the presence of this species at identified locations;
- minimising the disturbance area for all significant waterway crossings; and
- implementing appropriate sediment and erosion control for all works, stockpiles and bunds adjacent to waterways.

Table D.13 Assessment of significant impact for Oxleyan Pygmy Perch (Endangered)

Will the proposed works …	Oxleyan Pygmy Perch
▪ lead to a long-term decrease in the population?	The proposed action does not affect known habitat for this species. No long-term decrease in the population would be expected to result.
▪ reduce the area of occupancy for the species?	No reduction in the area of occupancy is expected.
▪ fragment an existing population into two or more populations?	The proposed action will not fragment any existing known populations. In any event, there will be no permanent barriers to fish movement as a result of construction works.
▪ adversely affect habitat critical to the survival of the species?	No critical habitat for this species was identified in the study area.
▪ disrupt the breeding cycle of the population?	The proposed action is not expected to have any impact on the breeding cycle of this species.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed action will not result in modification to known habitat areas for this species.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	Cabomba is known to occur in Lake Macdonald and Six Mile Creek. Infestations of this weed can choke waterways and impact on the physico-chemical characteristics of waterways. A weed management plan will be implemented to ensure there is no introduction or further spread of this weed as a result of construction works.
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	The proposed action is highly unlikely to interfere with the recovery of this species.

Summary of Impact Assessment

The proposed action will not result in significant or long-term impacts on Oxleyan Pygmy Perch populations or habitat critical to their survival. Six Mile Creek (left branch) represents sub-optimal habitat for this species (Hydrobiology 2008a), and potential impacts to this habitat will be temporary and localised. With the implementation of appropriate mitigation measures, no significant impacts are expected for the Oxleyan Pygmy Perch as a result of project.

D.6.4 Neoceratodus forsteri, Australian Lungfish (Vulnerable)

Current Distribution

The Australian Lungfish is endemic to south-east Queensland, with its natural distribution restricted to the Mary and Burnett rivers (Brooks & Kind 2002). The Lungfish has been introduced to a number of locations, including the Brisbane, Albert, Coomera and Stanley rivers and the Enoggera Reservoir, with varying degrees of success (DPI 2003; Hydrobiology 2008a). The Lungfish has a restricted distribution, with natural populations threatened by changes in in-stream habitats and flow regimes of waterways they inhabit.

Ecology and Threatening Processes

The Lungfish typically inhabits slow-flowing streams or deep pools, with adults favouring submerged logs and densely vegetated bank habitat. Spawning habitat is generally characterised by relatively shallow water and a dense coverage of macrophytes (greater than 70% cover) (TSSC nd), with spawning occurring between August and December.

In rivers with natural flows (ie not flow regulated), the Lungfish is sedentary; moving only short distances between habitat features (Brooks & Kind 2002). The Lungfish can withstand poor water quality and/or high levels of turbidity, and is also able to withstand dry conditions (DPI 2003).

The decline of Lungfish populations is largely due to habitat change associated with catchment development, water resource development such as impoundments and the introduction of exotic fish species that compete for habitat and prey on Lungfish eggs and juveniles.

Potential Impacts—Waterway Crossings

The Lungfish has been reported to be an occasional visitor to the upper reaches of the main branch of Six Mile Creek, typically following high-flow events (see Hydrobiology 2008a). However, due to a lack of macrophyte cover and deep pools, the study reach is unlikely to support established populations of the Lungfish, and no significant impacts on this species are expected as a result of waterway crossings for this project (see Table D.14).

Potential Impacts—Water Extraction from the Mary River (Existing Entitlements)

An assessment of the impacts associated with the full resource development for the Mary Basin indicated that any potential impacts downstream of the current extraction point at Coles Crossing would be temporally limited to the dry season (August–November) (Hydrobiology 2008b). While this coincides with the known breeding period for the species (August-December) this would be likely to occur under any water supply strategy as it is inherent in the natural seasonal flow dynamics of the system.

During the seasonal dry periods, there is potential that the proposed action will reduce the connectivity between deep pool habitats downstream or at the existing extraction point. However, Kind (2002) has previously observed that lungfish in the Mary River do not move significant distances during breeding periods compared with populations in other catchments.

As such, stream connectivity may be less critical for Mary River populations than those in catchments such as the Burnett River.

Mitigation strategies that may be implemented include:

- undertaking detailed survey to confirm the presence of this species at identified locations;
- minimising the disturbance area for all significant waterway crossings;
- implementing appropriate sediment and erosion control for all works, stockpiles and bunds adjacent to waterways; and
- development and implementation of a habitat monitoring program for the main channel of the Mary River, downstream of the existing extraction location at Coles Crossing to monitor changes in habitat condition and availability (particularly during the 'dry' period of August-November).

Table D.14 Assessment of significant impact for Australian Lungfish (Vulnerable)

Will the proposed works …	Australian Lungfish
▪ lead to a long-term decrease in the population?	Substantial populations of the Lungfish are not known to occur in Six Mile Creek although individuals have been observed in the area from time to time when conditions are suitable. Consequently the species will not be significantly impacted as a result of transient activities associated with construction of the pipeline crossing. The proposed water supply strategy will not result in a long-term decrease in the population of Lungfish.
▪ reduce the area of occupancy for the species?	The proposed action will not significantly impact the availability of deep pool habitat favoured by lungfish and will not reduce the area of occupancy for this species.
▪ fragment an existing population into two or more populations?	The proposed action is not expected to result in fragmentation of existing populations.
▪ adversely affect habitat critical to the survival of the species?	The proposed action is not likely to affect habitat critical to the survival of the species.
▪ disrupt the breeding cycle of the population?	No disruption to the breeding cycle of the Lungfish population is expected.
▪ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The species will not decline as a result of short-term and spatially restricted impacts from the proposed project.
▪ result in invasive species that are harmful to a species becoming established in the species' habitat?	Cabomba is known to occur in Lake Macdonald and Six Mile Creek. Infestations of this weed can choke waterways and impact on the physico-chemical characteristics of waterways with adverse effects upon the Lungfish. A weed management plan will be implemented to ensure there is no introduction or further spread of this weed as a result of construction works.

Table D.14 (continued)

Will the proposed works …	Australian Lungfish
▪ introduce disease that may cause the species to decline?	The proposed action will not introduce any disease that may cause the species to decline.
▪ interfere with the recovery of the species?	With the implementation of appropriate mitigation measures, the proposed action is unlikely to interfere with the recovery of this species. There is the potential to improve ecological understanding of habitat requirements for species at and below the extraction point at Coles Crossing as a result of the implementation of the proposed habitat monitoring program.

Summary of Impact Assessment

Six Mile Creek (left branch and main channel) are highly unlikely to support populations of the Lungfish due to the lack of critical habitat features (Hydrobiology 2008a). Although this species has been recorded within the main channel, these individuals were likely to be visitors, rather than permanent residents of this reach of Six Mile Creek. Potential reduction of connectivity between deep pool habitat at and downstream of the extraction point at Coles Crossing will not have significant long-term impacts on populations of the Lungfish. Breeding in the Mary River will not be adversely affected by the project.

D.7 Listed Migratory Species

Listed migratory species were identified, in the first instance, through database searches. Potential habitat areas were identified from literature reviews, aerial photography of the proposed route followed up with limited field visits to key sites. Based on this information, and the ecological requirements of key fauna species, a likelihood of impact was determined for each species (see Table D.15).

The migratory species identified are all mobile bird species. These species are unlikely to be adversely impacted by construction of linear infrastructure, which typically results in disturbance of small areas of individual habitat types rather than destruction of large tracts of suitable habitat. Coxen's Fig Parrot (*Cyclopsitta diophthalma coxeni*) is classified as both migratory and endangered under the EPBC Act and is addressed at Table D.5 in Section D.5 of this report.

The Australian Painted Snipe (*Rostratula benghalensis australis*) was initially identified as potentially using habitats in the project area for breeding. However, field survey of the corridor did not record any suitable habitat and discussion of potential impacts upon this species is not considered relevant to the proposed action.

Table D.15 Listed migratory species potentially occurring within the project area

Species	Common name	EPBC status	Habitat/distribution	Likelihood of occurrence within the project area
Haliaeetus leucogaster	White-bellied Sea Eagle	Migratory	Generally associated with marine and estuarine habitats and larger wetland areas	**Low**—no loss of habitat or significant impact on species is expected
Monarcha trivirgatus	Spectacled Monarch	Migratory	Prefers wet and forested habitats within tall forest and riparian vegetation	**Low**—a relatively narrow corridor (<20 m) through riparian vegetation will not constitute a barrier to local movement for this species
Myiagra cyanoleuca	Satin Flycatcher	Migratory	Prefers wet and forested habitats within tall forest and riparian vegetation	**Low**—relatively narrow corridor (<20 m) through riparian vegetation will not constitute a barrier to local movement for this species
Ardea ibis	Cattle Egret	Migratory	Widespread from the Kimberley to south-eastern Australia, migrating to southern states in winter to spring. Frequents paddocks and grasslands in the study area	**Low**—species utilises a wide range of habitats and will not be unduly affected by disturbance to paddock environs, which are ubiquitous in study area
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Migratory	Inhabits freshwater and brackish swamps, marshes and flooded paddocks	**Low**—minimal habitat recorded within the proposed corridor, and disturbance to farm dams etc. will be reinstated
Rostratula benghalensis australis	Painted Snipe	Migratory	Cryptic species occurring in shallow terrestrial wetlands. Also recorded using grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. Species is threatened by drainage of wetlands, diversion of water from rivers, clearance of wetland vegetation and overgrazing	**Low**—species has a low potential occurrence within the project area, and disturbance to suitable habitat (farm dams etc.) will be reinstated

D.8 Summary of Effects upon MNES

This appendix has focused on providing a clear description of environmental attributes of national significance that occur, or are likely to occur, within the proposed corridor for the Northern Pipeline Interconnector (NPI) Stage 2 project. This descriptive process is an inherent starting point in examining potential ecological effects of the project as required for a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Data gathered and analysed has been discussed in the specific context of matters of national environmental significance (MNES) for flora and fauna protected under the EPBC Act. This has covered threatened species and communities (as per ss. 18 and 18A of the Act) and listed migratory species (as per ss. 20 and 20A of the Act).

Details of the effects upon EPBC-listed species of flora and fauna known from the region have used the standard EPBC format of assessing the effects upon Endangered, Vulnerable and Migratory listed species under a series of headings. These discussions have included assessment of potential impacts and proposed mitigation strategies.

Areas of greatest sensitivity and of highest rank in MNES in the study area are those regional ecosystems associated with lowland riparian rainforests and vine forests. These ecosystems were once widespread but with settlement and population expansion in the region, have been reduced to generally narrow remnants along larger permanent waterways. Waterway crossing points thus assume particular significance in terms of environmental management as these are areas of greatest species diversity and highest regional ecological value.

All waterway crossings are in freshwater environments and will not affect tidal vegetation or marine reserves in estuaries further to the east of the alignment.

To limit the extent of further disturbance to these high value areas, corridor route planning particularly focused on using existing infrastructure rights–of-way such as powerline and road corridors. In the few instances where these existing cleared passages were not available, the point of narrowest disturbance was selected as the preferred pipeline routing. Elsewhere the pipeline was aligned through cleared farmlands.

The outcome of this route selection process has been an integrated approach to reduce the potential environmental impacts to a minimum along the route. Where disturbance was considered to be unavoidable, detailed field surveys were undertaken to gather information on species and habitats of significance. From this, practical mitigation strategies were developed and these have been proposed as measures to offset possible effects of construction.

A specific benefit of pipeline construction is that this infrastructure is underground and will require minimal maintenance upon commissioning and seldom limits agricultural land use or natural rehabilitation processes.

Specific measures to mitigate impacts include:

- adopting trenching as the preferred method for all waterway crossings as this is a rapid process (1 to 2 days) for almost all the waterways encountered along the route. The

possible exception is the South Maroochy River, which is the largest waterway intersected by the route

- reducing to a minimum the cleared corridor sufficient to excavate a trench, place bedding material, place the pipe sections and cover the excavation in readiness for revegetation. For open unrestricted areas, a corridor of 30–40 m is required to allow safe truck and excavator operations. For short sections such as riparian areas this is likely to be reduced to less than 20 m
- plotting the location of EPBC-listed tree species at crossing points through highly sensitive REs as part of detailed route alignment studies to optimise the placement footprint and minimise clearing of mature trees. Where some clearing is required, ensure the revegetation planting includes advanced potted specimens of species of high significance that required removal
- timing activities to seasonal conditions that minimise the potential to disrupt breeding patterns for aquatic fauna species and also minimise exposure to flood risk in low-lying areas
- adopting best practice methods for control of earthworks including stockpile controls, topsoil collection and replacement, detailed surface drainage management and silt control, flood contingency planning and weed suppression controls.

In closing, this appendix has examined and responded to the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). From the information collected and discussed, it is apparent that specific concerns of longer term detriment to listed species known to occur within the project area have been assessed and addressed. While there will be some unavoidable losses, these for the most part will be short term and within the capacity of local ecosystems to repair and continue without medium and longer term effects.

No populations of listed species will be put at risk.

Permanent changes to sensitive habitats will be restricted to the narrow rights-of-way through dense riparian fringing forest communities. These will be offset wherever possible by appropriate species replacement and management to encourage canopy closure. In this way the proposed Stage 2 of the Northern Pipeline Interconnector will result in minimal long-term change to existing ecological processes and attributes.

D.9 References

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