

6 Ecology

An ecological assessment of the proposed modification was prepared by Alison Hunt and Associates, with review and input by EMM's ecologists. The assessment report is provided in full in Appendix C and key outcomes are summarised in this chapter.

6.1 Existing environment

6.1.1 Method

The existing environment has been well characterised by previous surveys and ecological assessments, comprising:

- GGP Ecological Assessment Gloucester to Hexham (AECOM 2009d);
- GGP Gloucester to Hexham Addendum: Ecological Assessment Report (Alison Hunt & Associates Pty Ltd 2009);
- GGP Seaham Property Potential Land Acquisition Ecological Values Report (Alison Hunt & Associates Pty Ltd 2010);
- GGP Seaham Property Potential Land Acquisition Ecological Assessment (Alison Hunt & Associates Pty Ltd 2011a);
- GGP Gloucester to Hexham Targeted Threatened Species Surveys (Alison Hunt & Associates Pty Ltd 2011b); and
- Flora and Fauna Assessment for Proposed Transmission Line from the TransGrid Tomago Substation to Stroud (Landpartners Pty Ltd 2011b).

The following tasks were completed to describe the biodiversity values within the Seaham, Brandy Hill, Millers Forest and Tomago sections and assess the potential impacts (both positive and negative) of the proposed modification:

- review of available literature and databases, including previous vegetation mapping for the area, to assist with the identification of site values, especially in relation to threatened species, populations and communities;
- field investigations to ascertain the current site condition and the presence or likely presence of threatened or protected species, populations, communities and aquatic habitats;
- identification of the likely ecological effects of the proposed modification with particular reference to threatened species, populations and/or communities;
- review of existing requirements within the Project approval for the protection and management of biodiversity and evaluation of their effectiveness to incorporate and address the proposed modification; and
- preparation of any additional recommendations to ameliorate and mitigate any impacts.

The methodology, including for the field surveys, is described in detail in Appendix C.

6.1.2 Native vegetation and weeds

i Seaham section

The approved pipeline corridor alignment traverses Ironbark - Spotted Gum Woodland that is contiguous with remnant vegetation in Wallaroo National Park and AGL's proposed biodiversity offset areas to the south. The proposed realignment to the north is largely to avoid clearing this woodland. The Seaham section now traverses predominantly cleared land that has been used for livestock grazing until recently. It is within and adjacent to a transmission line easement which is regularly slashed as a part of TransGrid's maintenance program.

The Seaham section mainly supports agricultural grasses such as Kikuyu (*Pennisetum clandestinum*) and Couch (*Cynoden dactylon*) and weeds including Lantana (*Lantana camara*). Lantana is a Class 4 noxious weed in the Port Stephens LGA, as declared under the *Noxious Weeds Act 1993* (NW Act). Class 4 weeds are considered to pose a threat to primary production, the environment or human health, and are widely distributed and likely to spread. Legal requirements state that their growth and spread must be controlled according to the measures specified in a management plan published by the local control authority.

There are small areas of Ironbark - Spotted Gum Woodland that extend into the eastern end of the 100 m wide corridor, generally where it overlaps the approved corridor (Figure 6.1). Canopy species are predominately Narrow-leaved Ironbark (*Eucalyptus crebra*) and Spotted Gum (*Corymbia maculate*) and the shrub layer is mostly absent. There is room to construct the ROW without clearing Ironbark - Spotted Gum Woodland (Figure 6.1).

Scattered occurrences of remnant species such as Cabbage Gum (*Eucalyptus amplifolia subsp. amplifolia*) and Narrow-leaved Ironbark at the western end of the Seaham section suggest that this area may have supported floodplain forest before clearing. The understorey is however now dominated by pasture species. There are also some pockets of early regrowth of native species in depressions, the most substantial being *Acacia spp.* around the dry drainage line, labelled as watercourse crossing 141 on Figure 6.1.

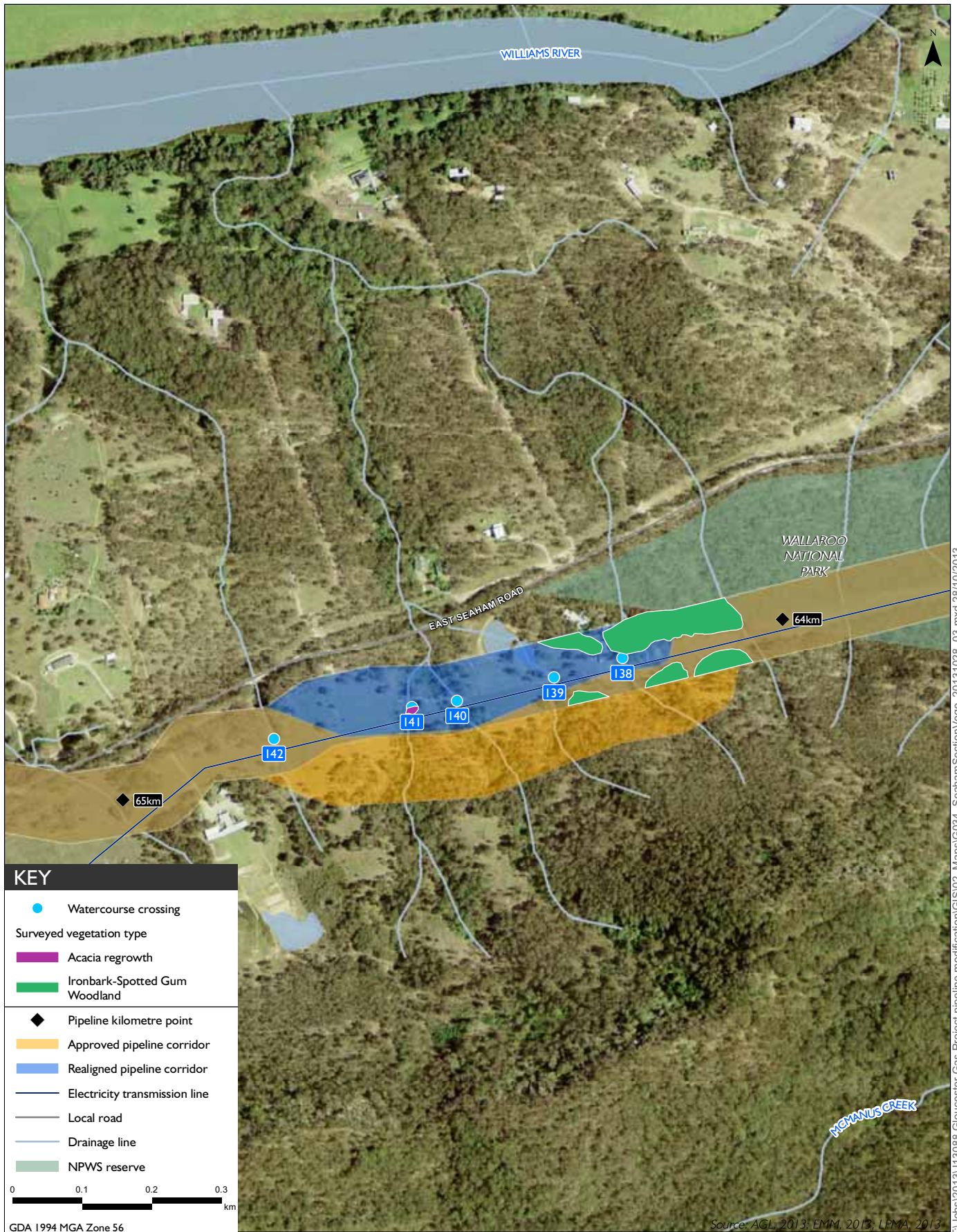
In summary the Seaham section does not support ecological features of conservation significance.

ii Brandy Hill section

The Brandy Hill section largely supports Kikuyu dominated paddocks used for livestock grazing with small patches of native vegetation (Figure 6.2) comprising:

- Modified remnants of Redgum Forest meeting the description of Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC (Hunter Lowland Redgum Forest EEC), listed under the TSC Act. The canopy is dominated by native tree species including Forest Red Gum (*Eucalyptus tereticornis*) and Grey Gum (*Eucalyptus punctata*) however, shrubs and groundcover characteristic of this EEC are largely absent.
- Isolated, degraded patches of Swamp Oak Forest meeting the description of Swamp Oak Floodplain Forest in the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC (Swamp Oak Floodplain Forest EEC), listed under the TSC Act. These are dominated by Swamp Oak (*Casuarina glauca*) though native understorey is largely absent

The approved pipeline corridor alignment traverses the Hunter Lowland Redgum Forest EEC at the northern end of the Brandy Hill section. The proposed realignment to the eastern edge of this community is largely to reduce the amount of vegetation clearing required from within this EEC.



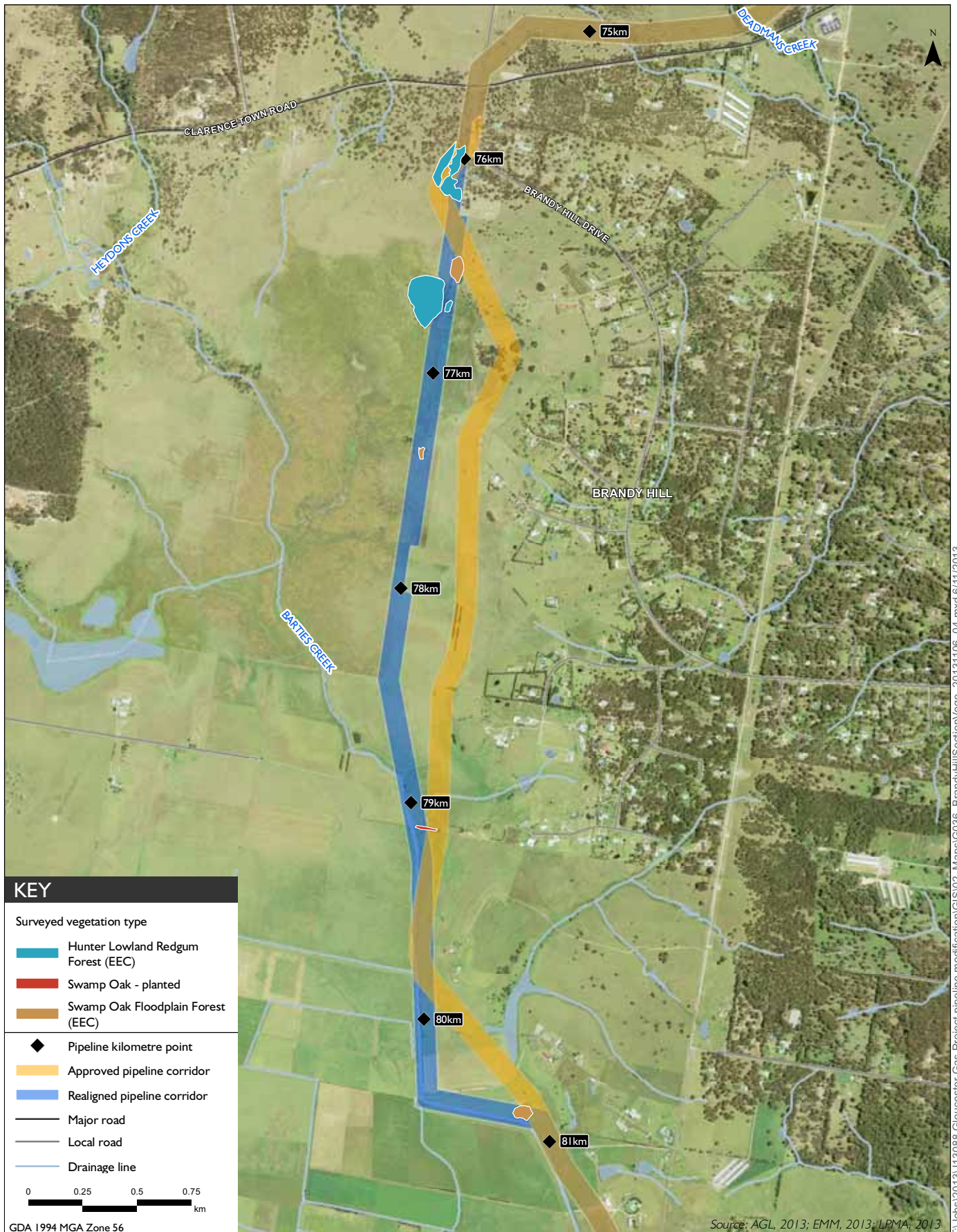
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Seham section - surveyed vegetation and watercourse crossings

Minor pipeline corridor realignments EA

Figure 6.1





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Brandy Hill section - surveyed vegetation
 Minor pipeline corridor realignments EA
 Figure 6.2

Lantana and Blackberry (*Rubus fruticosus*), both Class 4 noxious weeds in the Port Stephens LGA, were recorded in the modified pipeline corridor. The control requirements for Class 4 noxious weeds are outlined above. Blackberry is also listed as a Weed of National Significance (Weeds in Australia 2013), and plans and controls associated with this listing should be implemented for control of this weed.

iii Millers Forest section

The Millers Forest section is considered to be devoid of ecological features of conservation significance. Aerial photograph interpretation and a study by Landpartners (2011) for the recently-constructed transmission line, the easement of which partly overlaps the Millers Forest section, indicate that it comprises agricultural pastures used for grazing and cropping (Figure 6.3). The area was mapped as 'Cleared' by AECOM (2009d) and described in Landpartners (2011) as 'Exotic Grasslands'. Part of the Millers Forest section is subject to ploughing and cultivation, making it unlikely that intact soil seedbanks from previous native vegetation communities occur.

The paddocks would be dominated by agricultural pasture species as well as agricultural weeds, some of which may be declared as noxious under the NW Act.

iv Tomago section

The western end of the Tomago section, including the temporary laydown/ pipe stringing area, supports paddocks used for cattle grazing and cultivation. These areas are dominated by agricultural species such as Kikuyu and Couch and agricultural weeds. There are small degraded patches of Swamp Oak Forest, which are representative of the Swamp Oak Floodplain Forest EEC (Figure 6.4). They are dominated by Swamp Oak though native understorey is largely absent.

The Tomago section crosses the Hunter River and the edge of a SEPP 14 wetland. The river's riparian zone contains Mangrove Forest dominated by Grey Mangrove (*Avicennia marina subsp. australasica*) with the exotic Sharp Rush (*Juncus acutus*) occurring in damp areas just upslope from the top of bank (Figure 6.4). Mangroves are protected under the *Fisheries Management Act 1994*. Impacts to these areas will be avoided by using HDD.

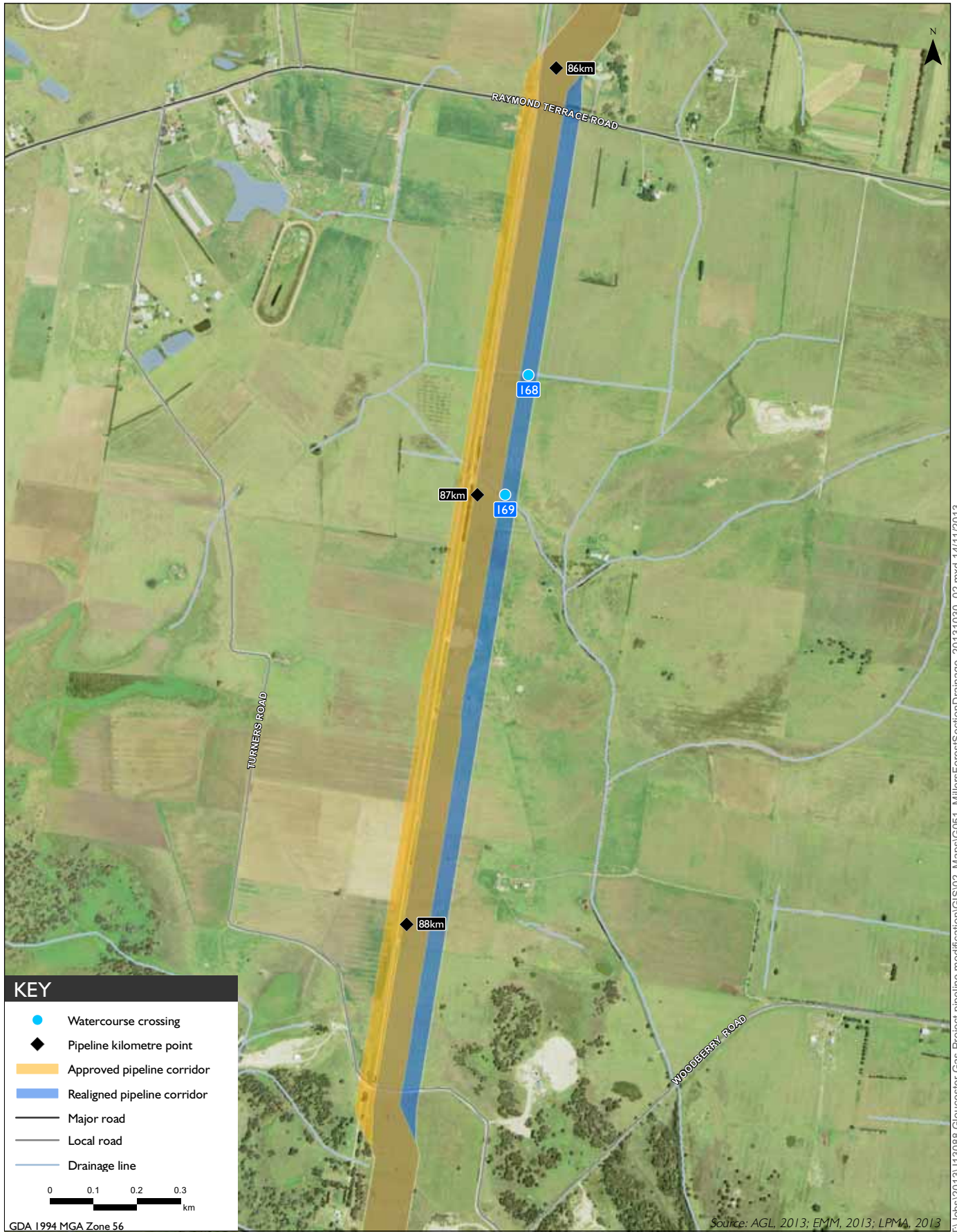
That part of the Tomago section east of the Hunter River was not surveyed as part of it will be underbored by HDD (with no surface disturbance), with the remainder within an existing cleared utility easement with no native vegetation. The entry point for the HDD will be at around KP 93 which is also devoid of native vegetation. The exit point will be at around KP92 and sited to avoid clearing of nearby Swamp Oak Floodplain Forest EEC.

Glaucous Starthistle (*Carthamus glaucus*), a Class 5 noxious weed in the Maitland LGA, was recorded in the Tomago section. Class 5 weeds are plants which are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State. The requirements under the NW Act relating to a notifiable weed must be complied with.

6.1.3 Terrestrial fauna habitat

i Seaham section

The Seaham section is mostly cleared land and fauna habitat is limited. Scattered trees and regenerating stands would however provide habitat for some woodland birds. Microchiropteran bats are also likely to forage through this area.



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KEY

- Watercourse crossing
- ◆ Pipeline kilometre point
- Approved pipeline corridor
- Realigned pipeline corridor
- Major road
- Local road
- Drainage line

0 0.1 0.2 0.3 km

GDA 1994 MGA Zone 56

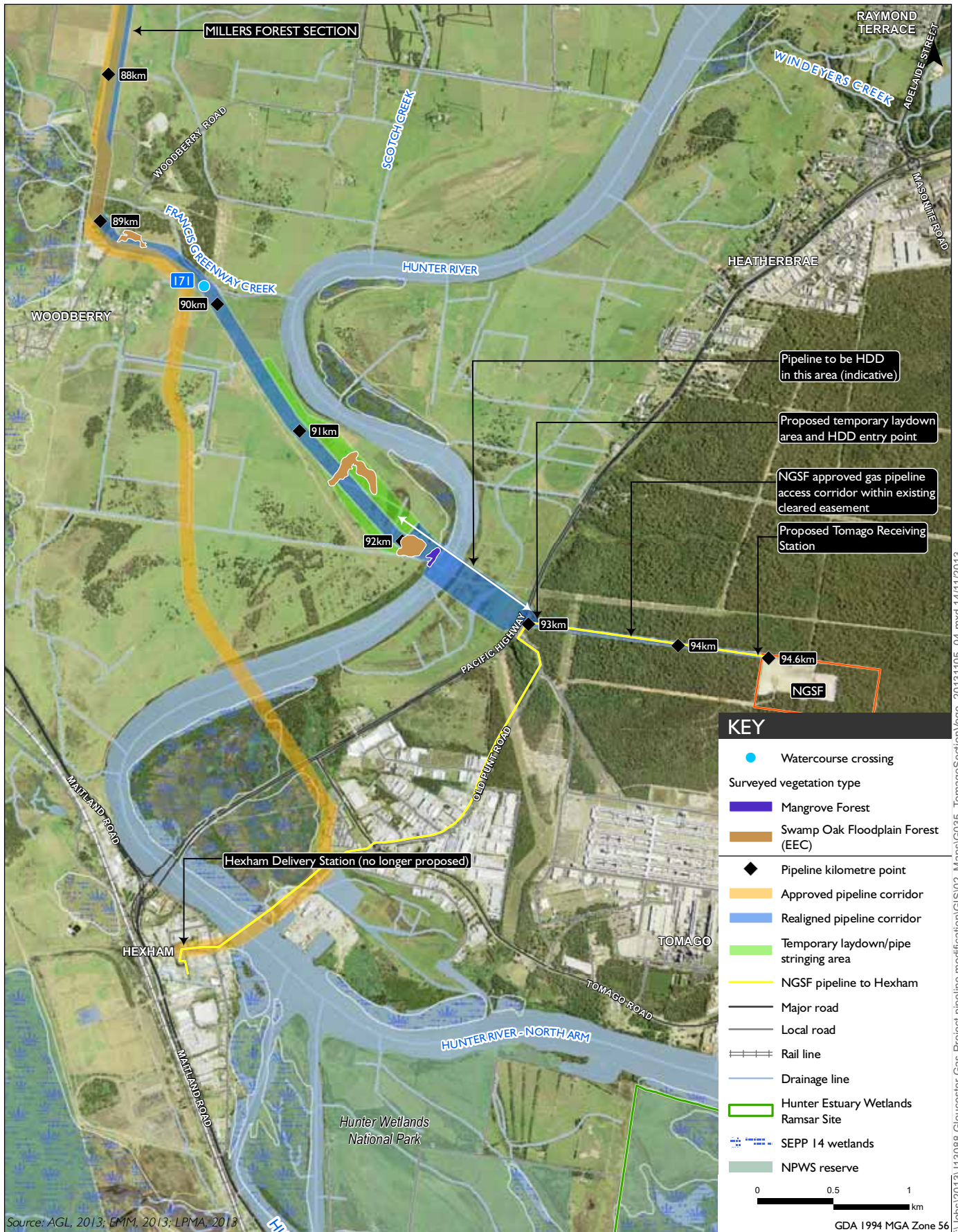
Source: AGL, 2013; EMM, 2013; LPMA, 2013



Millers Forest section - watercourse crossings

Minor pipeline corridor realignments EA

Figure 6.3



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Tomago section - surveyed vegetation and watercourse crossings

Minor pipeline corridor realignments EA

Figure 6.4



ii Brandy Hill section

Fauna habitat in the Brandy Hill section is limited to open paddocks, dry open woodland and Swamp Oak Forest patches. Habitat features include open canopy, large woody debris, tree hollows, clumped sedges and occasional stag trees. A range of native fauna including macropods, microchiropteran bats, some arboreal mammals and woodland birds could potentially use these areas. Hollows were evident in some larger trees and could provide suitable habitat for hollow-dependent birds, possums, gliders and microchiropteran bats.

A swarm of approximately 49 Black Kites (*Milvus migrans*) and a Spotted Harrier (*Circus assimilis*) were recorded foraging around a farm dam approximately 350 m east of the Brandy Hill section. The Spotted Harrier is listed as vulnerable under the TSC Act.

Whilst the provisions of SEPP 44 do not apply to Part 3A projects, this EA has considered Koala habitat consistent with the requirements of this SEPP and with reference to the Port Stephens Council (2002) *Comprehensive Koala Plan of Management* (CKPoM). Port Stephens is listed as an LGA subject to the provisions of SEPP 44 and is known to support a Koala population.

The two patches of Redgum Forest and the nearby Swamp Oak patch, near the northern end of the Brandy Hill section, have been mapped as 'Marginal Koala Habitat' in the Western Management Unit of the Port Stephens Council (2002) CKPoM (Figure 6.5). Marginal Koala habitat has been identified by the CKPoM as all forested areas which are not preferred or supplementary Koala habitat.

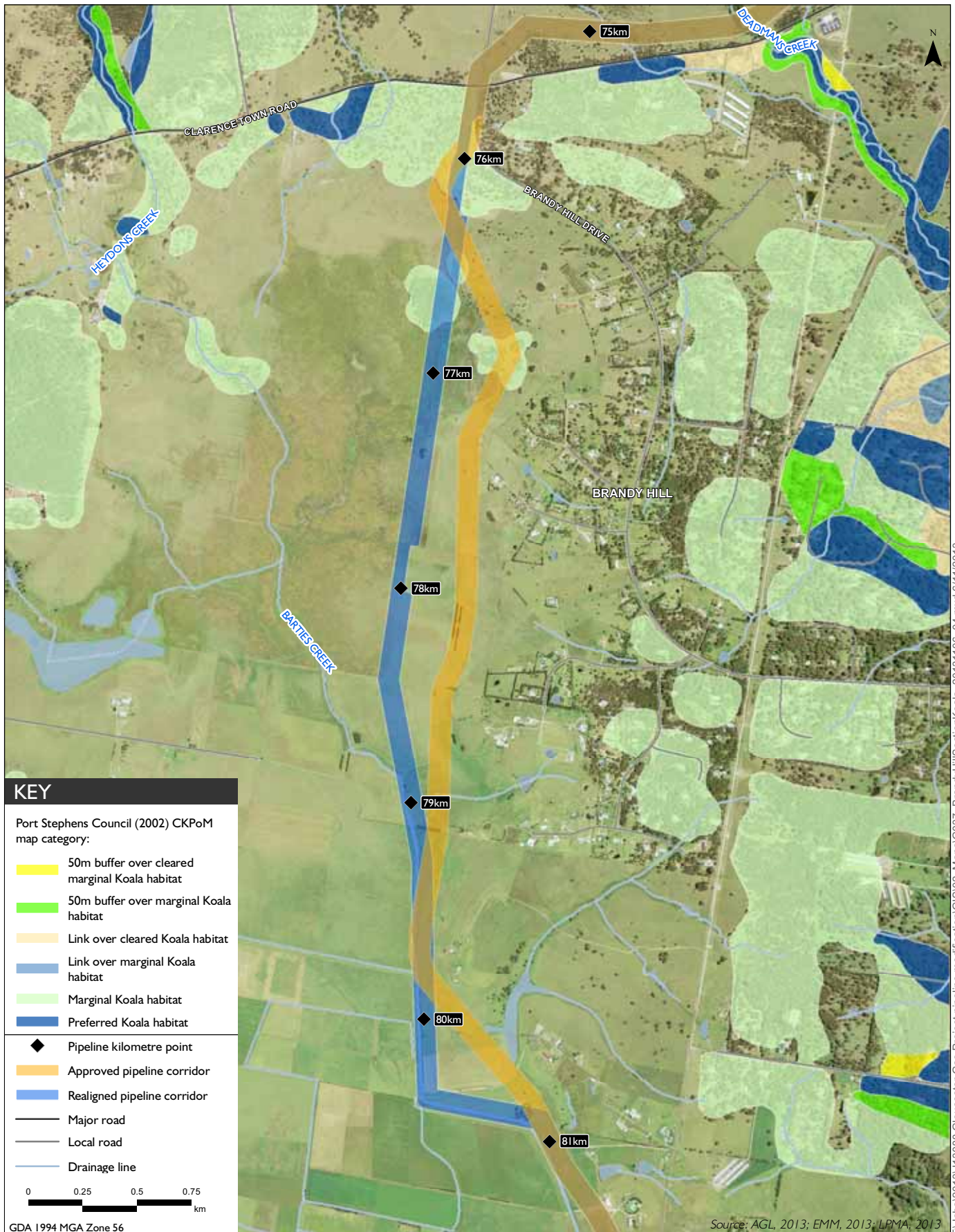
Two species of Koala feed trees listed on Schedule 2 of SEPP 44, that is Forest Red Gum (*Eucalyptus tereticornis*) and Grey Gum (*Eucalyptus punctata*), were recorded within or directly adjacent (west) to the Brandy Hill section. For an area to be considered potential core Koala habitat under SEPP 44, Schedule 2 tree species must occur at densities greater than 15%. In the Brandy Hill section, Grey Gum does not occur at densities greater 15%. However, Forest Red Gum does so in the remnant patches of Hunter Lowland Redgum Forest. This area could be considered to be potential core habitat for Koalas under SEPP 44. While the Redgum Forest could provide foraging habitat, the Swamp Oak Forest patches would be more likely to provide shelter and stepping stone habitat as this species moves through the landscape.

iii Millers Forest section

Fauna habitat would be limited along the Millers Forest section due to the paucity of native vegetation and the highly modified nature of the paddocks. Birds and possibly microchiropteran bats could fly over this area as they move between remnant patches of vegetation.

iv Tomago section

Fauna habitat is also very limited in the majority of the Tomago section due to the paucity of native vegetation and the highly modified nature of the paddocks. Many of the paddocks appear to have been drained using constructed earthen drainage channels. These areas are largely devoid of vegetation other than low growing pasture grasses and hence do not provide high quality fauna habitat. A number of birds were however incidentally recorded during the survey. As mentioned earlier, habitats of the Hunter River and its fringing mangroves and wetlands will be avoided by HDD.



Brandy Hill section - Potential Koala habitat
 Minor pipeline corridor realignments EA
 Figure 6.5



6.1.4 Aquatic habitat

Aquatic habitat assessments were made for watercourses and drainage lines traversed by the modified pipeline corridor alignment. Strahler (1952) and Fairfull and Witheridge (2003) classifications were broadly used. The Strahler stream ordering process provides a measure of complexity, and ranges from 1st order streams at the headwaters to 4th order streams which are generally large permanent waterways. The Fairfull & Wetheridge (2003) fish habitat classification system ranges from Class 1 waterways which are major waterways that provide ‘major fish habitat’ to Class 4 waterways which are ephemeral with little or no defined drainage channel and are unlikely to provide fish habitat.

i Seaham section

The Seaham section crosses four ephemeral drainage lines, all of which are crossed by the approved pipeline corridor (Figure 6.1). These drainage lines were dry at the time of the site inspection in September 2013 and do not support aquatic vegetation. Their banks are generally vegetated by weeds and colonising native plants. The condition of the drainage lines is poor due to past clearing, weeds and bare ground. They are unlikely to provide fish habitat (ie Class 4 waterways) and are all considered to be headwaters (Strahler Stream Order 1). Table 6.1 provides a classification of these drainage lines.

Table 6.1 Drainage lines crossed by the modified pipeline corridor alignment at Seaham

Identification number ¹	Description	Stream Order/ Waterway Classification ²	Overall condition
138	Headwater. Ephemeral dry v-shaped gully approximately 1 m wide. Steep sided. No recognisable riparian vegetation due to the infrequency of water flow.	Strahler 1 / Class 4	Poor
139	Headwater. Ephemeral dry u-shaped gully approximately 0.5 m wide. No recognisable riparian vegetation due to the infrequency of water flow.	Strahler 1 / Class 4	Poor
140 and 141	Headwater. Ephemeral dry v-shaped gully approximately 1.5 m wide. No recognisable riparian vegetation due to the infrequency of water flow although the gully area supports regrowth Acacia.	Strahler 1 / Class 4	Poor

Note: 1. Identification number is that used by AECOM (2009a).
2. Stream order definition accords with Strahler (1952) and waterway classification with Fairfull & Wetheridge (2003).

ii Brandy Hill section

The Brandy Hill section does not cross any discernible drainage lines or creeks. It runs adjacent to Barties Creek for approximately 2 km (Figure 6.2). At this location Barties Creek is a constructed irrigation/drainage channel which does not support riparian vegetation and has only very minor and isolated occurrences of aquatic plants. It is unlikely to provide important habitat for aquatic fauna or flora due to the simplicity of habitat present and apparent poor water quality.

iii Millers Forest section

The modified pipeline corridor alignment crosses low-lying paddocks on the Hunter River floodplain. These areas are largely devoid of vegetation other than low growing pasture grasses. The Millers Forest section crosses two artificial drainage channels, both of which are crossed by the approved pipeline corridor (Figure 6.3). One of these drainage channels runs adjacent to the corridor’s western side for approximately 1 km before crossing it. The condition of these drainage channels is poor and they are unlikely to provide fish habitat (ie Class 4 waterways). Table 6.2 provides a classification of these drainage lines.

Table 6.2 Drainage lines crossed by the modified pipeline alignment at Millers Forest

Identification number ¹	Description	Stream Order/ Waterway Classification ²	Overall condition
168	Unnamed watercourse. Undefined ephemeral drainage line in cleared paddock.	Strahler 1 / Class 4	Poor
169	Unnamed watercourse (incorrectly labelled this as Scotch Creek in the AECOM (2009a) EA). Undefined ephemeral drainage line in cleared paddock.	Strahler 1 / Class 4	Poor

Note: 1. Identification number is that used by AECOM (2009a).
2. Stream order definition accords with Strahler (1952) and waterway classification with Fairfull & Wetheridge (2003).

iv Tomago section

The Tomago section crosses a tributary of Francis Greenway Creek (Figure 6.4) approximately 70 m upstream of its confluence with Francis Greenway Creek. The tributary is a constructed earthen drainage channel that lacks riparian vegetation. It is heavily impacted by cattle pugging, eutrophication and weed infestation.

The Hunter River is a large and important river system in the Hunter region. The pipeline will pass under the Hunter River using HDD techniques, and so its riparian and aquatic habitats will be avoided.

Table 6.3 provides a classification for these watercourses.

Table 6.3 Drainage lines crossed by the modified pipeline alignment at Tomago

Identification number ¹	Description	Stream Order/ Waterway Classification ²	Overall condition
171	Tributary of Francis Greenway Creek. Ephemeral soggy u-shaped gully approximately 2 m wide. Steep sided. No recognisable riparian vegetation due to realignment and clearing. Badly degraded by stock through nutrient inputs and pugging.	Strahler 1 / Class 4	Extremely poor
177	Hunter River. Large and important resource in the Hunter Valley	Strahler 4 / Class 1	Good

Note: 1. Identification number is that used by AECOM (2009a).
2. Stream order definition accords with Strahler (1952) and waterway classification with Fairfull & Wetheridge (2003).

6.1.5 Threatened species, populations and ecological communities

There are no EECs listed under the EPBC Act known or likely to occur along the modified pipeline corridor alignments. As described in Section 6.1.2, the Brandy Hill section contains two degraded patches of the TSC Act-listed Hunter Lowland Redgum Forest EEC. Shrubs and groundcover characteristic of this EEC are largely absent. There are also scattered patches of Swamp Oak Floodplain Forest EEC within the Brandy Hill and Tomago sections, also listed under the TSC Act. These patches are generally degraded through clearing, weed invasion and use by stock.

There are no EPBC or TSC Act-listed populations known or predicted to occur along the modified pipeline corridor alignments.

No threatened flora species listed under the EPBC or TSC Acts were recorded along the modified pipeline corridor.

There is marginal habitat along the modified pipeline corridor alignments for seven fauna species listed under the EPBC Act. Three of these are also listed as vulnerable or endangered under the TSC Act, being the Swift Parrot (*Lathamus discolor*), Koala (*Phascolarctos cinereus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). An additional three bird species and one mammal species listed as vulnerable under the TSC Act were considered to have at least some potential to occur along the modified pipeline corridor alignments. These species and their conservation status are listed in Table 6.4. More detail on their habitat requirements is provided in Appendix C.

Table 6.4 Threatened fauna species assessed

Threatened biodiversity	Group/taxon	TSC Act status	EPBC Act status
Woodland birds	Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>)	V	-
	Swift Parrot (<i>Lathamus discolor</i>)	E	E, Mar
	Little Lorikeet (<i>Glossopsitta pusilla</i>)	V	-
Raptors	Spotted Harrier (<i>Circus assimilis</i>)	V	-
Migratory birds	Great Egret (<i>Ardea alba</i>)	-	M, Mar
	Cattle Egret (<i>Ardea ibis</i>)	-	M, Mar
	White-throated Needletail (<i>Hirundapus caudacutus</i>)	-	M, Mar
	Rainbow Bee-eater (<i>Merops ornatus</i>)	-	M, Mar
Arboreal mammals	Koala (<i>Phascolarctos cinereus</i>)	V	V
Microchiropteran bats	Yellow-bellied Sheath-tail Bat (<i>Saccolaimus flaviventris</i>)	V	-
Megachiropteran bats	Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	V	V

Notes 1. V- vulnerable species, E – endangered species, Mar – marine species, M – migratory species.

6.2 Impact assessment

6.2.1 Approach to impact assessment

This impact assessment focuses on the differences (ie net gains and losses) observed when comparing the GGP and the proposed modification. The comparison is based on the estimated native vegetation loss, habitat loss and edge effects that would result from the ROW which will generally be 30 m wide, though minimised to 15 m wide in sensitive areas such as EECs, to minimise impacts.

Assessments of significance have been completed for EECs and threatened species (threatened biodiversity) recorded or likely to occur in the ROW (refer Section 6.1.3). These assessments were based on the criteria provided in DECC (2007) *Threatened Species Assessment Guidelines: The Assessment of Significance* for TSC Act-listed threatened biodiversity. These guidelines use the risk of extinction to determine if a significant impact will occur. The guidelines define the risk of extinction as the likelihood that the local population will become extinct either in the short term or in the long term as a result of direct or indirect impacts on the viability of that population.

Potential impacts on EPBC Act-listed species were assessed by 'assessments of significance' that used criteria from the DoE (2013) *Matters of National Environmental Significance - Significant impact guidelines 1.1*. These guidelines define 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 upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

6.2.2 Direct impacts

i Vegetation clearing

The modified pipeline corridor alignment has been designed to avoid remnant native vegetation, paddock trees and riparian areas where possible. The vast majority traverses cleared land. Drainage line crossings will be in areas that lack riparian vegetation. HDD techniques will be used to cross the Hunter River and its fringing mangroves and SEPP 14 wetlands, which would avoid native vegetation clearing and direct impacts to these sensitive areas. Overall, the proposed modifications to the pipeline corridor alignment would reduce native vegetation clearing compared to the approved alignment, particularly in the Seaham and Brandy Hill sections.

The proposed modification would avoid clearing Ironbark - Spotted Gum Woodland in the vicinity of the Seaham section. There is no remnant native vegetation in the Millers Forest section therefore none will be impacted by the proposed works in this area.

There are isolated patches of Hunter Lowland Redgum Forest and Swamp Oak Floodplain Forest within the Brandy Hill and Tomago sections which cannot be completely avoided. AGL has committed to reducing the ROW from 30 m to 15 m in these areas and removal of mature trees will be avoided where feasible. For example, tree clearing within Hunter Lowland Redgum Forest at the northern end of the Brandy Hill section is anticipated to be limited to two mature and six juvenile trees from within an approximately 0.09 ha area. The ROW has been minimised to 15 m wide in this area and moved as far to the edge of this vegetation as the design allows.

The proposed modification reduces anticipated clearing of Hunter Lowland Redgum Forest EEC from approximately 0.23 ha to approximately 0.09 ha.

The modified pipeline corridor alignment includes degraded and isolated remnant patches of Swamp Oak Floodplain Forest EEC which would not have been impacted by the approved alignment. AGL has committed to avoiding three of these patches (Table 6.6) however three patches cannot be completely avoided (Figures 6.2 and 6.4); approximately 0.25 ha is predicted to be cleared from within 15 m ROWs in these areas. Mature trees will be avoided where possible to minimise impacts to the EEC.

A comparison of native vegetation predicted to be cleared for the approved and proposed modified pipeline corridors is provided in Table 6.5. It can be seen that the proposed modification reduces total anticipated clearing of remnant native vegetation by approximately 1.69 ha. AGL's commitments to minimise disturbance to remnant vegetation, including EECs, are shown in Table 6.6.

Table 6.5 Comparison of vegetation clearing for the approved and realigned sections

Vegetation community	Endangered ecological community	Approved pipeline alignment clearing ¹ (ha)	Seaham, Brandy Hill and Tomago sections clearing (ha)	Outcome (ha)
Ironbark - Spotted Gum Woodland	N/A	1.80	0	-1.80
Forest Red Gum	Hunter Lowland Redgum Forest	0.23	0.09	-0.14
Swamp Oak Forest	Swamp Oak Floodplain Forest	0	0.25	+0.25
Total		2.03	0.34	-1.69

Notes: 1. The approved pipeline alignment clearing only relates to the area required to be cleared in the ROW at the respective sections. The ROW has been reduced from 30 m wide to 15 m in sensitive areas to minimise disturbance.

Table 6.6 Design optimisation to minimise vegetation disturbance

Realigned section	Vegetation type within 100 m wide pipeline corridor	Mitigation measure adopted
Seaham	Ironbark-Spotted Gum Woodland	Avoided
	Agricultural land	n/a
Brandy Hill	Hunter Lowland Redgum Forest EEC (KP 76)	ROW reduced to 15 m
	Swamp Oak Floodplain Forest EEC (KP 76.5)	Avoided
	Hunter Lowland Redgum Forest EEC (KP 76.7)	Clearing restricted to approximately 5 m by 5 m
	Swamp Oak Floodplain Forest EEC (KP 77.5)	Avoided
	Swamp Oak planted windbreak (KP 79.1)	n/a
	Swamp Oak Floodplain Forest (KP 80.8)	ROW reduced to 15 m
	Agricultural land	n/a
Millers Forest	Agricultural land	n/a
Tomago	Swamp Oak Floodplain Forest (KP 89.3)	Avoided
	Swamp Oak Floodplain Forest (KP 91.5)	ROW reduced to 15 m
	Swamp Oak Floodplain Forest (KP 92)	Avoided
	Mangrove Forest	Avoided by HDD
	Agricultural and cleared land	n/a

ii Terrestrial fauna habitat

Terrestrial fauna habitat along the modified pipeline corridor alignment is generally limited to open paddocks, dry open woodland and patches of Swamp Oak Forest. There will be minor (0.34 ha) clearing of native vegetation communities and this will consist of a small number of trees with minimal native understorey. The proposed modification will reduce vegetation clearing compared to the approved project, which is considered to be an improvement. Removal of hollow-bearing or stag trees from within the woodland areas would be avoided where possible.

There will be minimal removal of Marginal Koala Habitat identified in the Port Stephens Council CKPoM, comprising approximately 0.09 ha of potential foraging and shelter habitat. Disruption to this habitat is unlikely to significantly impact this species.

Impact assessments for the Koala and other threatened fauna with potential to occur along the modified pipeline corridor (Table 6.4), conducted in accordance with the Commonwealth and State government's assessment guidelines, are provided in Appendix C. They conclude that these species are unlikely to be significantly impacted by the proposed modification (refer Section 6.2.4 for further discussion).

iii Aquatic habitat

The proposed modification reduces the potential for impacts on aquatic habitats. This is partly due to the reduction of the Hunter River crossings from two to one, reduced disturbance to ASS and avoidance of a SEPP 14 wetland area that would have been impacted by the approved route. The proposed HDD crossing of the Hunter River would be initiated approximately 500 m east of the Hunter River with the exit point approximately 250 m west of the river. Consequently, there are unlikely to be direct impacts on the aquatic habitats of the Hunter River, fringing mangrove forest, wetlands or downstream habitats. The HDD crossing is further upstream of the Hunter Estuary Wetlands Ramsar site and Hunter Wetlands National Park than the approved crossing.

Other drainage lines to be crossed are ephemeral or artificially constructed, have low habitat value and are approved to be crossed by the approved pipeline. Trenching of the ephemeral drainage lines within the Seaham, Millers Forest and Tomago sections is likely to have few impacts on aquatic habitats as none support riparian vegetation or in-stream macrophytes and none are likely to provide fish habitat. Without mitigation, there is the potential for impacts on the constructed irrigation/drainage channel (Barties Creek) that the modified pipeline alignment at Brandy Hill runs adjacent to. However, erosion and sediment controls will be implemented in accordance with existing Project approval conditions, which will ensure the potential for impacts is negligible.

iv Corridors and connectivity

It is unlikely that the proposed modification would substantially disrupt large-scale corridors or fragment connectivity as the proposed pipeline corridor alignment generally traverses cleared land and the ROW required for construction is narrow (ie between 15 m and 30 m). Construction of the pipeline through these areas would only cause minor temporary disruption to connectivity across these open landscapes as the pipeline trench would be backfilled and the current level of habitat restored in the paddock areas.

The proposed realignments in the Seaham and Brandy Hill sections, to the edge of remnant Ironbark-Spotted Gum Woodland and Hunter Lowland Redgum Forest, decrease the opportunity for fragmentation. As shown in Table 6.6, the ROW will be reduced to 15 m wide through native vegetation where clearing is required, which would reduce the opportunity for disruption to connectivity.

6.2.3 Indirect impacts

i Changes to water quality

The proposed modification will reduce the potential for impacts on water quality during and following construction due to:

- a reduction in the number of watercourse crossings required, including reducing the number of Hunter River crossings from two to one;
- reduction in disturbance of ASS; and
- an overall reduction in native vegetation clearing.

The existing Project approval conditions include suitable measures to minimise the potential for water quality impacts.

ii Edge effects

The proposed pipeline corridor realignment within the Seaham section, to within and adjacent to a cleared transmission line easement, and avoid clearing approximately 1.8 ha of Ironbark - Spotted Gum Woodland, would effectively reduce the potential for edge effects in this area. At Brandy Hill the modified pipeline corridor alignment is closer to the edge of a patch of Hunter Lowland Redgum Forest, at an area that requires minimal vegetation clearing (approximately two mature and eight juvenile trees). This would also reduce edge effects compared to the approved project. Similarly, the eastern portion of the Tomago section, which passes through remnant native vegetation, will be confined to an existing cleared utility easement (Figure 6.4).

iii Fauna disturbance

Temporary disturbance of fauna during construction could occur through an increase in noise and activity levels across the site, including increased traffic. The potential for disturbance to fauna at the proposed work sites is unlikely to differ from that of the approved pipeline.

iv Key threatening processes

Key threatening processes (KTPs) listed under the EPBC and TSC Acts which may be relevant to the proposed modification include 'Clearing of native vegetation/land clearance' and 'Predation by the European Red Fox'. The proposed modification will not increase the risk of these KTPs when compared with the approved GGP. The proposed modification will result in an overall reduction in native vegetation clearing (Table 6.5).

6.2.4 Threatened species, populations and ecological communities

As discussed in Section 6.1.3, no threatened populations or flora species were recorded or considered likely to occur within the modified pipeline corridor alignments and therefore none will be impacted by the proposed modification.

Assessments of significance were completed for the TSC Act-listed Hunter Lowland Redgum Forest EEC and Swamp Oak Floodplain Forest EEC, which occur within the Brandy Hill and Tomago sections. Assessments of significance were also completed for the threatened fauna species listed in Table 6.4, considered to have at least some potential to occur along the modified pipeline corridor alignments. These assessments are provided in Appendix C. In summary, they concluded that the proposed modification is unlikely to significantly impact EECs or threatened species as:

- the proposed modification reduces clearing of remnant native vegetation, including the Hunter Lowland Redgum Forest EEC, compared to the approved GGP;
- in unavoidable areas of high conservation status such as EECs the ROW width will be minimised and generally follows cleared areas between trees, resulting in minimal tree clearing and impact in the form of habitat removal or fragmentation;
- Swamp Oak Floodplain Forest EEC to be removed occurs in small isolated patches which are highly degraded and modified through clearing and grazing;

- the proposed modification generally avoids areas of threatened species habitat and EECs. Disturbance to potential habitat, including the number of trees to be removed, would be relatively minimal; and
- potential impacts, including indirect impacts, can be managed and mitigated with the environmental management measures already required as part of the Project approval.

6.2.5 Cumulative impacts

Construction and operation of the proposed modification is not likely to substantially increase cumulative impacts. The proposed pipeline corridor realignments are predominately through pastures and only relatively small amounts of native vegetation would be removed, which are along the edges of existing disturbed areas. Therefore, it is considered that the scale of potential impacts is small and predicted to be manageable. The modified pipeline corridor alignment would not increase the potential for cumulative impacts above that associated with the approved pipeline corridor alignment.

Given that the proposed pipeline corridor realignments are minor and that there would be an overall reduction in the clearing of native vegetation, it is considered that impacts could be adequately integrated into the current biodiversity offset package being developed for the approved GGP.

6.3 Management and monitoring

The current ecological condition and biodiversity values of the proposed modified pipeline corridor alignments will be protected and maintained by implementing the environmental mitigation and management measures already required as part of the Project approval. These measures will be incorporated into management and rehabilitation plans.

Condition 3.34 of the Project approval requires a compensatory habitat package. Accordingly, AGL is currently finalising an offset package, in consultation with the DoE and OEH. Once finalised, it will be submitted to DoE and OEH. AGL has purchased the Seaham property, which includes its proposed biodiversity offset site. This site supports numerous features of conservation value and has been shown to share many of the values of the adjacent Wallaroo National Park. It is also in close proximity to Seaham Swamp Nature Reserve.

The proposed offset site does not contain Swamp Oak Forest EEC, but contains riparian and floodplain communities including Lowland Rainforest on Floodplain EEC and Lower Hunter Valley Dry Rainforest EEC. It also contains more common vegetation types that occur across the proposed pipeline corridor alignment and habitat for a range of threatened fauna species that may be impacted.

The offset package being prepared for the pipeline corridor will protect more than six times the amount of vegetation to be impacted. The proposed pipeline corridor realignments are minor and there would be an overall reduction in clearing of native vegetation. It is therefore considered that the proposed modification could be adequately integrated into the GGP biodiversity offset package. On balance the proposed biodiversity offset site is considered to adequately compensate for the GGP's impacts, inclusive of the proposed modification.

The Project approval requires preparation of a Flora and Fauna Management Plan (Condition 7.3(a)), including measures to minimise and manage impacts to native vegetation, important habitat features, riparian and instream habitat, and construction practices to avoid direct interaction/injury to fauna. It also requires preparation of a Watercourse Crossing Management Strategy (Condition 7.3(b)), including measures to minimise impacts of pipeline waterway crossings and for rehabilitation. These existing approved measures are considered suitable for the proposed modification and no additional management or monitoring measures are required.

The recommendations and mitigation measures specific to each of the key ecological features identified in the proposed modification areas are listed in Table 6.7, along with the relevant Project approval condition. Each of the recommendations and management measures will be implemented under the relevant requirements under the Project approval and management plans for the protection of biodiversity for the approved GGP.

Table 6.7 Key ecological features and recommendations

Key ecological features	Recommendation / management	Relevant Project approval condition
Seaham		
Surrounding remnant vegetation	Implement sediment and erosion controls	3.2 and 7.3(c)
	Undertake follow-up weed control	7.3(a)
Drainage lines	Implement sediment and erosion controls before trenching of watercourses	3.2 and 7.3(c)
Brandy Hill		
Adjacent Barties Creek (constructed channel)	Implement and regularly check sediment and erosion controls	3.2 and 7.3(c)
Hunter Lowland Redgum Forest and Swamp Oak Floodplain Forest EECs (where clearing is required)	Where clearing of EECs and Koala habitat is required, the ROW will be minimised to 15 m wide, and clearing of trees avoided where feasible.	7.3(a)
'Marginal' habitat for Koalas mapped under the Port Stephens Council CKPoM (where clearing is required)	Implement and regularly check sediment and erosion controls	3.2 and 7.3(c)
	Undertake follow-up weed control	7.3(a)
Millers Forest		
Drainage lines	Ensure that sedimentation and erosion controls are in place before trenching of drainage lines (Identification No. 168-169).	3.2 and 7.3(c)
Tomago		
Swamp Oak Floodplain Forest (EEC) (where clearing is required)	Where clearing is required, the ROW will be minimised to 15 m wide and clearing of trees avoided where feasible.	7.3(a)
	Implement and regularly check sediment and erosion controls	3.2, 7.3(c)
	Undertake follow-up weed control	7.3(a)
Tributary of Francis Greenways Creek	Implement sediment and erosion controls before trenching	3.2, 7.3(b) and 7.3(c)
Hunter River	HDD entry and exit points to be set back from the riparian areas and avoid Mangrove Forest and the Swamp Oak Forest (EEC) at around KP 92.	3.3, 7.3(a), 7.3(b) and 7.3(c)

6.4 Conclusion

The proposed modification has been designed to minimise impacts on native vegetation, EECs, paddock trees and riparian areas. This has generally been achieved by shifting the alignment to avoid areas of conservation significance. Where these features could not be avoided, then an alignment with the least amount of disturbance has been selected. The proposed modification reduces proposed clearing of remnant native vegetation by approximately 1.69 ha.

Impact assessments for those species, populations and communities listed under the TSC Act concluded that the proposed modification is unlikely to have any significant impacts, given the modified nature of the proposed modified sections of pipeline corridor, and provided that the environmental management measures already contained within the Project approval are implemented. Similarly, it was concluded that MNES listed under the EPBC Act would not be significantly impacted provided management and mitigation measures already contained within the Project approval are implemented. The proposed modification is not a controlled action under the EPBC Act.

To ensure the protection of native vegetation and fauna habitat, a range of mitigation and management measures are proposed, in accordance with the existing conditions of Project approval. The existing approved measures are considered suitable for the proposed modification and no additional measures are required.

