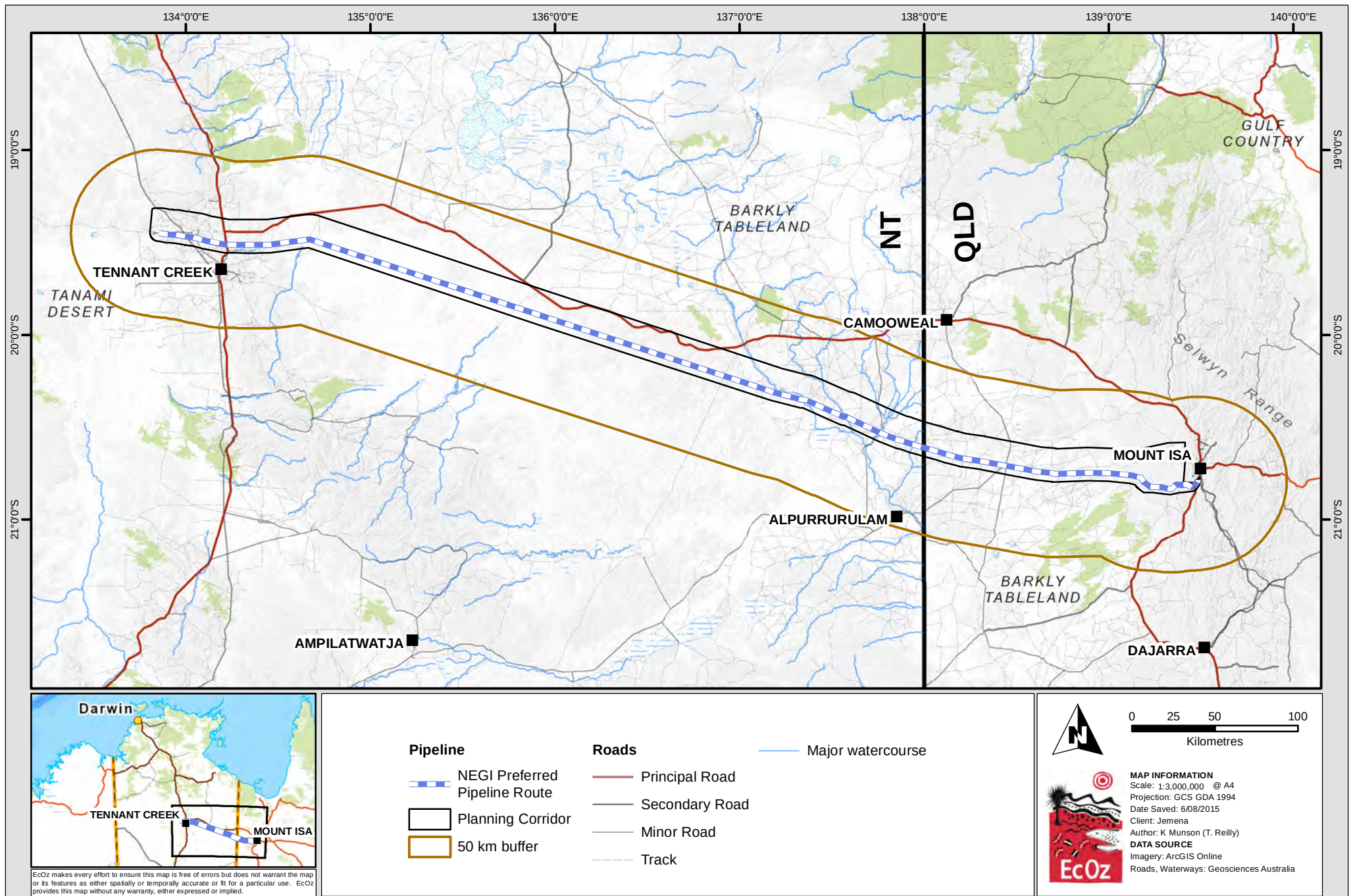
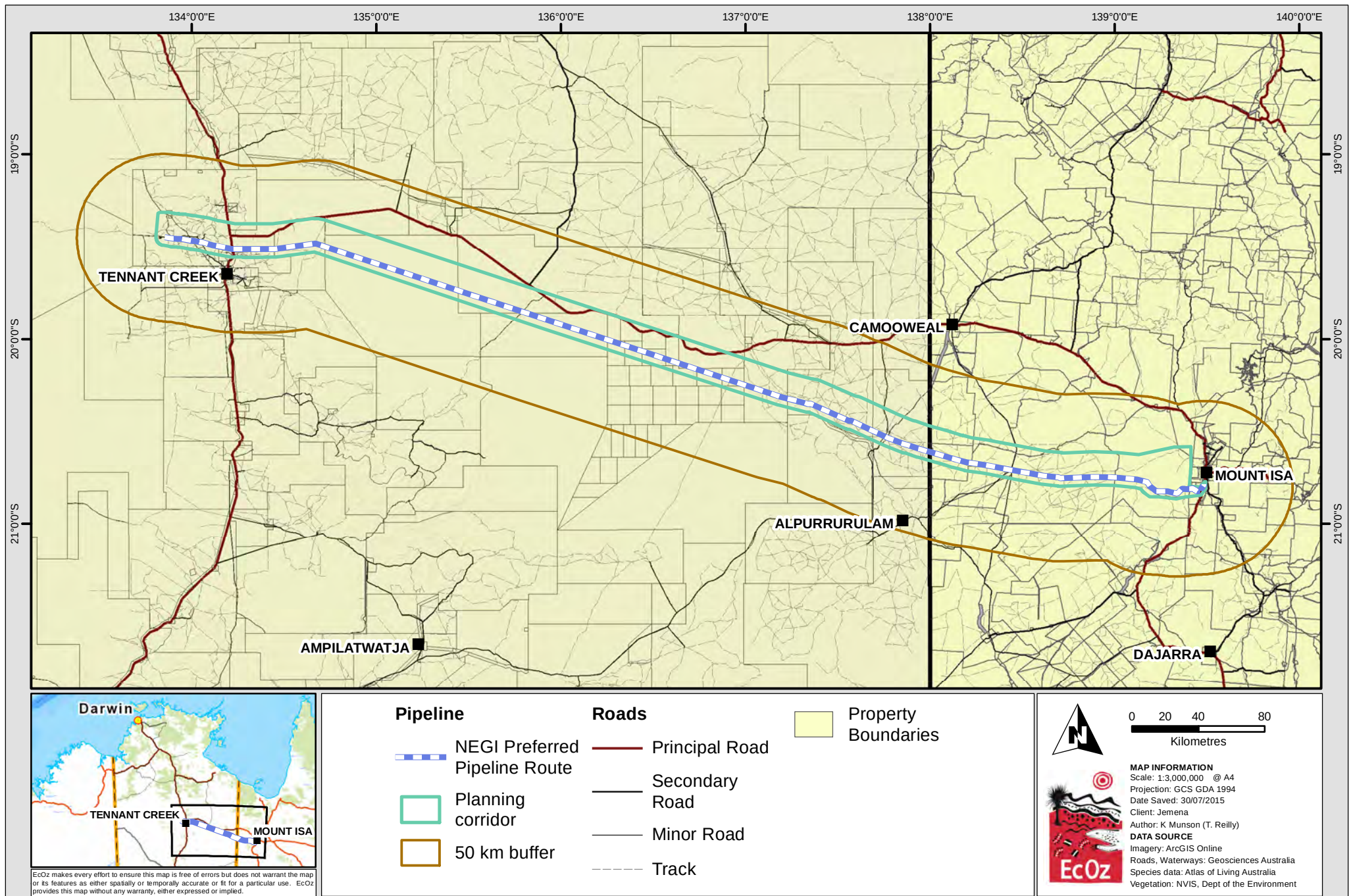


APPENDIX A1 – PROJECT MAPS



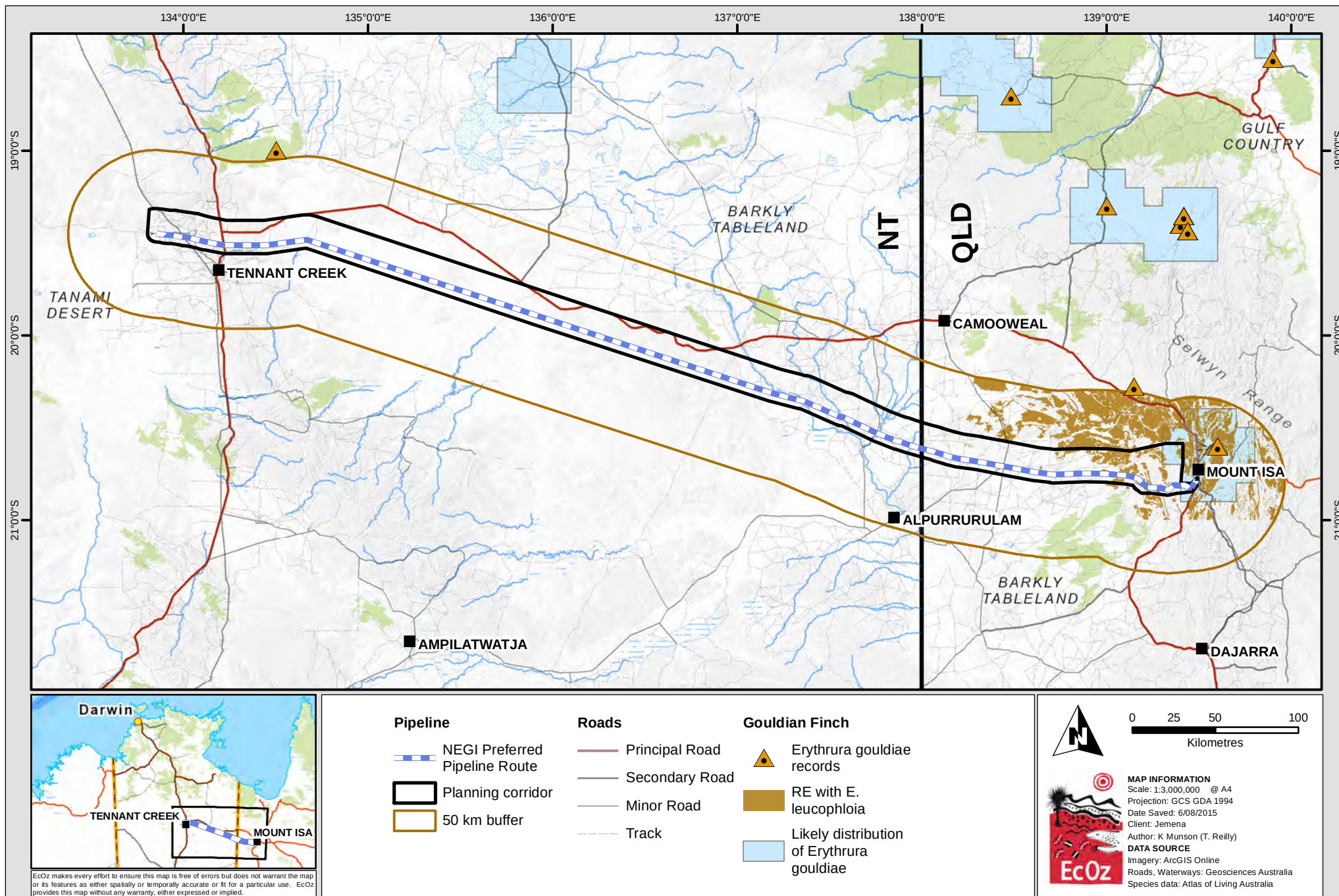
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Figure 1. Location of proposed pipeline alignment



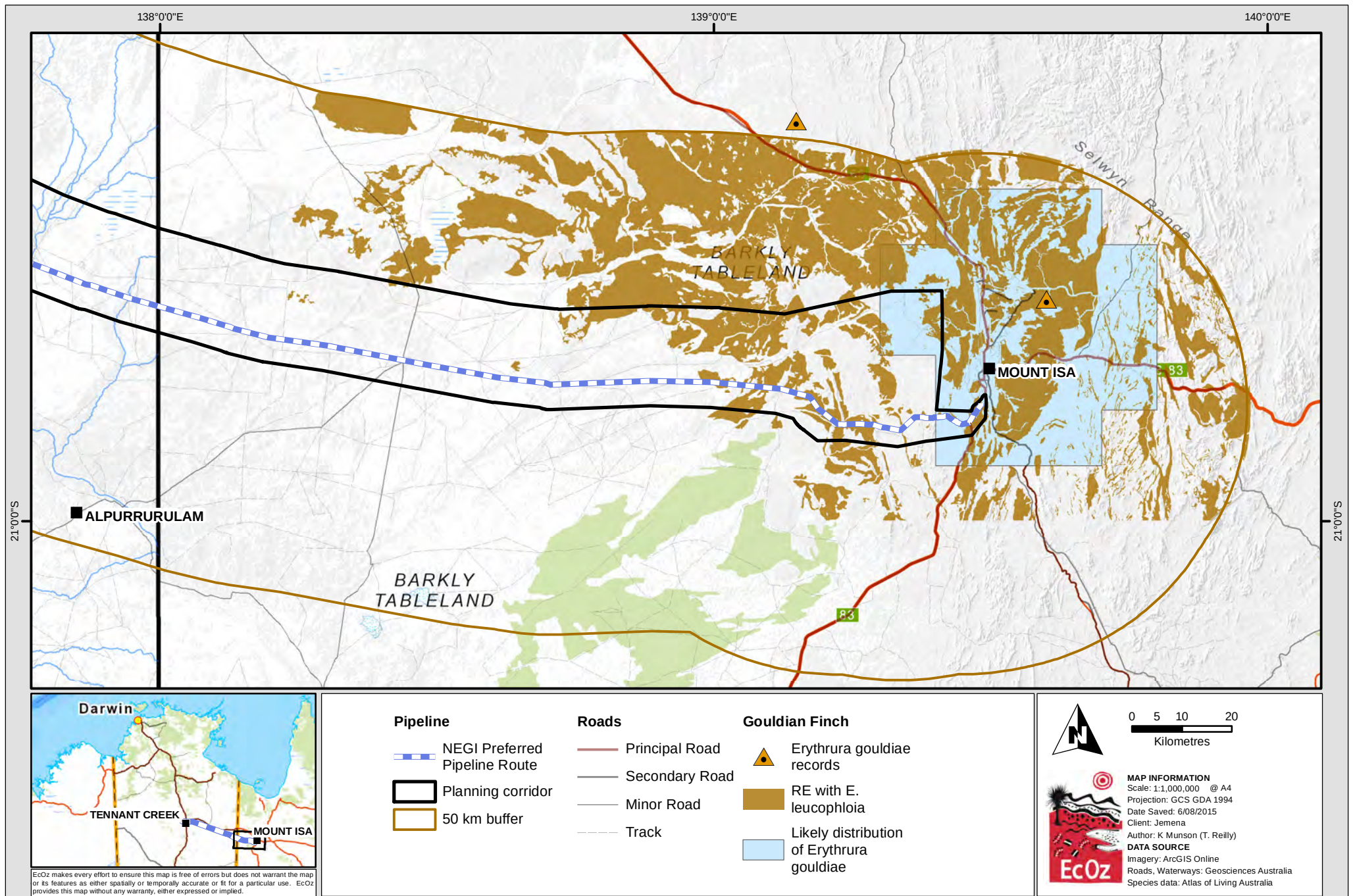
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Figure 2. Property boundaries crossed by the proposed alignment



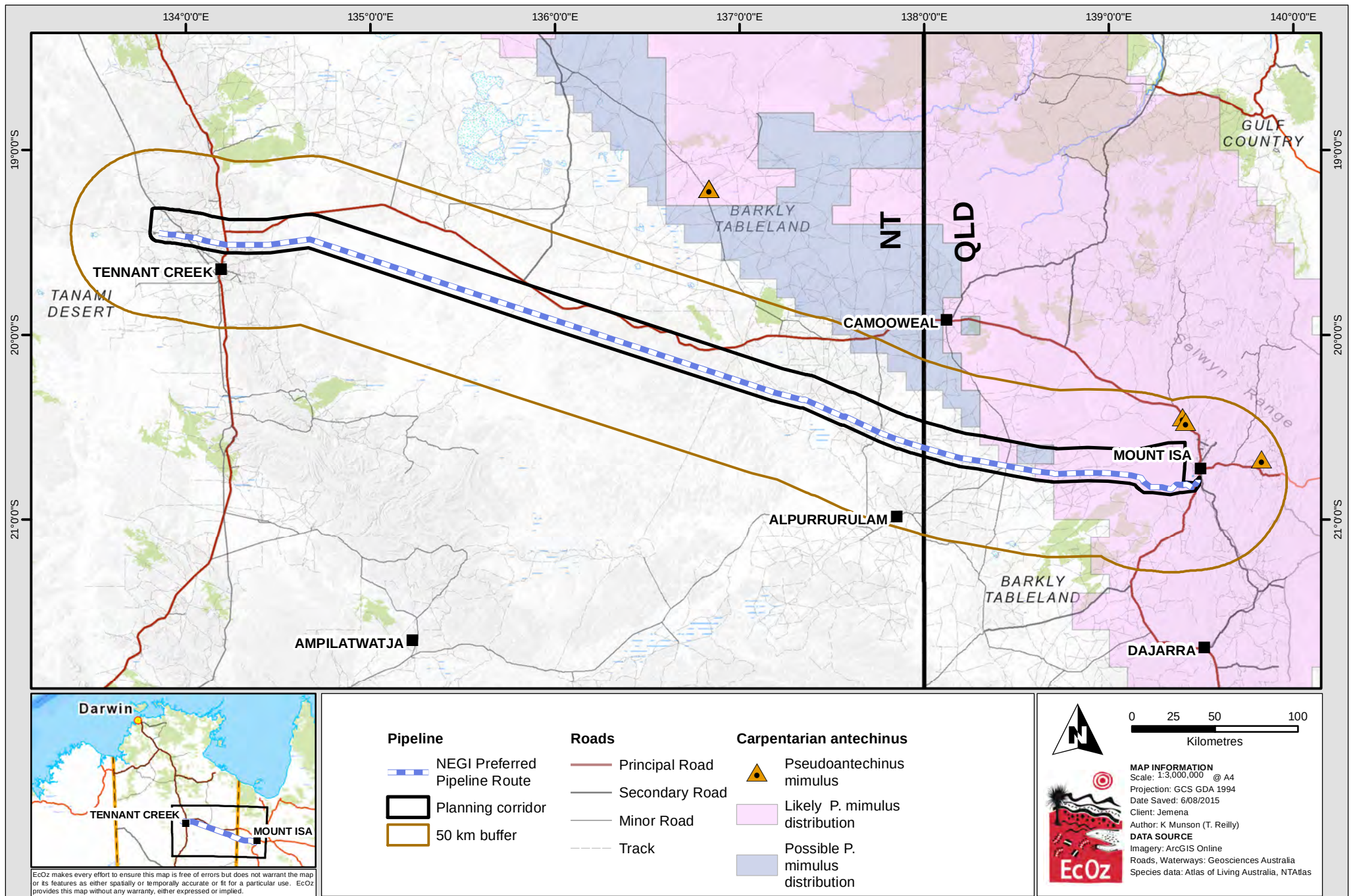
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Figure 3. Gouldian Finch records and derived distribution across the proposed pipeline alignment



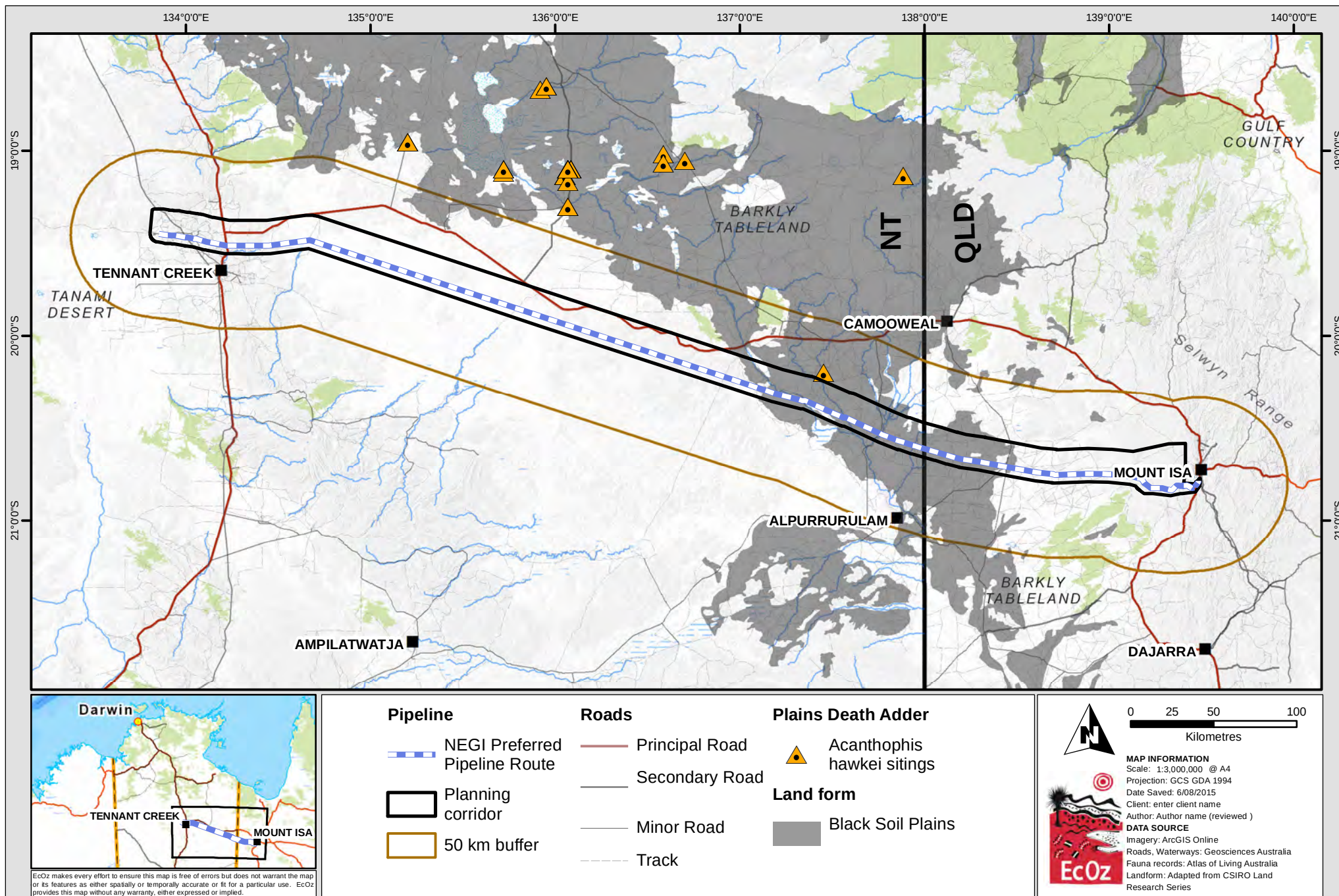
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Figure 4. Gouldian Finch records and derived distribution near Mount Isa



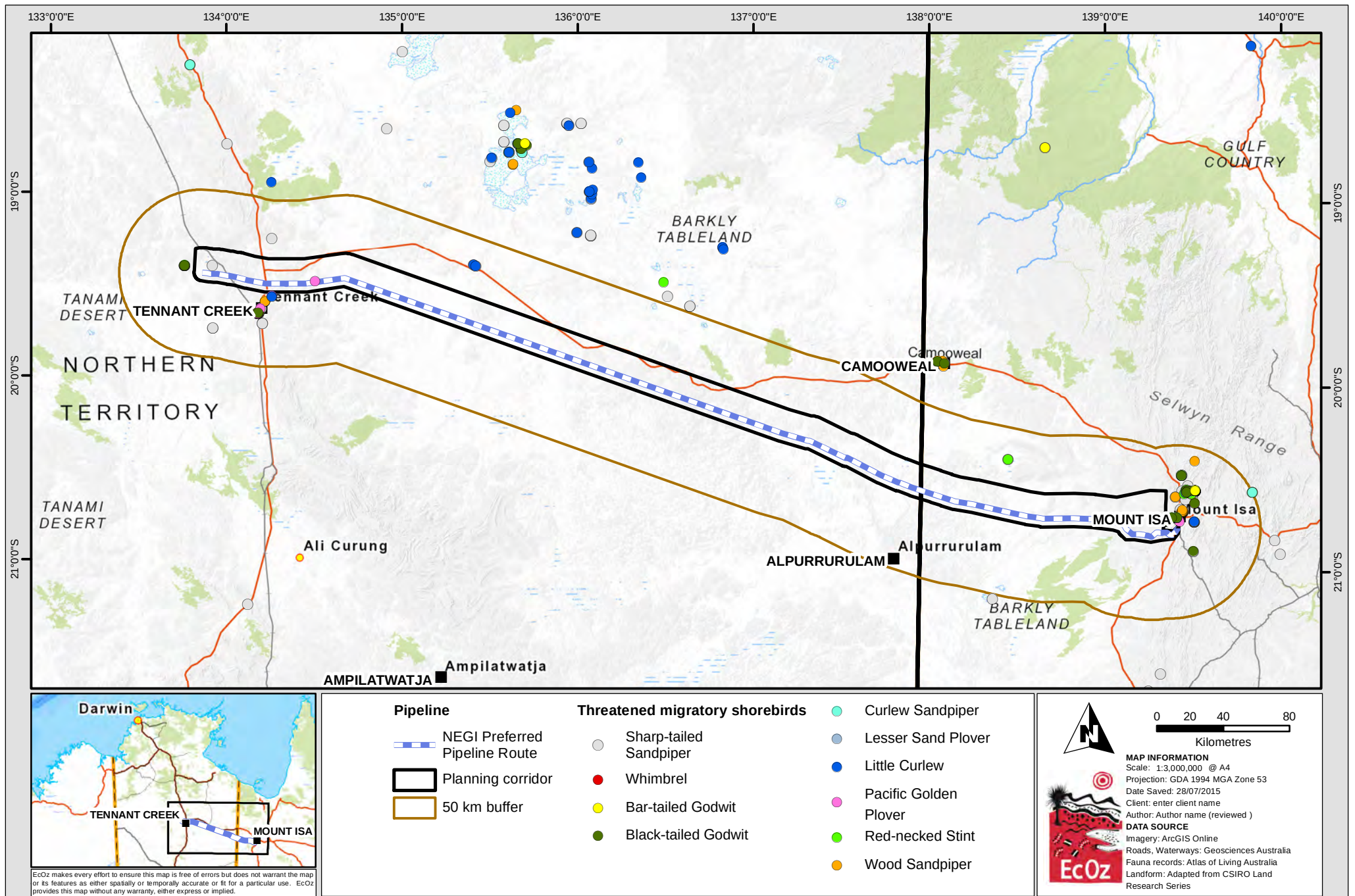
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Figure 5. Carpentarian Antechinus records and distribution across the proposed Jemena NEGI pipeline alignment



Path: Z:\01 EcOz Documents\04 EcOz Vantage GIS\EZ15211 - Jemena EPBC Referral\01 Project Files\KM EPBC\Plains Death Adder.mxd

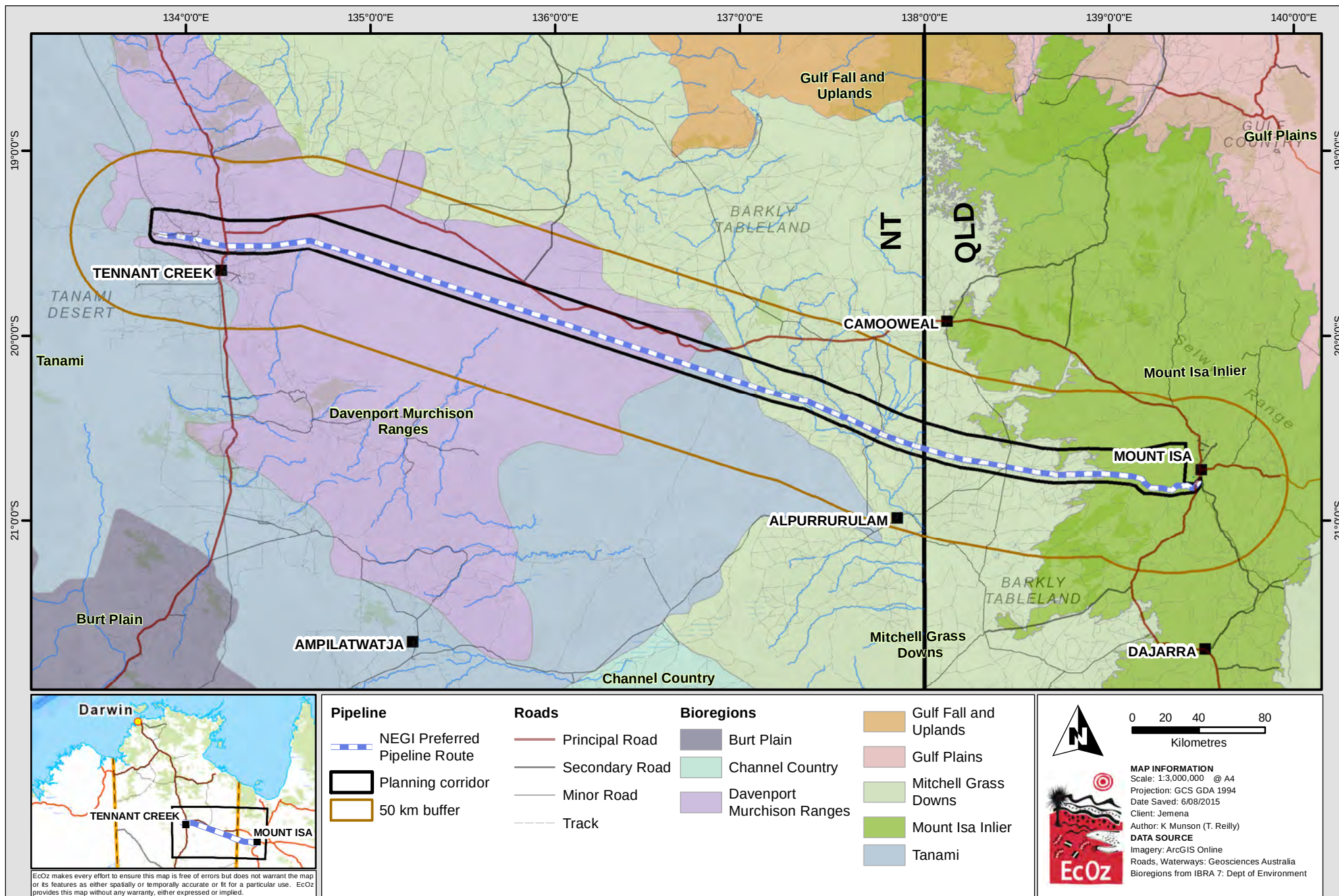
Figure 6. Plains Death Adder records and black soil plains across the proposed pipeline alignment



Path: Z:\01 EcOz Documents\04 EcOz Vantage GIS\EZ15211 - Jemena EPBC Referral\01 Project Files\KM EPBC\Threatened Migratory Shorebirds.mxd

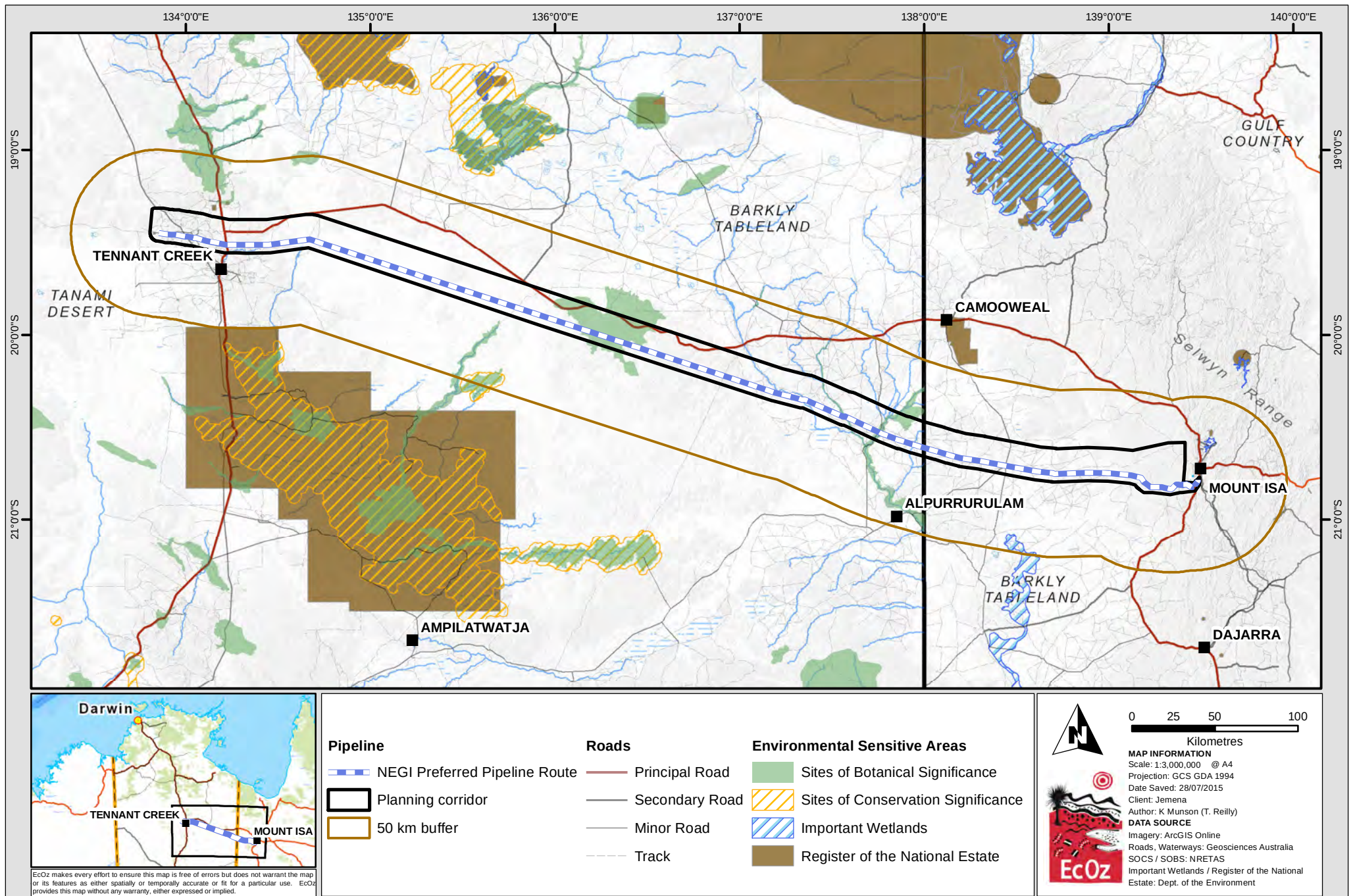
Figure 7. Threatened migratory shorebird records

APPENDIX A2 – PROJECT MAPS



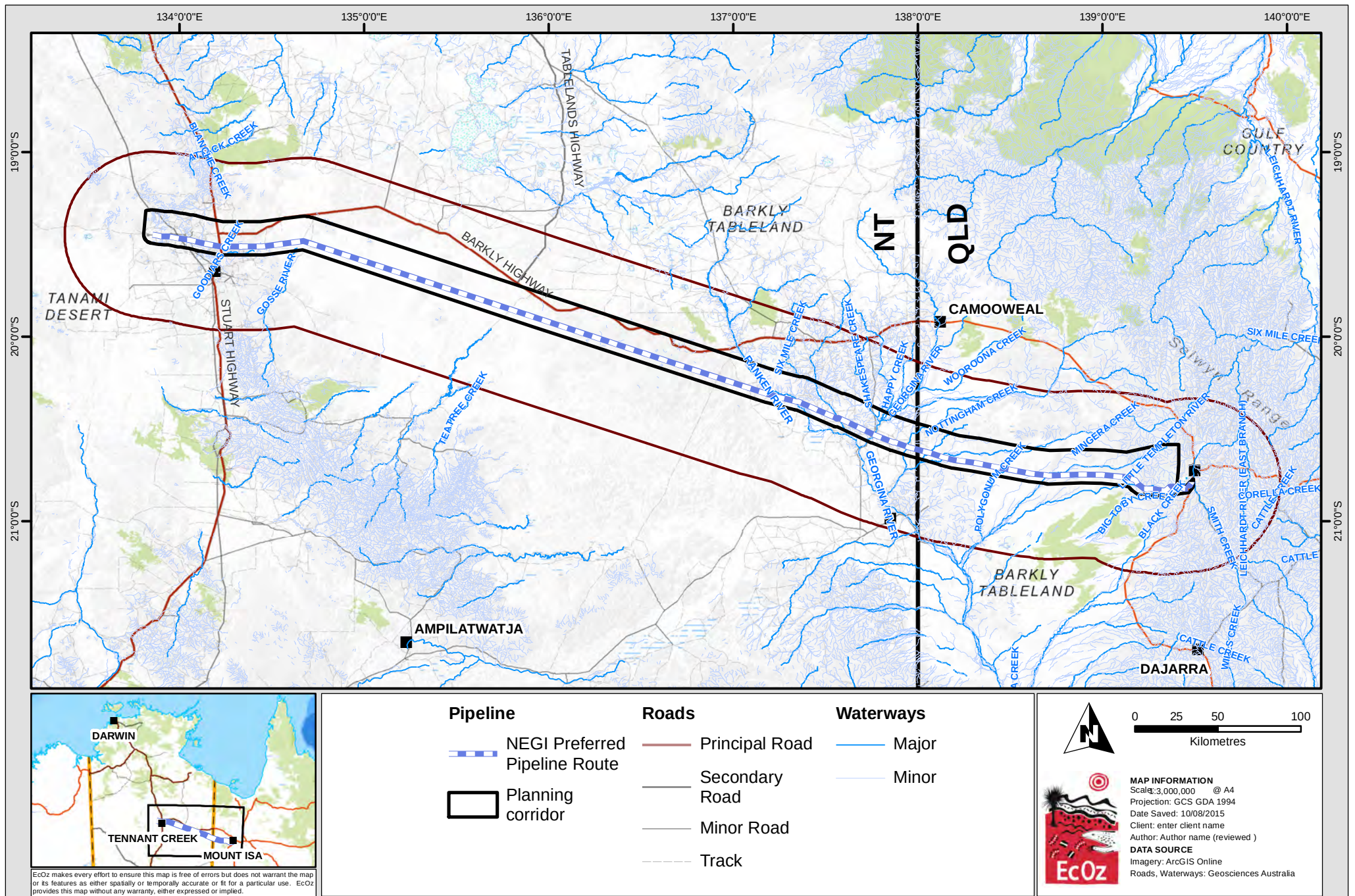
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Figure 8. Bioregions across the proposed pipeline alignment



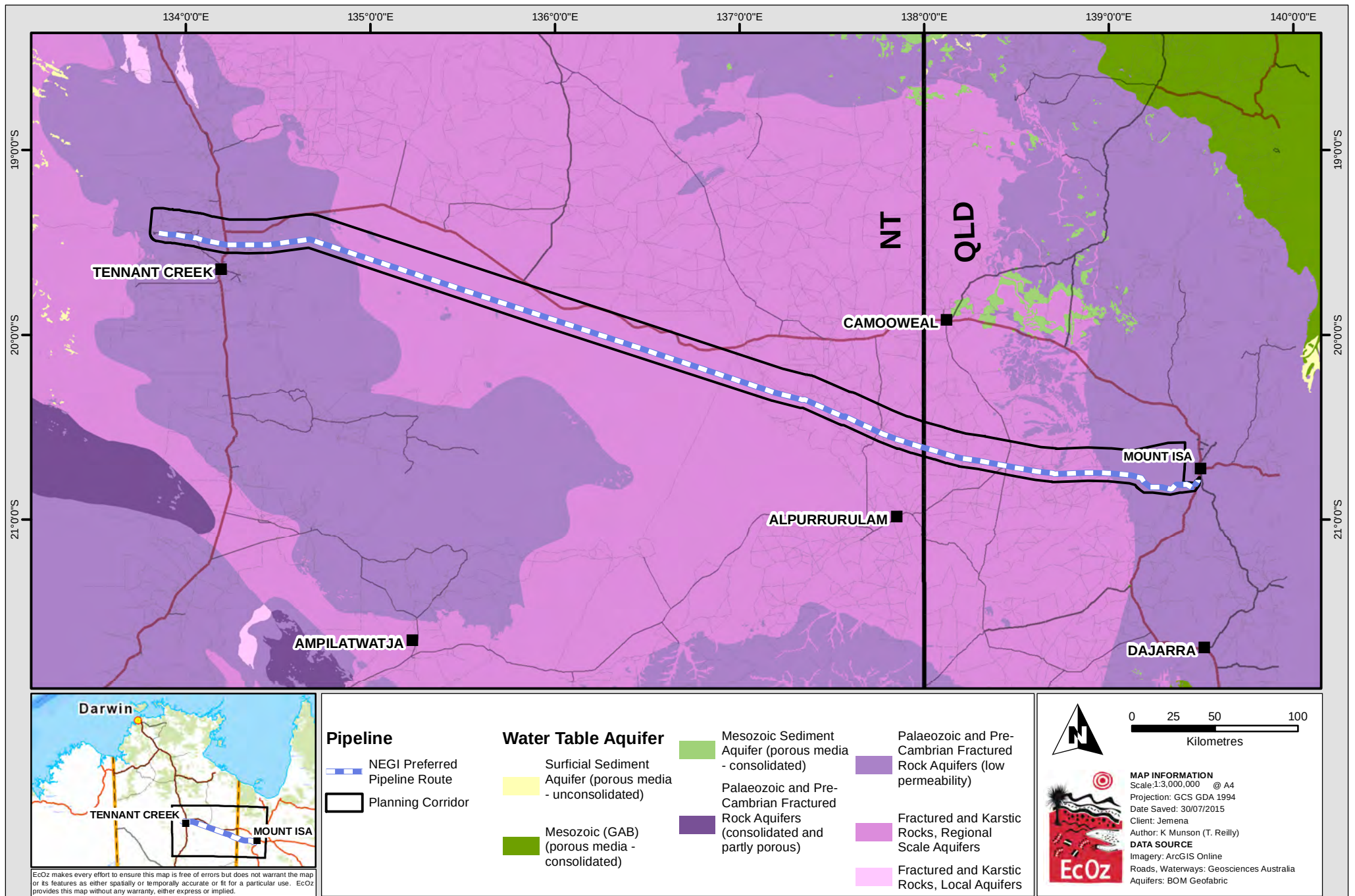
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Figure 9. Environmentally Sensitive Areas



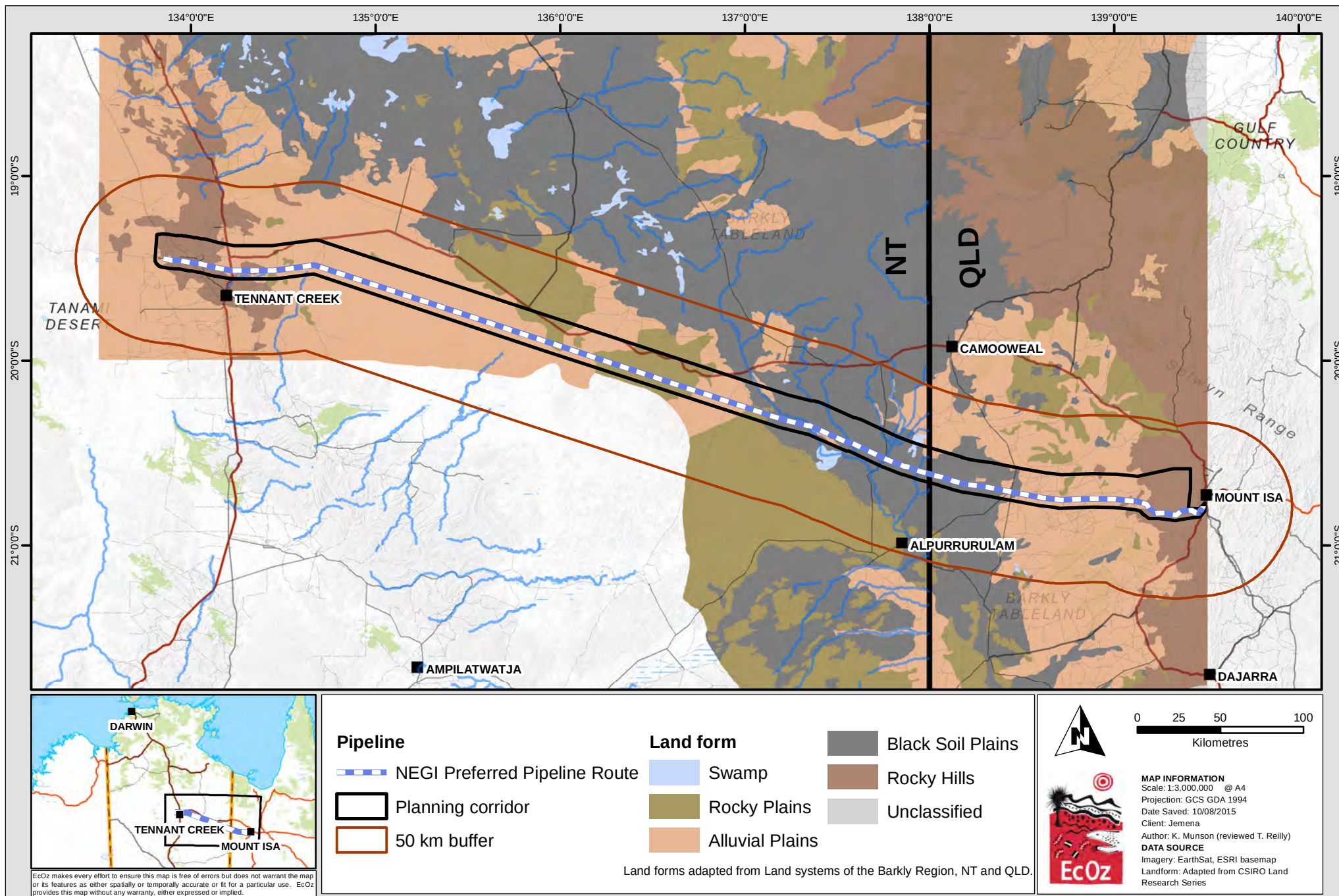
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Figure 10. Watercourses across the proposed pipeline alignment



Path: Z:\01 EcOz Documents\04 EcOz Vantage GIS\EZ15211 - Jemena EPBC Referral\01 Project Files\KM EPBC\Water Table Aquifers.mxd

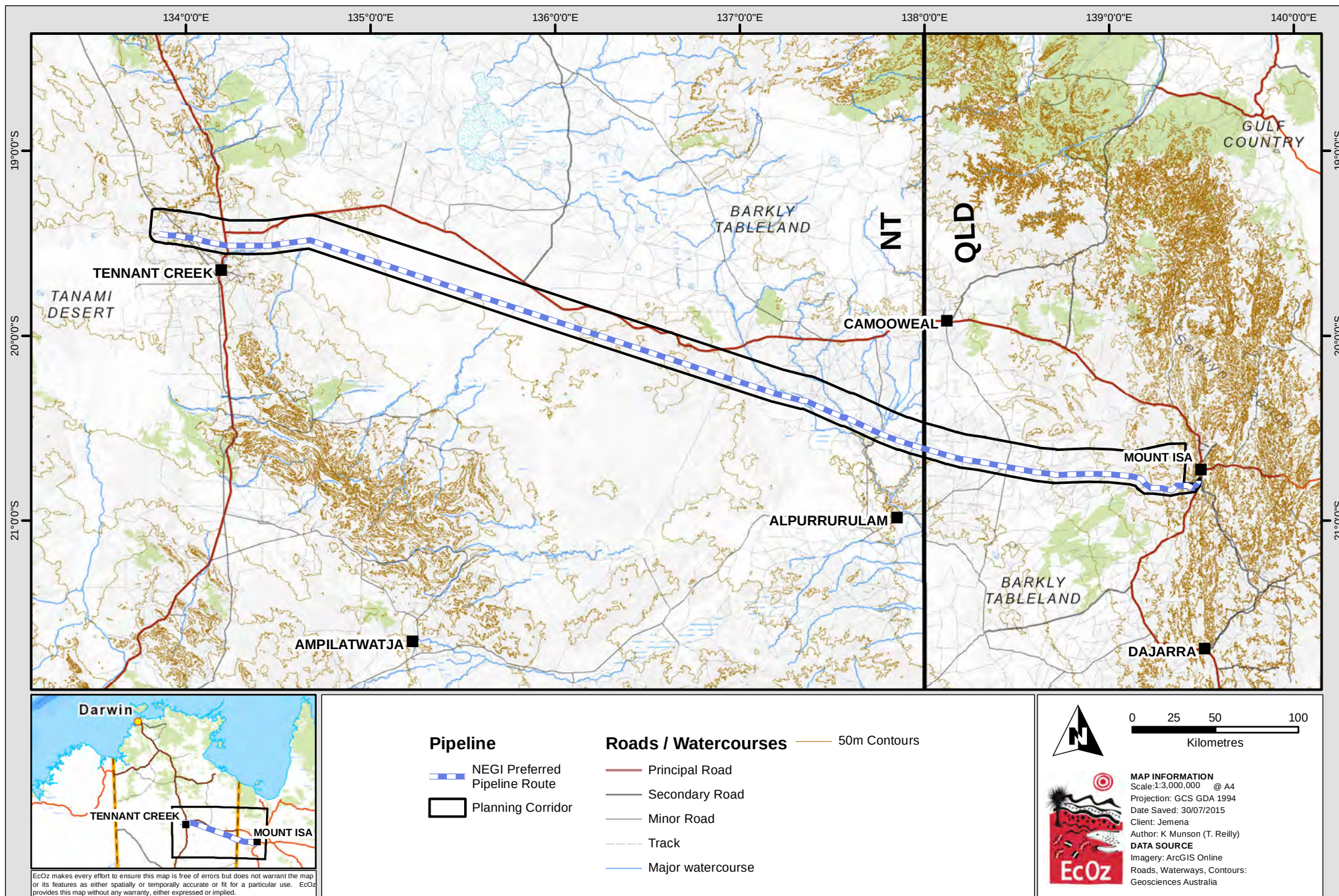
Figure 11. Groundwater resources



Path: Z:\01 EcOz Documents\04 EcOz Vantage GIS\15211 - Jemena EPBC Referral\01 Project Files\KM EPBC\Land forms.mxd

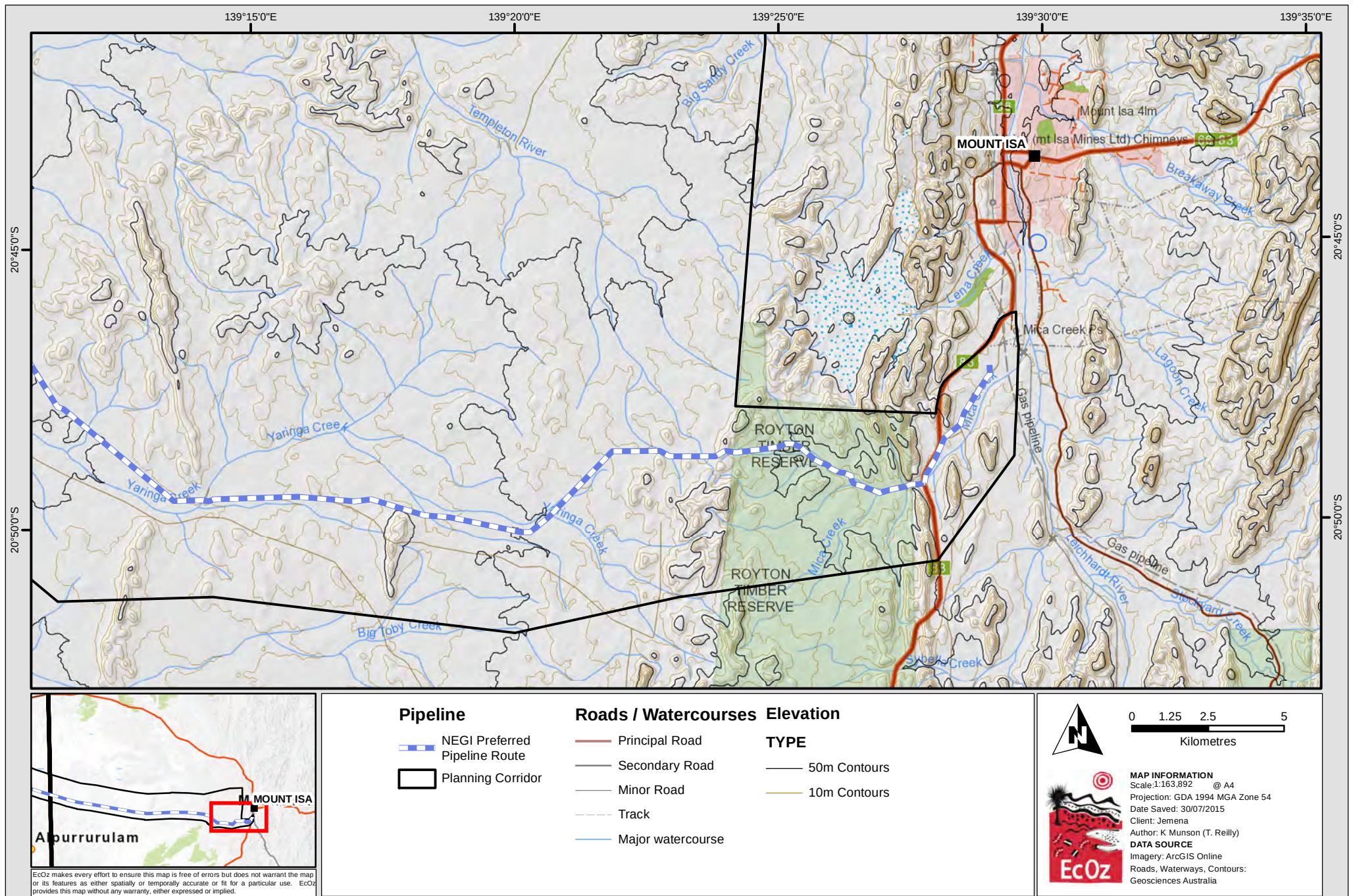
Figure 12. Derived land forms across the proposed pipeline alignment

APPENDIX A3 – PROJECT MAPS



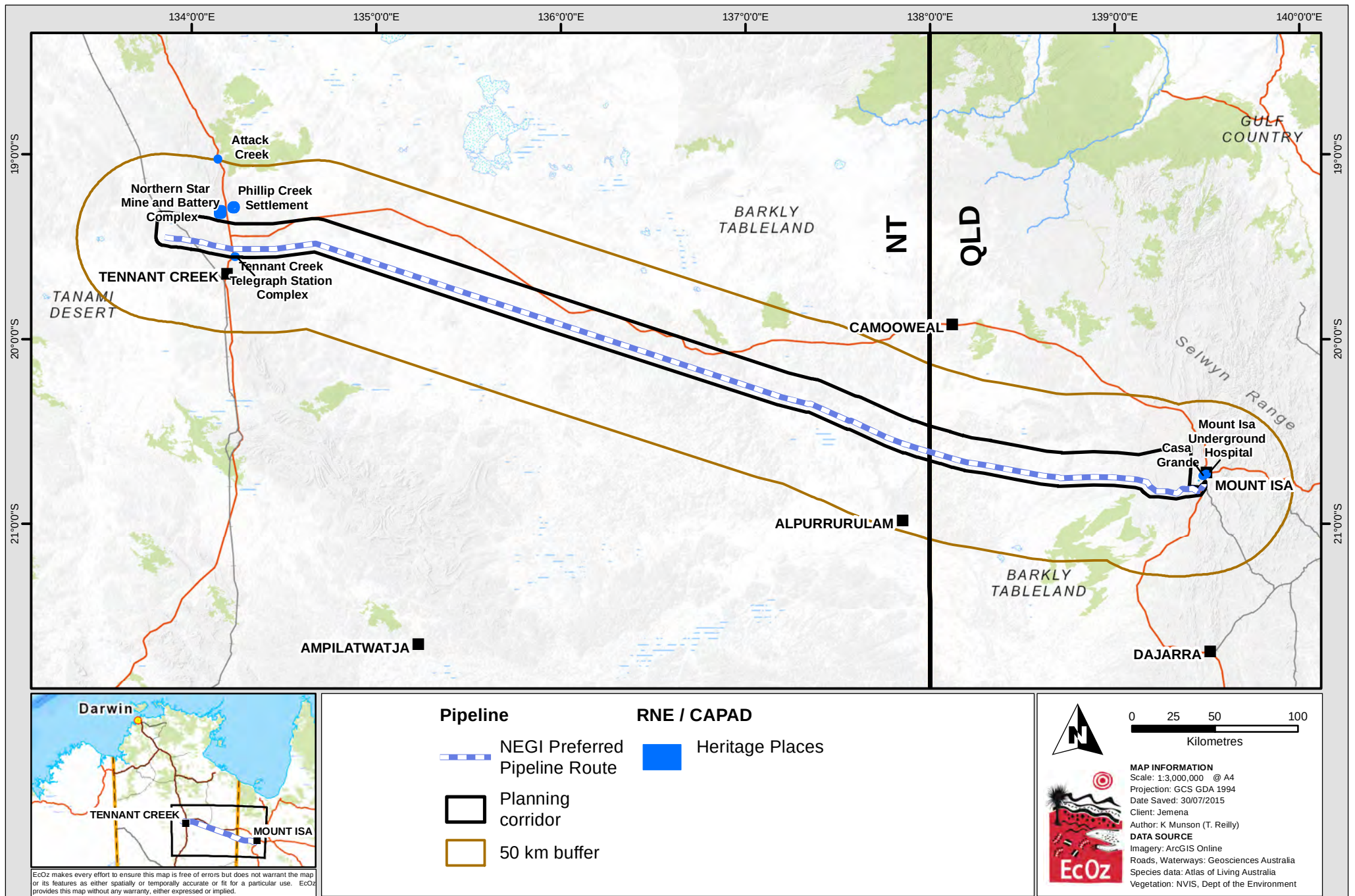
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Figure 13. Topography along the proposed alignment



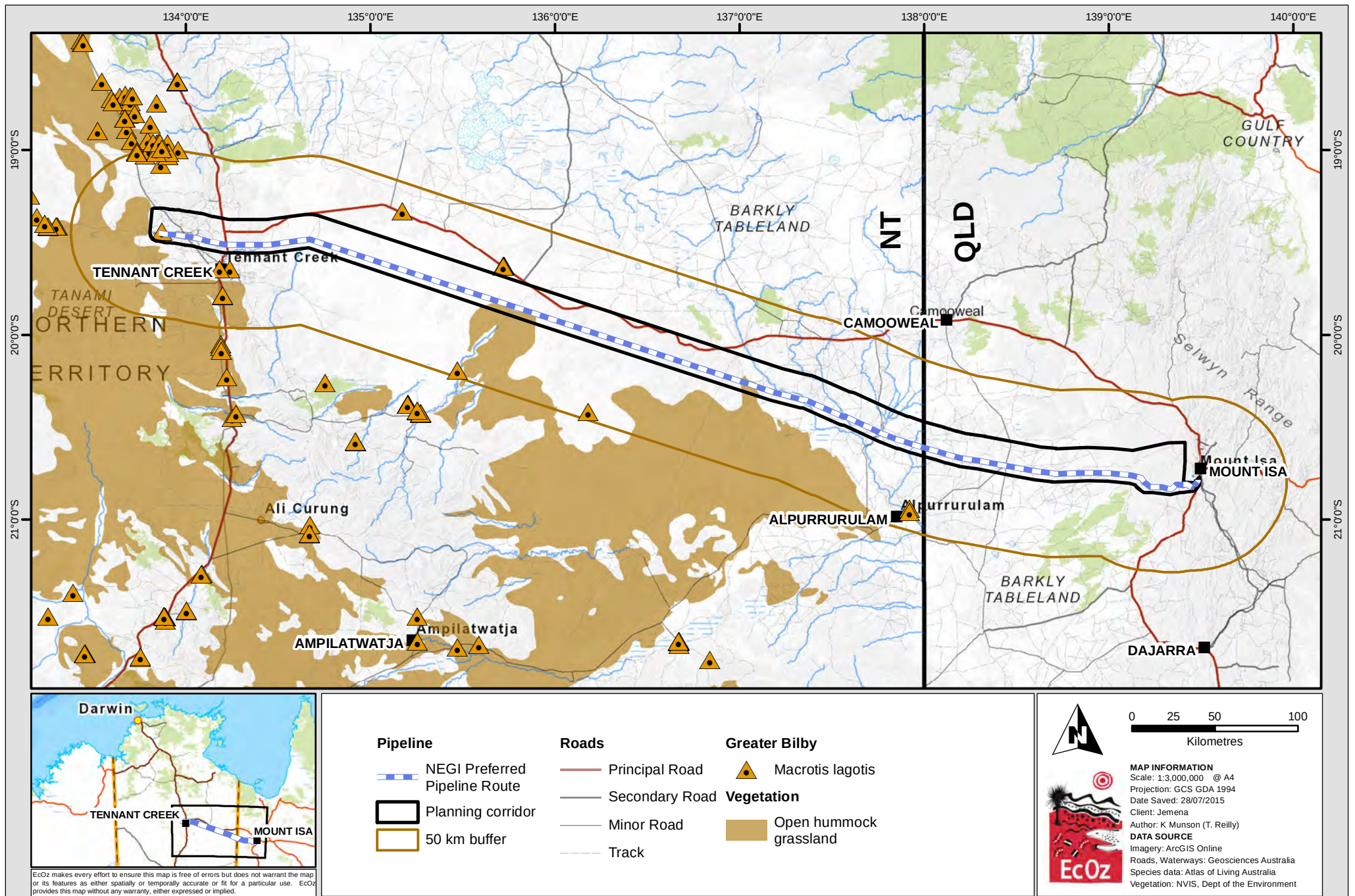
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Figure 14. Contours at the Mount Isa end of the proposed alignment



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Figure 15. Places with historic values along the proposed alignment



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Figure 16. Greater Bilby records and open hummock grassland along the proposed alignment

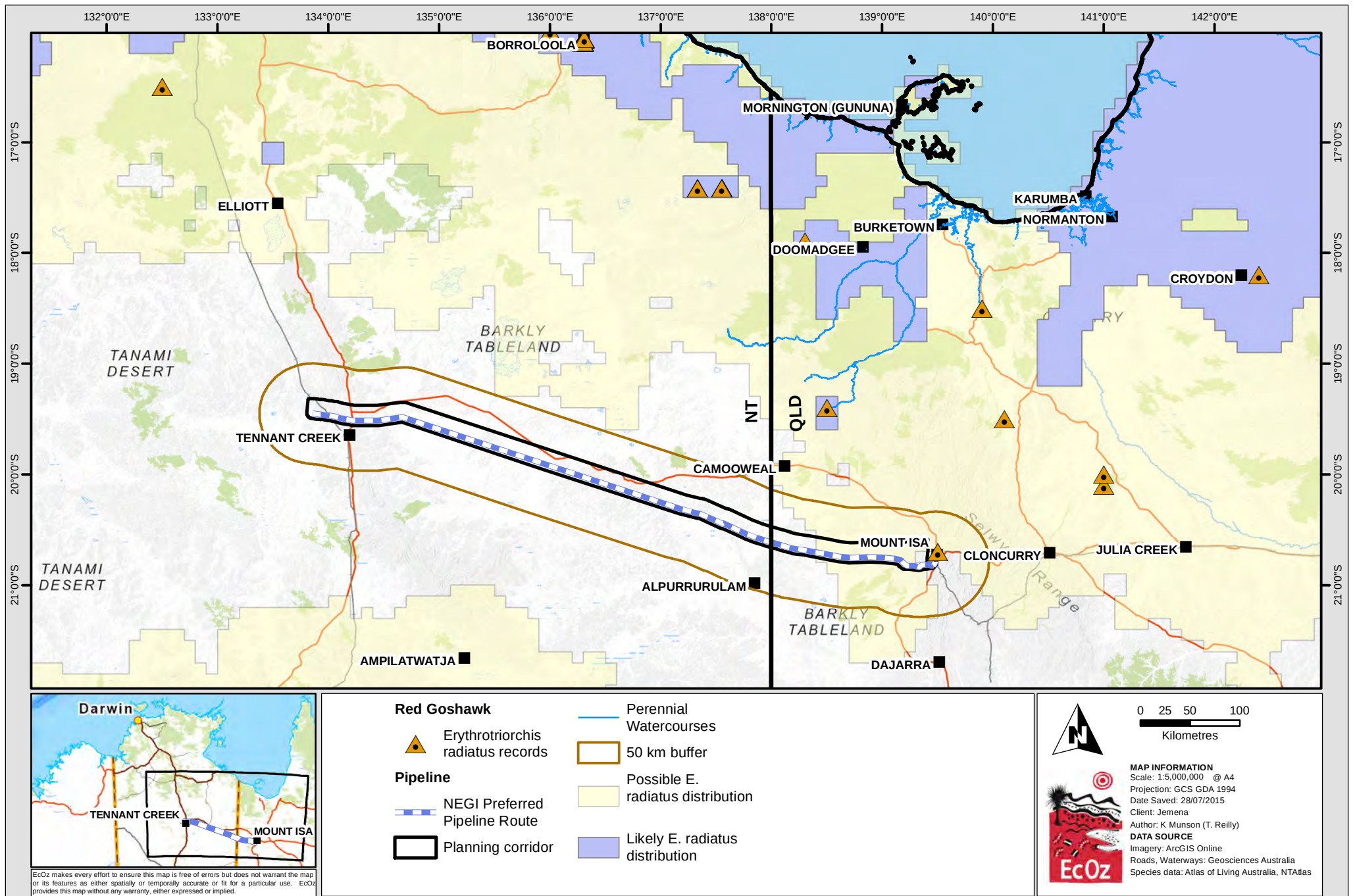
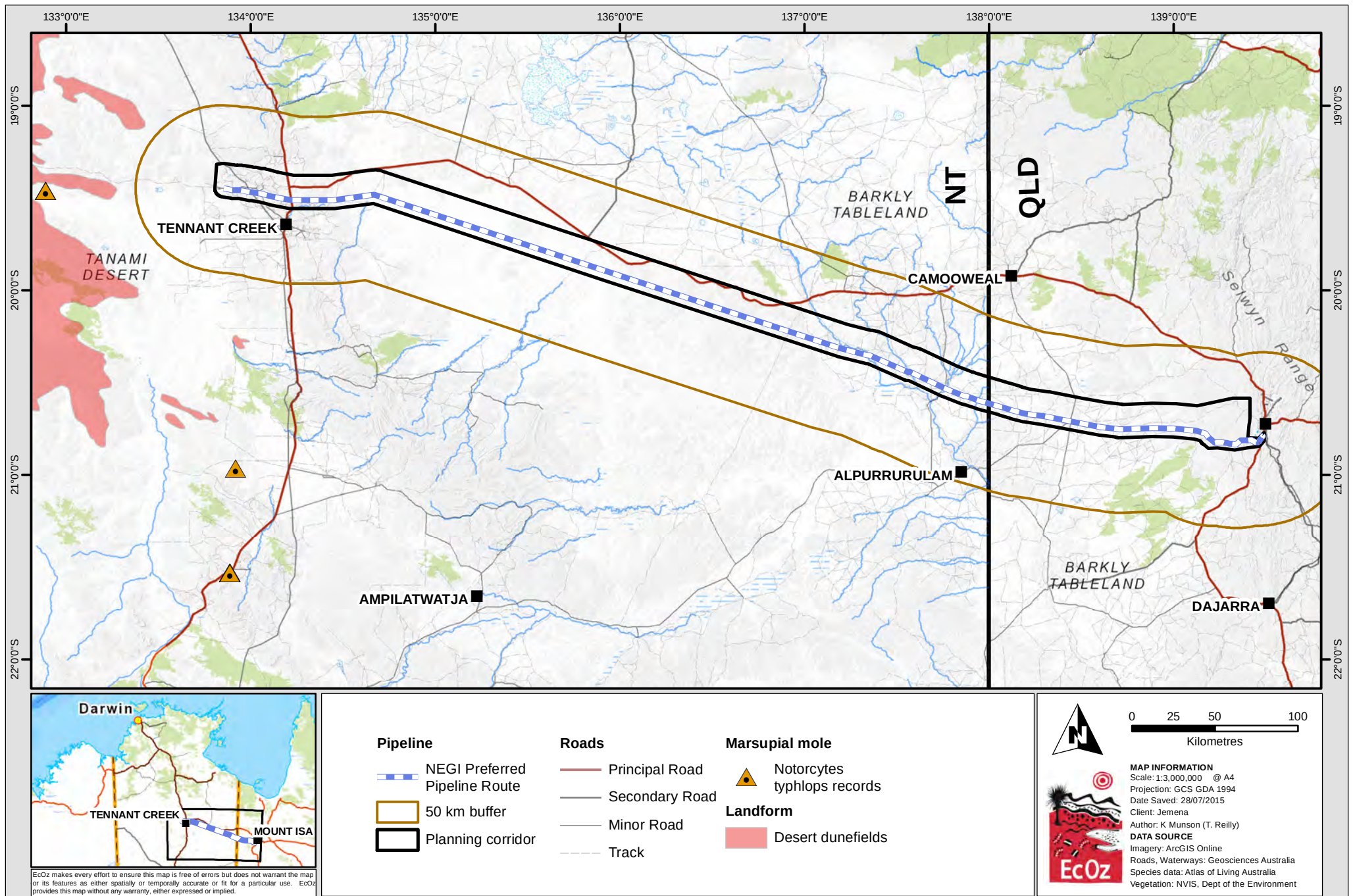


Figure 17. Red Goshawk records and modelled distribution



Path: Z:\01 EcOz Documents\04 EcOz Vantage GIS\EZ15211 - Jemena EPBC Referral\01 Project Files\KM EPBC\Marsupial Mole.mxd

Figure 18. Marsupial Mole records and desert dunefield areas along the proposed alignment

APPENDIX B – EPBC PROTECTED MATTERS SEARCH REPORT



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 26/05/15 14:19:24

[Summary](#)

[Details](#)

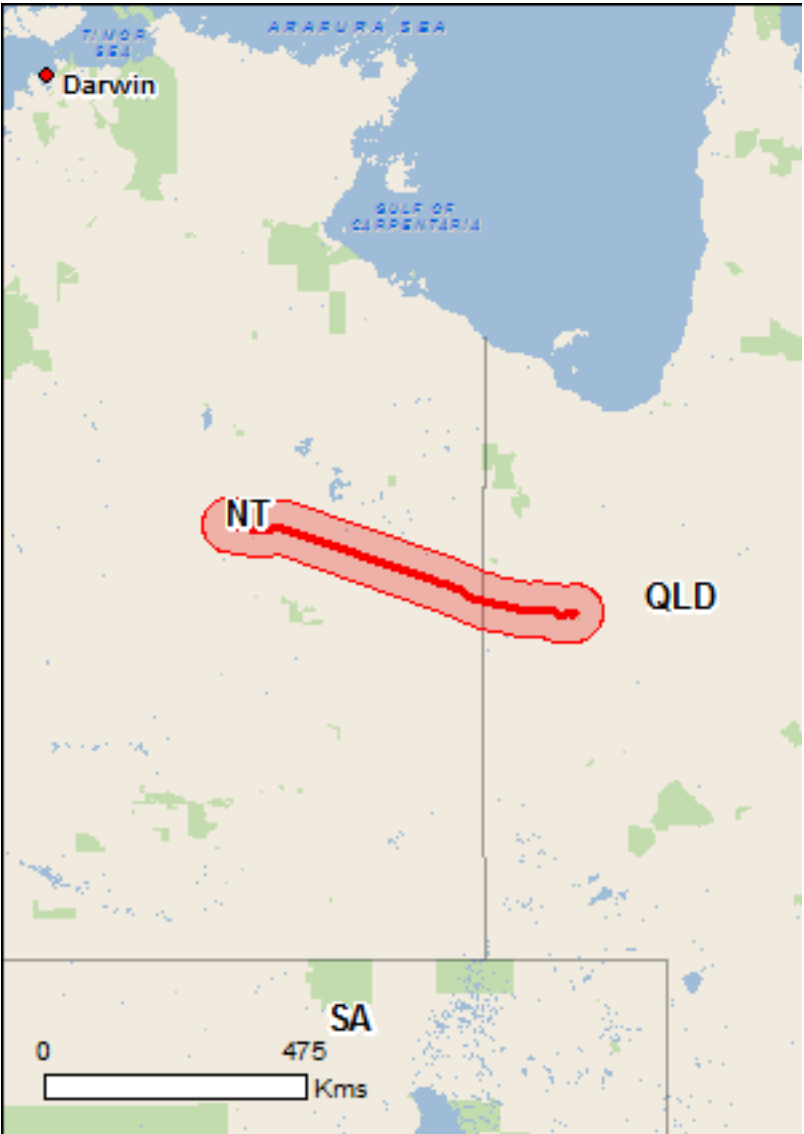
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
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[Coordinates](#)

Buffer: 50.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	13
Listed Migratory Species:	20

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	None
Listed Marine Species:	25
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	27
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Erythroriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Notoryctes typhlops Itjaritjari, Southern Marsupial Mole, Yitjarritjarri [296]	Endangered	Species or species habitat likely to occur within area
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat may occur within area
Pseudantechinus mimulus Carpentarian Antechinus [59283]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Elseya lavarackorum Gulf Snapping Turtle [67197]	Endangered	Species or species habitat known to occur within area
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Sharks		
Pristis pristis		
Large-tooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius mongolus		
Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat known to occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa		
Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius minutus		
Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus		
Whimbrel [849]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Pandion cristatus Eastern Osprey [82411]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Commonwealth Land - Australian Government Solicitor Commonwealth Land - Department of Administrative Services Commonwealth Land - Department of Transport & Regional Development Defence - MT ISA TRAINING DEPOT Defence - NORFORCE DEPOT - TENNANT CREEK Defence - RSL Hall

Listed Marine Species	[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Stiltia isabella Australian Pratincole [818]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Reptiles		
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Name		State
Ballara		QLD
John Flynn		NT
Tennant Creek Telegraph Station		NT

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina		
Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius		
Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus		
Horse [5]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913] Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507] Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018] Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Austral Limestone Aggregation	QLD
Lake Moondarra	QLD

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-19.448091 133.852,-19.452231 133.879,-19.455697 133.897,-19.456822 133.919,-19.45737 133.926,-19.45718 133.94,-19.468427 134.0,-19.466909 134.002,-19.475236 134.047,-19.474232 134.05,-19.491244 134.11,-19.492987 134.122,-19.511303 134.218,-19.511427 134.274,-19.511537 134.276,-19.511561 134.329,-19.512479 134.332,-19.511579 134.334,-19.511502 134.448,-19.482409 134.669,-20.313478 137.19,-20.351487 137.339,-20.351112 137.351,-20.443478 137.559,-20.444154 137.561,-20.441317 137.568,-20.534045 137.767,-20.572456 137.866,-20.573716 137.876,-20.597297 137.945,-20.630959 138.066,-20.649457 138.126,-20.65237 138.133,-20.668016 138.196,-20.68279 138.3,-20.715892 138.474,-20.740771 138.61,-20.750399 138.696,-20.753327 138.704,-20.746637 138.884,-20.749098 138.997,-20.760721 139.121,-20.775522 139.173,-20.781631 139.178,-20.796749 139.188,-20.797486 139.19,-20.799988 139.193,-20.825142 139.224,-20.824975 139.233,-20.825327 139.235,-20.824792 139.237,-20.824284 139.264,-20.825867 139.282,-20.82521 139.287,-20.830137 139.303,-20.830854 139.311,-20.835483 139.334,-20.835569 139.337,-20.831385 139.342,-20.81172 139.363,-20.811768 139.378,-20.813351 139.381,-20.813557 139.396,-20.812499 139.397,-20.812147 139.398,-20.811933 139.399,-20.812237 139.4,-20.812436 139.402,-20.810914 139.415,-20.809926 139.418,-20.810043 139.42,-20.810835 139.422,-20.814647 139.427,-20.816014 139.429,-20.816145 139.43,-20.816661 139.431,-20.817401 139.432,-20.817893 139.433,-20.818417 139.434,-20.818767 139.435,-20.818784 139.436,-20.819633 139.438,-20.821066 139.439,-20.822121 139.439,-20.822951 139.442,-20.824837 139.447,-20.823863 139.451,-20.823097 139.456,-20.822583 139.457,-20.822342 139.458,-20.822512 139.459,-20.821628 139.463,-20.820632 139.465,-20.81554 139.468,-20.813018 139.47,-20.81177 139.473,-20.811418 139.473,-20.809836 139.475,-20.804157 139.48,-20.796801 139.484,-20.793302 139.488,-20.779969 139.484

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- [Department of Environment and Natural Resources, South Australia](#)
- [Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [Environmental and Resource Management, Queensland](#)
- [Department of Environment and Conservation, Western Australia](#)
- [Department of the Environment, Climate Change, Energy and Water](#)
- [Birds Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [SA Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
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- [Australian National Herbarium, Atherton and Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence](#)
- [State Forests of NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix C – Threatened species likelihood analysis

This Appendix C aims to determine the likelihood of occurrence of threatened species within the Planning Corridor. It uses the threatened species output from the EPBC Protected Matters Search Tool report (Appendix B) and, by using species records data, modelled distributions, species ecology and habitat distribution it redefines likelihood of occurrence. This assessment has been undertaken using desktop information only, and results of this assessment will help identify which species will require special consideration (i.e. field work, management plans) during the environmental approvals process.

Method

The following procedure was used to determine the occurrence likelihood of threatened species within the Planning Corridor:

- 1) A search for Matters of National Environmental Significance (MNES) along the proposed pipeline route and within a 50 km buffer was undertaken using the Protected Matters Search Tool on 26 May 2015 (see Appendix B for this report). A 50 km buffer was used to get a broad scale picture of the area.
- 2) The Planning Corridor for this project is a 20km buffer (the final pipeline will occur within this buffer after Traditional Owners and other landholder agreements and ecological and geotechnical survey); consequently, for each of the species in Step 1 above, a likelihood of occurrence analysis within the 20km Planning Corridor was undertaken.
- 3) To further examine likelihood of occurrence of threatened species within the Planning Corridor, literature on the ecology and distribution of each of the above species was reviewed.
- 4) Habitat data from within the Planning Corridor was collated from spatial datasets from each jurisdictional, namely Regional Ecosystems data for Queensland and Land Units data from the Northern Territory.
- 5) Both 'likely' and 'possible' modelled expert distributions stored in the Atlas of Living Australia were used to assist in determining species distributions.
- 6) Threatened species records were obtained from the Northern Territory and Queensland datasets. For the Northern Territory, records were obtained from the NTG threatened species dataset. In Queensland data using the online tool *Wildlife Online* four coordinate points were entered (see table below) that included the Planning Corridor and an extended area around it. The results of these searches are in Appendix F. Records held in the Atlas of Living Australia were also used.

Search Area	Latitude	Longitude
1	20 - 21	138 - 139
2	21 - 22	138 - 139
3	20 - 21	139 - 140
4	21 - 22	139 - 140

- 7) After examining the threatened species list and using distribution / habitat data, each species allocated one of the following categories:
 - Known – there are recent records of the species within the Planning Corridor.
 - Likely – core habitat for the species occurs within the footprint but there are no records.
 - Unlikely – there is no core habitat for the species within the footprint; however, the species may be present on occasion.

It should be noted that resultant likelihood rankings may differ from those assigned in the EPBC Protected Matters Search Report because criteria in this assessment considers habitat present within the defined search area (see point 6 above), whereas the EPBC Report utilises coarser-scale filters.

- 8) For those species that are known or likely to occur, a more detailed analysis of the species ecology is provided to help assess and reduce impacts.

Results of likelihood analysis

Within the 50 km search area, the EPBC Act Protected Matters Search Report (Appendix B) lists 13 threatened species. The following table details the likelihood analysis of the 13 species within the Planning Corridor.

Table B- 1. Likelihood of occurrence within the Planning Corridor summary

Species	EPBC Act	Species details	Likelihood of occurrence
BIRDS			
Red Goshawk <i>Erythrorchis radiata</i>	VU	Habitat: Prefers tall open eucalypt forest and riparian areas. Nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water (Debus et al.1988; Aumann et al. 1991). Distribution: Sparsely distributed across much of the northern Australia, from the Kimberley to south-eastern Queensland. PMST presence: Species or habitat may occur. Queensland records: 1 record (unknown date) NT records: 0 records	UNLIKELY - Although the project footprint intersects riverine vegetation along major rivers (Figure 17) these do not contain permanent water and thus would not be suitable habitat. - Although the species' is sparsely distributed, its range incorporates the eastern section of the project footprint (Figure 17). - There is a single record from within the Mt Isa Township this is outside the Planning Corridor.
Gouldian Finch <i>Erythrura gouldiae</i>	EN	Habitat: Prefers annual and perennial grasses (especially Sorghum), a nearby source of surface water and, in the breeding season, unburnt hollow-bearing <i>Eucalyptus</i> trees (especially <i>E. tintinnans</i>, <i>E. brevifolia</i> and <i>E. leucophloia</i>) (Tidemann 1996; Higgins et al. 2006). Distribution: Sparsely distributed across northern Australia from the Kimberley to north-central Queensland (Dostine 1998; Franklin 1999; Barrett et al. 2003). PMST presence: Species on habitat known to occur. Wildlife online records: 1 record (unknown year) Infonet Records: 0 records	LIKELY - The edge of the species possible distribution extends just within the eastern edge of the Planning Corridor (Figure 3, Figure 4). - Vegetation mapping indicates the project footprint passes regional ecosystems containing <i>E. leucophloia</i> near Mt. Isa which could provide suitable habitat (Figure 3, Figure 4). - There is only a single record of Gouldian Finch within the <i>Wildlife Online</i> search area. There are no records within the <i>Infonet</i> search area. The Atlas of Living Australia records approximately 14 birds were observed at Lady Loretta Mine Rd, NW of Mt. Isa in 2011 (ALA, 2015) this is outside of the Planning Corridor.
Australian Painted Snipe <i>Rostratula australis</i>	EN	Habitat: Inhabits fringes of permanent and temporary wetlands, swamps and inundated grasslands (Taylor et al. 2007). The species could occur on any shallow ephemeral wetlands in central or southern Northern Territory or western Queensland. Distribution: The species has a distribution that covers nearly all of the Northern Territory and Queensland (Garnett et al 2011). This species is nomadic and scattered across Australia with no predictable occurrence (Rogers 2001) but could occur at any wetland or inundated grassland across its distribution.	UNLIKELY - There are suitable permanent and ephemeral wetlands within the search area however no large wetlands within the Planning Corridor. Of note is the wetland area near Barkly and Lake Moondarra to the north east of Mt. Isa. Both of these areas are outside the Planning Corridor. - The species' distribution incorporates the entire Planning Corridor. - There are records of <i>Rostratula australis</i> within the search area but no records of the species within the Planning Corridor. The records within the search area are within Queensland

Species	EPBC Act	Species details	Likelihood of occurrence
		PMST presence: Species or habitat likely to occur. Wildlife online records: 7 records (unknown) Infonet Records: 0 records	(there was also one spatially suspect record from the Atlas of Living Australia that may have come from the Tennant Creek Sewerage works this record was excluded from the analysis.
Masked Owl (Northern) <i>Tyto novaehollandiae kimberli</i>	VU	Habitat: Occurs mainly in eucalypt tall open forests (especially those dominated by <i>Eucalyptus miniata</i> and <i>E. tetrodonta</i>), but also roosts in monsoon rainforests, and forages in more open vegetation types, including grasslands (Woinarski & Ward 2006). Distribution: Poorly known, with few records from across its broad range in northern Australia. In the Northern Territory records known from the Top End, Kakadu, Coburg Peninsula (majority of records) and south-west Gulf country (Woinarski & Ward 2006). PMST presence: Species or species habitat known to occur. Wildlife online records: 0 records Infonet Records: 1 record (2001)	LIKELY • Suitable foraging habitat potentially occurs within the search area. • The single record from within the Planning Corridor is near tussock grassland and acacia open woodland habitat in the Northern Territory. • The area south of Avon Downs is included in the species' distribution and is within the Planning Corridor. • There is a single Infonet record (2001) from south of Avon Downs within the search area.
Night Parrot <i>Pezoporus occidentalis</i>	EN	Habitat: During the day it rests within clumps of spinifex. It also nests within spinifex hummocks, building a rough nest in which up to four white eggs are laid (Garnett & Crowley 2000). Distribution: No specimens of the night parrot have been taken in the Northern Territory; however, sightings were made up to 1923 at the Alice Springs Telegraph Station, Horseshoe Bend Station, Idracowra Station, Henbury Station and Hermannsburg (Whitlock 1924). PMST presence: Species or habitat likely to occur. Wildlife online records: 0 records Infonet Records: 0 records	UNLIKELY • Mapped areas of suitable hummock grassland habitat end approximately 30 km south of the Alignment Corridor. • The species' mapped distribution ends south of the Alignment Corridor (aligned with the hummock grassland habitat). This is well south of the Planning Corridor, which does not contain any suitable habitat. • There are no database records from within the search area; the closest record is over 200 km south to the proposed pipeline alignment.
MAMMALS			
Greater Bilby <i>Macrotis lagotis</i>	VU	Habitat: Found in hummock grasslands on sandy soils with a preference for drainage lines (Southgate 1990). Has large foraging area and will move home range in search for food (Johnson 2008) Distribution: Historically this species was widespread in arid Australia. Currently in the Northern Territory its strong holds are in the Tanami Desert (Pavey 2006). PMST presence: Species or habitat known to occur. Wildlife online records: 0 records Infonet Records: 54 records (2009)	UNLIKELY • An extremely small area of hummock grassland is located within the Planning Corridor (Figure 16). • The majority of records are west of the Stuart Highway in the Tanami Desert outside the Planning Corridor. • There are 16 records from within the search area and 54 records from within the grid cells in which the search area occurs however only one of these (1990) occurs within the Planning Corridor (Figure 16).
Southern Marsupial Mole <i>Notoryctes typhlops</i>	EN	Habitat: This species is found in sandy deserts where it is mostly associated with dunes, sandy plains and river flats (Pavey 2006). Distribution: This species occurs in	UNLIKELY • Core habitat (desert sand dunes) does not occur within the Planning Corridor. The areas of suitable dunefield habitat occur to the west

Species	EPBC Act	Species details	Likelihood of occurrence
		central Western Australia, northern South Australia and southern Northern Territory. Within the Northern Territory it has been found as far north as Barrow Creek (Pavey 2006) and appears and is confined to the southern and western sections of the Territory (Beshemesh 2008). PMST presence: Species or habitat likely to occur. Wildlife online records: 0 records Infonet Records: 1 records	of the Planning Corridor (Figure 18). - No areas of the Planning Corridor are included in the distribution of the species. - The species is known to occur within sandplains, however they are often found close to dune habitat which does not occur within the Planning Corridor. - There are no database records of the species within the search area. There is a single record from the grid cells in which the search area occurs.
Black-footed Rock-wallaby <i>Petrogale lateralis</i> (MacDonnell Ranges Race)	VU	Habitat: This species occurs in upland rocky areas with associated steep slopes (Pavey 2006). Relevant to the project the sandstone hills and sandstone plains and rises habitat within the Davenport and Murchison Ranges SOC could provide suitable habitat (DNRETAS 2015). Distribution: In the Northern Territory this species is mostly found in the MacDonnell Ranges, but also occurs throughout the arid southern end of the Northern Territory (Pavey 2006) and may be found in the Davenport and Murchison Ranges. PMST presence: Species or habitat may occur. Wildlife online records: 0 records Infonet Records: 16 records (1988)	UNLIKELY - Potential habitat of upland rocky areas within the Davenport Ranges exists at the southern margin of the 50 km buffer but well outside the Planning Corridor. The Alignment Corridor will not pass through this area. - The distribution of the species is centred on the West MacDonnell Ranges; however, the species is found in the Davenport Ranges south of the Planning Corridor. - There are only 3 records (1988) within the search area with the other 13 records occurring south of the Planning Corridor in the grid cells in which the search area sits.
Carpentarian Antechinus <i>Pseudantechinus mimulus</i>	VU	Habitat: The few records of this species show a preference for a range of vegetation types associated with a high cover of rocks and boulders. Within Queensland the records come from rocky habitat with open woodland dominated by <i>Eucalyptus leucophloia</i>, <i>E. normantonensis</i> and <i>Corymbia terminalis</i>. Distribution: At the present time this species is only known from Sir Edward Pellew group of islands in the Northern Territory (Kitchener 1991; Johnson & Kerle 1991; Taylor et al. 2004) and around Mount Isa (Wonarski 2004) and Pungalina Station (Woinarski & Ward 2012). PMST presence: Species or habitat known to occur. Wildlife online records: 0 records Infonet Records: 2 records (1969) (within grid cells)	LIKELY - The sandstone hills and boulders to the west of Mt. Isa within the Planning Corridor potentially provide suitable habitat for the species. - The distribution of the species incorporates the eastern section of the Planning Corridor (Figure 5). - There are no records of the species within <i>Wildlife online</i> database however this may not be complete. - There are three records in the vicinity of Mt. Isa within the ALA database. These are outside the Planning Corridor. There are two old records from within the grid cells in which the search area sits from the Northern Territory but no records from within the search area.
REPTILES			
Plains Death Adder <i>Acanthophis hawkei</i>	VU	Habitat: Occurs on floodplains and cracking soil plains (Webb et al. 2002). Distribution: Occurs across mainland northern Australia in a disjointed pattern. In the Northern Territory, it is known from	LIKELY There is an area of potentially suitable habitat towards the eastern end of the Planning Corridor (Figure 6). This section

Species	EPBC Act	Species details	Likelihood of occurrence
		floodplains of the Adelaide, Mary and Alligator Rivers as well as the Barkly Tableland on the Northern Territory (Northern Territory)/Queensland (QLD) border. PMST presence: Species or habitat known to occur. Wildlife online records: 0 records Infonet Records: 23 records (1985)	of Vertosols/cracking clay soils across tussock grassland could be habitat for the species. - The distribution of the species extends across a section of the eastern end of the Planning Corridor though the core distribution is north of the Barkly Highway within the Barkly Tablelands. - There is one record just north of the Planning Corridor in the Northern Territory (Figure 6).
Gulf Snapping Turtle <i>Elseya lavarockorum</i>	EN	Habitat: The species inhabits large rivers and their associated overflow lagoons and oxbow lakes (Cogger 2000). The Gulf Snapping turtle is found in deeper permanent pools most often with muddy, sandy or rocky bottoms. The species is also found in the middle reaches of rivers, upstream of saline regions and downstream of escarpments, including plunge pools. Steep rocky gorges, and river reaches with intact river banks seem to be preferred habitats for Gulf Snapping Turtles (Thomson et al. 1997). Distribution: The Gulf Snapping Turtle is known from the Calvert River to the Nicholson River systems, including the Roper, Limmen Bight, Robinson and Nicholson Rivers all of which discharge into the Gulf of Carpentaria (Georges & Adams 1996; Thomson et al. 1997). PMST presence: Species or habitat known to occur. Wildlife online records: 0 records Infonet Records: 0 records	UNLIKELY - The only section of Planning Corridor that overlaps with the species' potential distribution is the very eastern section around Mt Isa and confined to the Leichardt River. - From the potential distribution (above) there is unlikely to be potential habitat for the species in the very upper reaches of the Leichardt River above Lake Moondarra. - There are no records of the species from within the search area or grid cells in which the search area sits. There are no records of the species within the Leichardt River. The closest records are from the Lawn Hill area approximately 200 km from the Planning Corridor.
Great Desert Skink <i>Liopholis kintorei</i>	VU	Habitat: The species generally occurs on tall open shubland and hummock grasslands on red sandplains and sand ridges (Cogger et al. 1993). However, in some locations (e.g. the Gibson Desert) they are found on sandplains with fine gravel. Distribution: Currently known from seven populations (McAlpin 2001) but originally known to occur within a broad range extending from the desert parts of south western Northern Territory, eastern interior of Western Australia and north western south Australia (Cogger et al. 1993). However the precise habitat range is unknown (McAlpin 2001). PMST presence: Species or habitat may occur. Wildlife online records: 0 records Infonet Records: 0 records	UNLIKELY - The current distribution of the species is confined to the western Northern Territory particularly the western Tanami; well outside the Planning Corridor. - There are hummock grasslands in the western section of the Planning Corridor however these are well outside the species range. - There are no database records from within the search area (or grid cells). There are two old records 1906 from within the Planning Corridor on the Atlas of Living Australia.
FISH			
Large-tooth Sawfish, Freshwater Sawfish <i>Pristis pristis</i>	VU	Habitat: Juveniles and sub-adults predominantly occur in rivers and estuaries, while large mature animals tend to occur more often in coastal and offshore waters up to 25 m depth (Giles	UNLIKELY The Planning Corridor primarily sits in Lake Eyre drainages i.e. flowing south away from the river

Species	EPBC Act	Species details	Likelihood of occurrence
(<i>microdon</i>)		et al. 2006; Stevens et al. 2005). Distribution: This is known from several drainages in northern Australia from Western Australia to Queensland. In the Northern Territory, it is known from at least eight catchments in the Northern Territory, this species has the potential to occur in more. Currently it is known from the Adelaide, Alligator (East and South), Daly, Darwin, Goomadeer, McArthur, Robinson & Victoria Rivers (Larson et al. 2007). PMST presence: Species or habitat likely to occur. Wildlife online records: 0 records Infonet Records: 0 records	systems that this species uses. • The only area overlapping with potential distribution is the Leichardt River near Mt Isa. • This section of the Leichardt River is upstream of Lake Moondarra and thus does not provide suitable habitat for the species. The upper reaches of the Leichardt River does not present suitable habitat for <i>Pristis pristis</i>. • There are no database records of the species within the Planning Corridor. One study (Peverell 2009) has recorded the species in the Leichardt but well downstream of the Alignment Corridor and Moondarra Dam. Impact of the project such a distance downstream and below the dam is unlikely.

Appendix D - Migratory species likelihood analysis

This Appendix D details the likelihood analysis for each of the migratory species from the Matters of National Environmental Significance (**MNES**) search.

The following procedure was used to determine which migratory species may occur within the area and to identify the potential significance of any extant populations of migratory species:

- 1) A search for MNES along the proposed pipeline route and within a 50Km buffer (see Figure 7) was undertaken using the Protected Matters Search Tool on 26 May 2015 (see Appendix B).
- 2) The Planning Corridor for this project is a 20km buffer (the final pipeline will occur within this buffer after Traditional Owners and other landholder agreements and ecological and geotechnical survey); consequently, for each of the species in Step 1 above, a likelihood of occurrence analysis within the 20km planning corridor was undertaken.
- 3) To further examine likelihood of occurrence of Migratory species within or nearby to the planning corridor, the ecology, distribution and survey records of each of the species recorded in Step 1 were examined along with habitat types within the corridor.
- 4) Using the process from Step 3, species are allocated one of the following categories:
 - Known – there are recent records of the species within the footprint.
 - Likely – core habitat for the species occurs within the footprint but there are no records.
 - Unlikely – there is no core habitat for the species within the footprint; however, the species may be present on occasion.

It should be noted that resultant likelihood rankings may differ from those assigned in the EPBC Protected Matters Search Report because criteria in this assessment considers habitat present within refined project area, whereas the EPBC Report utilises coarser-scale filters.

Results of likelihood analysis

Non Shorebird Species

Table C-1. EPBC Act Listed Migratory Avian Species (non-shorebird) Summary and Likelihood of Occurrence within the planning corridor

Species	Species details	Likelihood of occurrence
<i>Apus pacificus</i> Fork-tailed Swift	Habitat: The Fork-tailed Swift is almost exclusively aerial. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. It catches insects on the wing (Higgins 1999). Distribution: The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. It breeds in Siberia and migrates southward during the northern winter (Higgins 1999). Within Queensland, there are scattered records of the Fork-tailed Swift in the Gulf Country, and a few records on Cape York Peninsula. In the north-east region there are many records east of the Great Divide from near Cooktown and south to Townsville (Higgins 1999).	Likely. There are recent records of the species within the 50 km buffer. Given the broad distribution and wide ranging nature of <i>Apus pacificus</i> it is likely to be present (at some time period) in the planning corridor.
<i>Haliaeetus leucogaster</i> White-bellied Sea-eagle	Habitat: Coastal habitats and around terrestrial wetlands. Requires large areas of open water. There are records of birds flying over a variety of terrestrial habitats (Marchant and Higgins 1993). Distribution: Found along the entire coastline of Australia and Tasmania. Extends inland along some major waterways.	Unlikely. The Moondarra Lake area to the north East of Mt Isa provides open water habitat for <i>Haliaeetus leucogaster</i>. There are available recent records for <i>Haliaeetus leucogaster</i> from this area around the lake. However this area is outside the planning corridor and suitable habitat does not exist within the Planning Corridor
<i>Pandion cristatus</i> Eastern Osprey	Habitat: Occur in coastal habitats and terrestrial wetlands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia (Johnstone & Storr 1998; Marchant & Higgins 1993; Olsen 1995). The species requires extensive areas of open fresh, brackish or saline water for foraging, where they feed mainly on fish (Marchant and Higgins, 1993).	Unlikely. The Moondarra Lake area to the north East of Mt Isa provides open water habitat for <i>Pandion cristatus</i>. There are recent records from this lake. However this area is outside the Planning Corridor and suitable habitat does not exist within the Planning Corridor.

	Distribution: The breeding range of the Eastern Osprey extends around the northern coast of Australia. The non-breeding range is nearly continuous along the north Australia coast.	
<i>Merops ornatus</i> Rainbow Bee-eater	Habitat: The Rainbow Bee-eater occurs mainly in open forests and woodlands, farmland and areas of human habitation (Higgins 1999). Distribution: The Rainbow Bee-eater is widely distributed throughout Australia, eastern Indonesia, Papua New Guinea, the Bismarck Archipelago and, rarely, the Solomon Islands. The majority of the global population breeds in Australia (Higgins 1999).	Known. There are multiple records from across the Planning Corridor.
<i>Ardea alba</i> Great Egret	Habitat: Great Egrets occur on a variety of habitat types including wetlands, flooded pastures, dams, estuaries, mangroves and reefs (Morcombe 2003). Distribution: The Great Egret is broadly distributed across Australia.	Known. There are multiple records from across the planning corridor.
<i>Ardea ibis</i> Cattle Egret	Habitat: Cattle Egrets occur on a variety of habitat types including flooded pastures, dam edges, mudflats and open wetlands (Morcombe 2003). Distribution: The Cattle Egret is broadly distributed across Australia.	Known. There are multiple records from across the Planning Corridor.
<i>Charadrius veredus</i> Oriental Plover	Habitat: After moving from coastal environments <i>Charadrius veredus</i> usually inhabit flat, open, grasslands, where short grass is interspersed with hard, bare ground (Boekel 1980; Carruthers 1966; Pedler 1982) Distribution: Oriental Plover is a non-breeding visitor to Australia, where the species occurs in both coastal and inland areas, mostly in northern Australia. It is found on black soil plains in the Northern Territory and Queensland.	Likely. The distribution of <i>Charadrius veredus</i> extends across much of the planning corridor. The hummock grasslands and open woodlands across much of the Planning Corridor contain sufficient open areas and bare ground to support inhabitation by <i>Charadrius veredus</i>.
<i>Glareola maldivarum</i> Oriental Pratincole	Habitat: Non-breeding in Australia the Oriental Pratincole usually inhabits open plains, floodplains or short grassland, often with extensive bare areas (DOE 2015). They often occur near inland water. Distribution: Most of the migratory population of the species is thought to spend the non-breeding season in Australia (Higgins & Davies 1996)	Likely. There are numerous records of <i>Glareola maldivarum</i> through the search area. The majority of these are associated with the Lake Moondarra area to the north east of Mt Isa. There are however other records through the four bioregions which the Planning Corridor crosses.

Wader/shorebird species

In general all of the wader shorebird species have the same distribution in regard to the Planning Corridor; Lake Moondarra area to the north east of Mt Isa but no other areas of the Planning Corridor (Figure 7).

This distribution can be expected given all the species' requirements for wetland/lake habitat. Lake Moondarra is large enough to be a habitat site but the lack of water in the surrounding landscape limits these species to the lake and immediate surrounds.

Although Lake Moondarra is within the 50 km buffer it is outside the Planning Corridor. As a result the analysis determined that none of the species listed within the 50 km buffer were likely to occur within the Planning Corridor and be impacted by the construction activities.

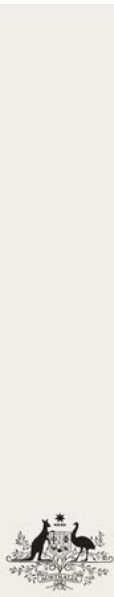
Table C-2. EPBC Act Listed Migratory Avian Species (shorebird) Summary and Likelihood of Occurrence within the planning corridor

Species	Species Details	Likelihood of occurrence
<i>Calidris acuminata</i> Sharp-tailed Sandpiper	Habitat: The Sharp-tailed Sandpiper prefers muddy edges of shallow wetlands, with inundated low vegetation. Distribution: In Queensland they are widely distributed along the coast but are sparsely distributed inland. One particular inland location is Lake Moondarra area near Mt Isa.	Unlikely. There are 104 records for <i>Calidris acuminata</i> within the 50 km buffer; 72 of which are from around Mt Isa or Cloncurry. These 72 records are associated with Lake Moondarra or the tailings dam and are outside of the planning corridor. There are two records from the western end of the Planning Corridor that are likely associated with small dams which will not be intersected by the pipeline.
<i>Calidris ferruginea</i> Curlew Sandpiper	Habitat: Predominately use mudflats and sheltered coastal areas but also recorded inland around lakes and dams etc. Distribution: In Queensland, scattered records occur in the Gulf of Carpentaria, with widespread records along the coast south of Cairns. There are sparsely scattered records inland. Moondarra area near Mt Isa.	Unlikely. The only records for <i>Calidris ferruginea</i> are from near Mt Isa; associated with Lake Moondarra or the tailings dam. This matches with the accepted distribution and the required habitat for the species. Neither of these areas will impacted by the Planning Corridor.
<i>Tringa glareola</i> Wood Sandpiper	Habitat: The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands as typical habitat. <i>Tringa glareola</i> forages on mud at the edges of wetlands and roosts by loafing on low, grassy hillocks in flooded meadows or perched low in trees and on fences (Higgins & Davies 1996). Distribution: The Wood Sandpiper has its largest numbers recorded in north-west Australia, with all	Unlikely. The records within the 50 km buffer near Mt Isa are associated with Lake Moondarra or the tailings dam. The records from Tennant Creek are from the sewerage works. These locations are outside of the Planning Corridor and will not be intersected by the Alignment Corridor.

	areas of national importance located in Western-Australia (Watkins 1993). In Queensland there are sparsely scattered records south of 17°S.	
<i>Tringa stagnatilis</i> Marsh Sandpiper	Habitat: The Marsh Sandpiper lives in permanent or ephemeral wetlands. In north Australia they prefer intertidal mudflats (Higgins & Davies 1996). Distribution: <i>Tringa stagnatilis</i> is found on coastal and inland wetlands throughout Australia and is widespread in coastal Queensland.	Unlikely. The records within the 50 km buffer near Mt Isa are associated with Lake Moondarra or the tailings dam. The records from Tennant Creek are from the sewerage works. These locations are outside of the Planning Corridor and will not be intersected by the Alignment Corridor.
<i>Calidris ruficollis</i> Red-necked Stint	Habitat: Found mostly in coastal areas. Sometimes occur inland at water bodies and water treatment facilities. They mostly forage on bare wet mud on intertidal mudflats or sandflats, or in very shallow water and roosts on sheltered beaches. Distribution: <i>Calidris ruficollis</i> has been recorded in all coastal regions, and found inland in all states when conditions are suitable.	Unlikely. There are 21 records of <i>Calidris ruficollis</i> within the 50 km buffer. The majority of these records are from the Mt Isa region and are associated with Lake Moondarra or the tailings dam. These records are outside the Planning Corridor. There is one record from the very western end of the Planning Corridor however there is no suitable habitat at this location.
<i>Charadrius mongolus</i> Lesser Sand Plover	Habitat: The species feeds mostly on extensive, freshly-exposed areas of intertidal sandflats and mudflats in estuaries or beaches, or in shallow ponds in saltworks. Distribution: <i>Charadrius mongolus</i> is widespread in coastal regions. Relative to the project location it mainly occurs in south-eastern parts of the Gulf of Carpentaria though it occasionally also occurs inland.	Unlikely. There are only two records within the 50 km buffer; both of which are close to Mt Isa and Lake Moondarra. Given that this is a predominately coastal species these records are likely incidental. Lake Moondarra is part of the accepted distribution however if <i>Charadrius mongolus</i> more records would be expected in this locality given its proximity to populated areas and known habitat.
<i>Limosa lapponica</i> Bar-tailed Godwit	Habitat: <i>Limosa lapponica</i> is found mainly in coastal habitats such as large intertidal sandflats and rarely on inland wetlands (Marchant & Higgins 1993). Distribution: <i>Limosa lapponica</i> is found in coastal areas of all Australian states. There are populations in the Gulf of Carpentaria, around Gove Peninsula, Groote Eylandt, Numbulwar and the Sir Edward Pellew Group.	Unlikely. There is a single record within the 50 km buffer; close to Mt Isa and Lake Moondarra. The species is primarily a coastal species but may use the large Lake Moondarra area as seasonal inland habitat. Lake Moondarra is outside the Planning Corridor.
<i>Limosa limosa</i> Black-tailed Godwit	Habitat: <i>Limosa limosa</i> strongly favours coastal habitat. There are a few inland records around	Unlikely. There are 17 records of <i>Limosa limosa</i> within the 50 km buffer. The

	waterbodies. They also use lagoons in sewage farms and saltworks (Higgins & Davies 1996). Distribution: Found in all states and territories of Australia <i>Limosa limosa</i> prefers coastal regions and the largest populations are found on the north coast between Darwin and Weipa. It is generally found in small numbers elsewhere including inland sites (Watkins 1993).	majority of these records are from the Mt Isa region and are associated with Lake Moondarra or the tailings dam. These are outside the Planning Corridor. There are no records of the species from within the Planning Corridor.
<i>Numenius minutus</i> Little Curlew	Habitat: <i>Numenius minutus</i> is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Distribution: Little Curlews generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland coast with scattered inland records.	Unlikely. There are 10 recent records of <i>Numenius minutus</i> within the 50 km buffer; all of which are from around Mt Isa and Lake Moondarra. However this area, suitable habitat and all records are outside of the Planning Corridor.
<i>Numenius phaeopus</i> Whimbrel	Habitat: Whimbrel is often found on the intertidal mudflats of sheltered coasts. It has been infrequently recorded using brackish lakes near coastal areas. Distribution: <i>Numenius phaeopus</i> is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions.	Unlikely. There are no records of <i>Numenius phaeopus</i> within the planning corridor even though Lake Moondarra is within the accepted range of the species. Given the reliance on coastal areas for feeding and the lack of records within the area it is unlikely that <i>Numenius phaeopus</i> is present.
<i>Pluvialis fulva</i> Pacific Golden Plover	Habitat: usually inhabits coastal habitats, though it occasionally occurs around inland wetlands especially those with muddy margins. Distribution: <i>Pluvialis fulva</i> is widespread in coastal regions, though there are also a number of inland records (in all states), sometimes far inland and usually along major river systems.	Unlikely. There 11 records of <i>Pluvialis fulva</i> within the 50 km buffer. The majority of these records are from the Mt Isa region and are associated with Lake Moondarra or the tailings dam. These records are outside the Planning Corridor (there is only one record from within the Planning Corridor but is a historical record from 1958).

APPENDIX E – NT NRM REPORT



Custom area

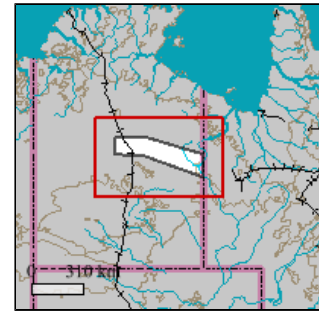
NT NRM Report



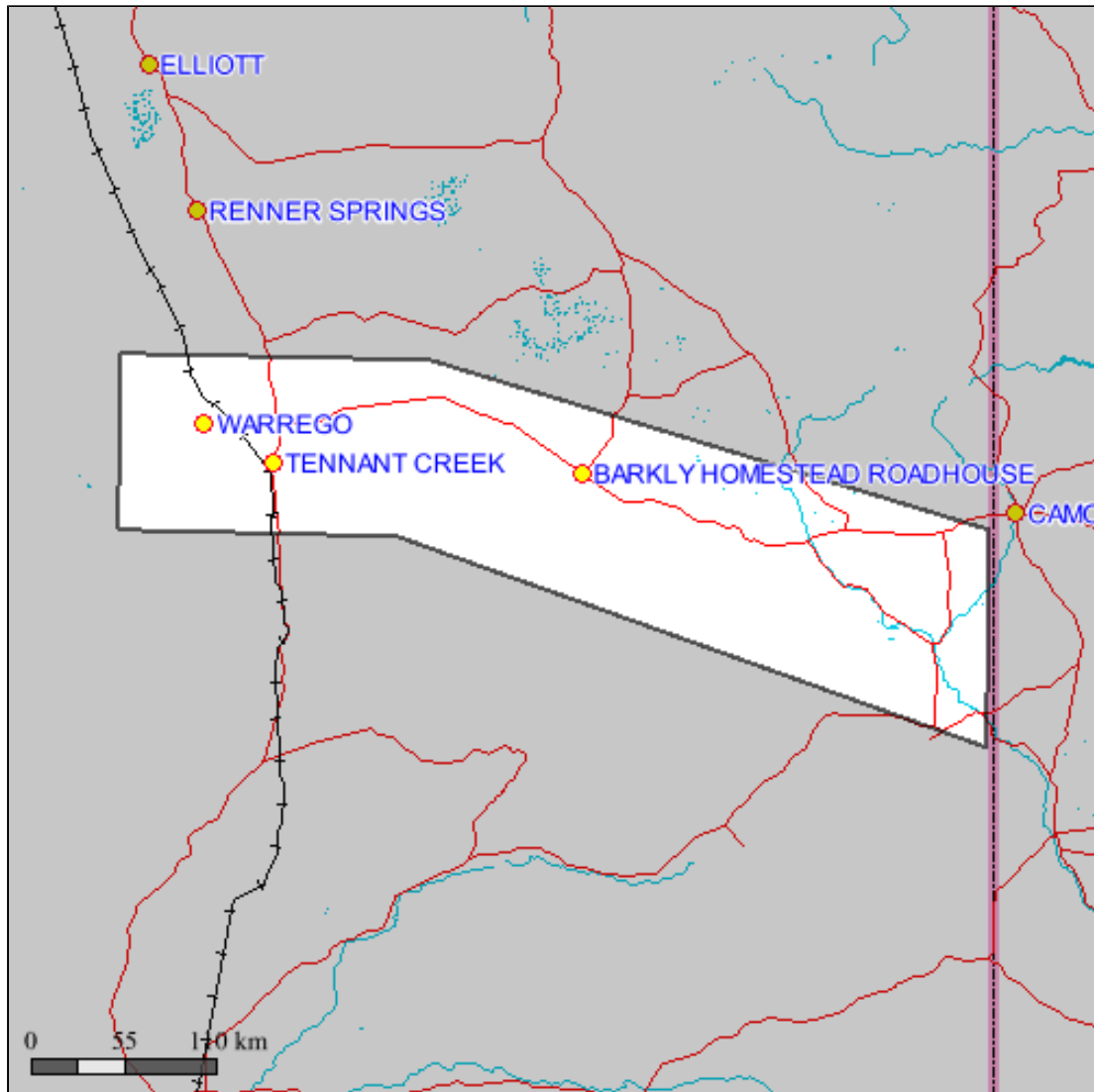
Custom area

Custom area encompasses an area of 54363.78 sq km extending from 19 deg 4.0 min to 21 deg 9.0 min S and 133 deg 22.0 min to 137 deg 58.0 min E.

Custom area is located in the Mitchell Grass Downs, Tanami, Davenport Murchison Ranges, bioregion(s)



Location of Custom area



Custom area Climate

The closest long-term weather station is WONARAH (19 deg 53.0 min S, 136.3358E)
73 km E of the center of selected area

Statistics

Mean max temp (deg C)
Mean min temp (deg C)
Average rainfall (mm)
Average days of rain

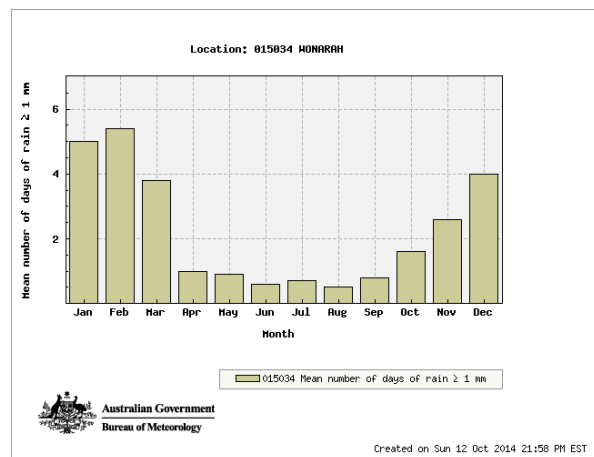
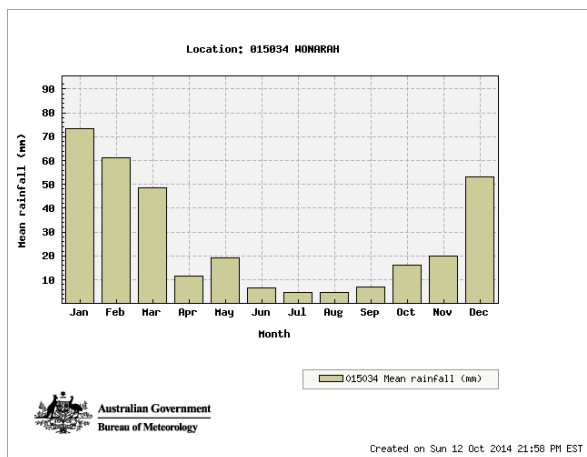
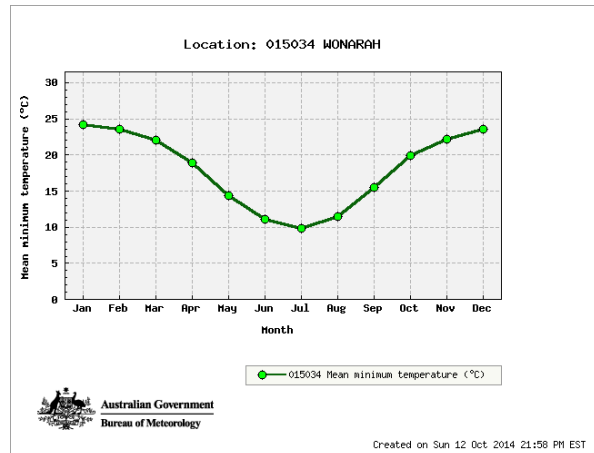
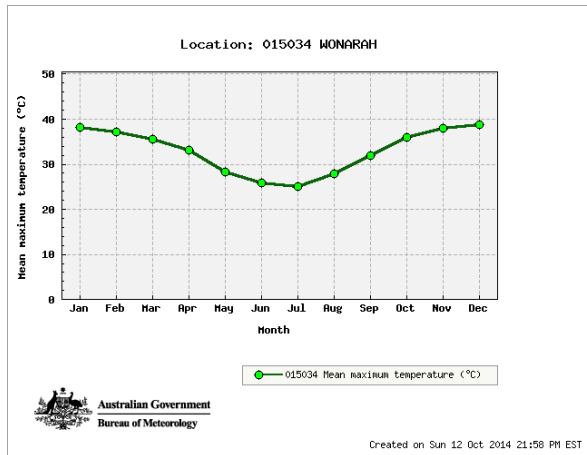
Annual Values

32.9
18.1
322.7
26.9

Years of record

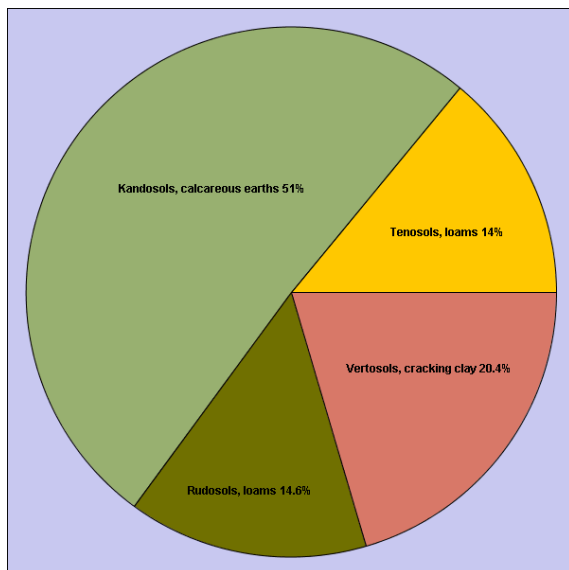
23
23
28
28

Climate summaries from Bureau of Meteorology (www.bom.gov.au)



Custom area Soils

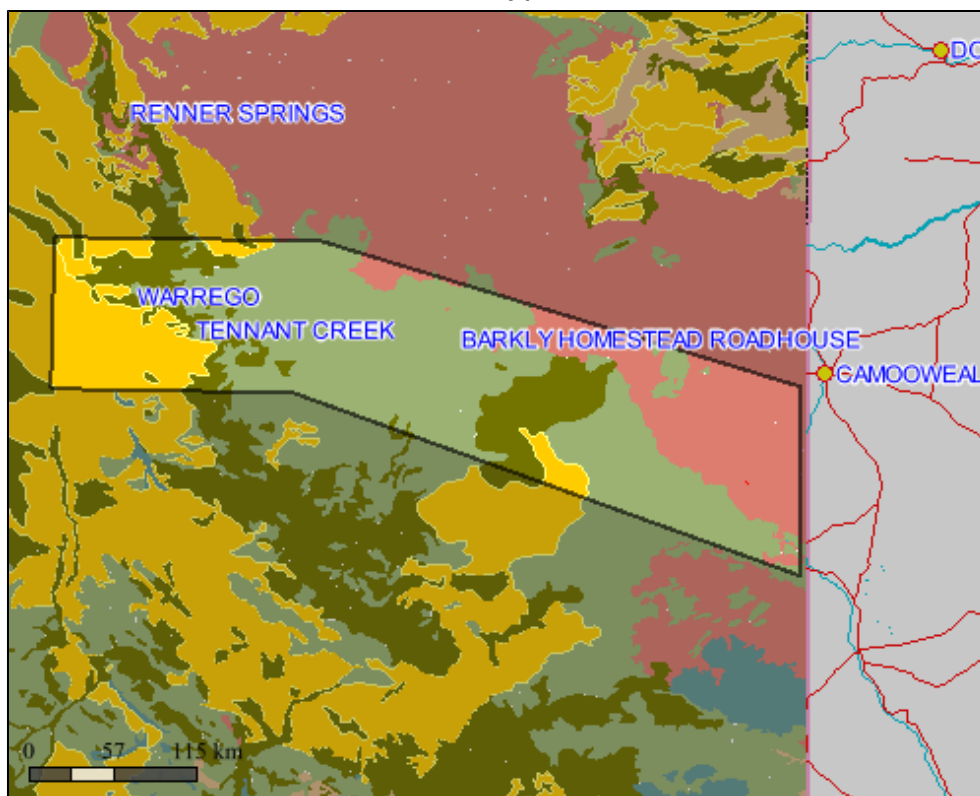
Soil Types



Area of soil types (Northcote Factual Key)

Category	Area sq km	Area%
Kandosols, calcareous earths	27723.63	51.00
Vertosols, cracking clay	11113.16	20.44
Rudosols, loams	7936.05	14.60
Tenosols, loams	7590.94	13.96

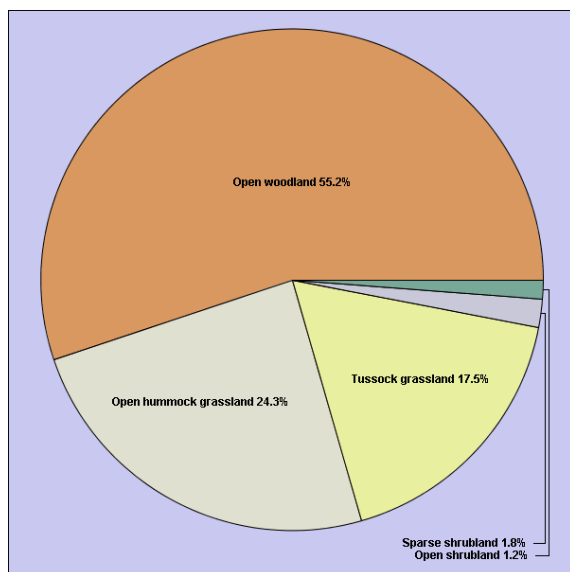
Soil Types



Soils 1:2M Layer is a copy of the NT portion (1:2,000,000 scale dataset) of the CSIRO Atlas of Australian Soils - K.H. Northcote et al. Data scale: 1:2,000,000 ANZLIC Identifier: 2DBC771205D06B6E040CD9B0F274EFE
More details: Go to www.lrm.nt.gov.au/nrmapsnt/ and enter the ANZLIC identifier in the Spatial Data Search

Custom area Vegetation

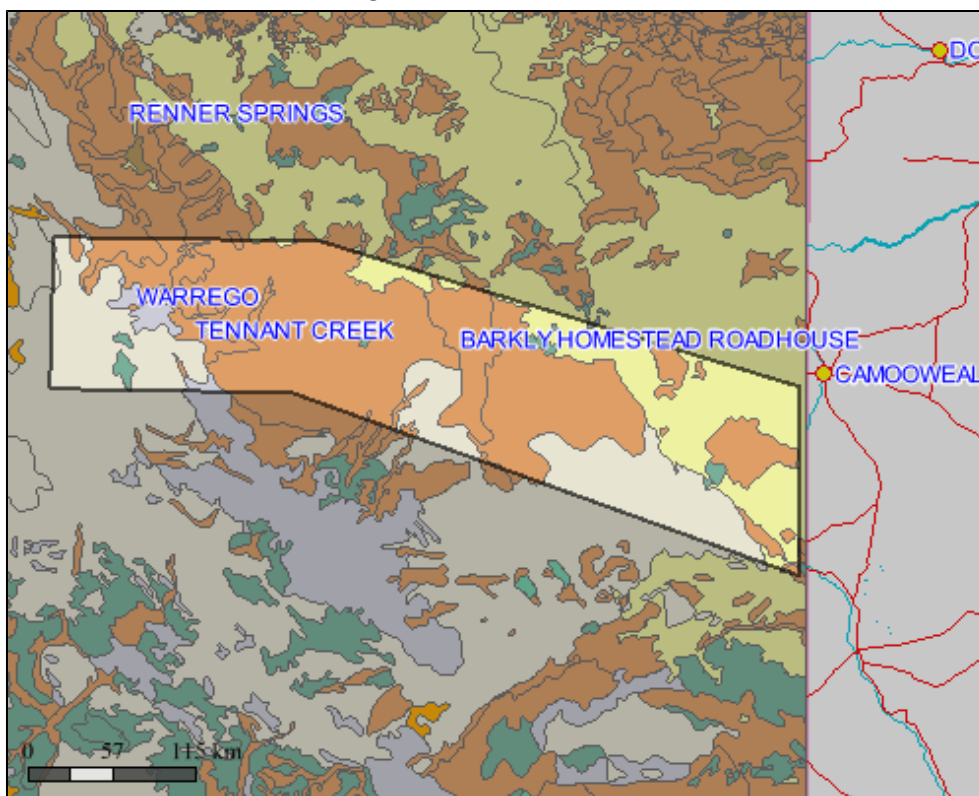
Vegetation Communities



Area of vegetation communities

Category	Area sq km	Area%
Open woodland	30002.43	55.19
Open hummock grassland	13196.61	24.27
Tussock grassland	9516.90	17.51
Sparse shrubland	983.48	1.81
Open shrubland	664.37	1.22

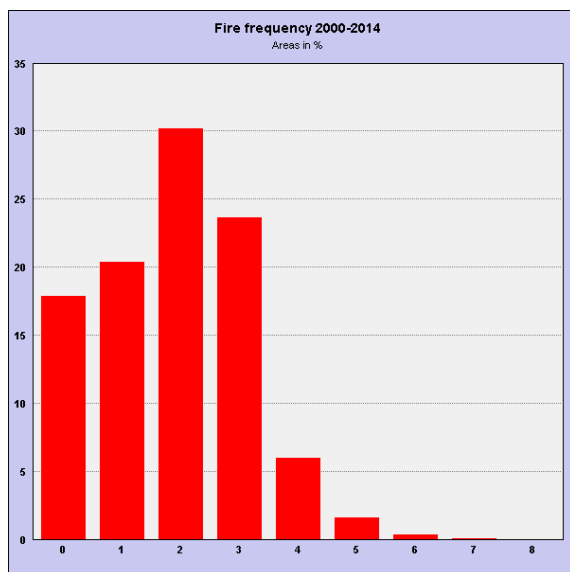
Vegetation Communities



The NVIS 2005 Layer is compiled from a number of vegetation and land unit survey maps that were recoded and re-attributed for the National Vegetation Information System (NVIS)
Data scale variable depending on location. ANZLIC Identifier:2DBC771207006B6E040CD9B0F274EFE
More details: Go to www.lrm.nt.gov.au/nrmapsnt/ and enter the ANZLIC Identifier in the Spatial Data Search

Custom area Fire History

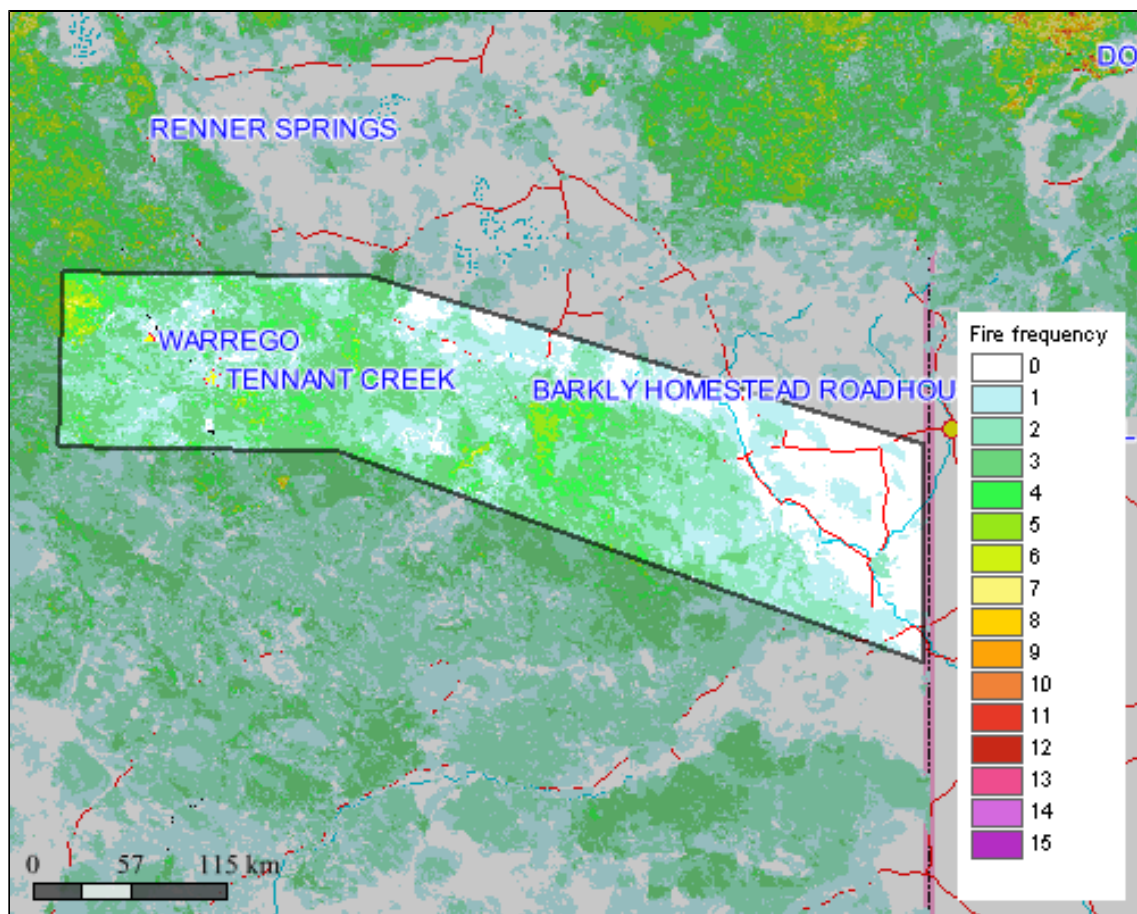
Years burnt 2000-2014



and area burnt in each category

Category	Area sq km	Area%
0	9724.48	17.89
1	11071.93	20.37
2	16410.37	30.19
3	12847.01	23.63
4	3245.32	5.97
5	862.27	1.59
6	176.56	.32
7	24.82	.05
8	1.01	.00

Years burnt 2000-2014



The fire frequency(250m) Layer is derived from satellite imagery sourced from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the NASA Terra satellite
Spatial Resolution: 250m x 250m pixels (at Nadir).

Custom area Threatened Species



Threatened species recorded in Custom area (Records Updated: Sept 2013)

Group	Common Name	Scientific Name	NT Status	National Status	ID	#Observations (Latest)	#Specimens (Latest)	#Surveys (Latest)
Flowering Plants	Sporobolus	<i>Sporobolus latzii</i>	VU	.	.	0 (Unknown)	1 (1993)	0 (Unknown)
Flowering Plants	Tobermorey Melon	<i>Austrobryonia argillicola</i>	VU	.	257219	0 (Unknown)	0 (Unknown)	0 (Unknown)
Snails	Spencer's Land Snail	<i>Bothriembryon spenceri</i>	VU	.	351895	0 (Unknown)	0 (Unknown)	0 (Unknown)
Reptiles	Plains Death Adder	<i>Acanthophis hawkei</i>	VU	VU	.	0 (Unknown)	1 (1978)	0 (Unknown)
Birds	Grey Falcon	<i>Falco hypoleucos</i>	VU	.	.	4 (2010)	0 (Unknown)	0 (Unknown)
Birds	Masked Owl (northern mainland)	<i>Tyto novaehollandiae kimberli</i>	VU	VU	594609	1 (2001)	0 (Unknown)	0 (Unknown)
Mammals	Brush-tailed Mulgara	<i>Dasycercus blythi</i>	VU	VU	351695	3 (1993)	2 (1901)	0 (Unknown)
Mammals	Crest-tailed Mulgara	<i>Dasycercus cristicauda</i>	VU	EN	351695	0 (Unknown)	3 (1905)	0 (Unknown)
Mammals	Golden Bandicoot	<i>Isodon auratus</i>	EN	VU	176421	8 (1969)	16 (1936)	0 (Unknown)
Mammals	Greater Bilby	<i>Macrotis lagotis</i>	VU	VU	177125	12 (1994)	2 (1969)	2 (2004)
Mammals	Common Brushtail Possum (southern)	<i>Trichosurus vulpecula vulpecula</i>	EN	.	177146	2 (1969)	3 (1901)	0 (Unknown)
Mammals	Black-footed Rock-wallaby	<i>Petrogale lateralis</i>	.	VU	351635	3 (1988)	0 (Unknown)	0 (Unknown)

EX = Extinct

EW = Extinct in the Wild

ER = Extinct in the NT

EN = Endangered

EN/VU = One Endangered subspecies/One Vulnerable subspecies

VU=Vulnerable

VU/- = One or more subspecies vulnerable EN/- = One or more subspecies endangered

Survey = this category refers to data collected using systematic survey methodology

Specimen = this category refers to museum or other records where a specimen has been collected and lodged

Observation = this category refers to all other incidental recordings where systematic methodology may not have been used consistently.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=####

where #### is the ID number from the tables above for the species of interest.

Custom area Threatened Species Grid



Threatened species recorded in the grid cell(s) in which Custom area occurs (Records Updated: Sept 2013)

Group	Family Name	Scientific Name	Common Name	NT Status	National Status	#Observations	Latest Observation Date	#Specimens	Latest Specimen Date	#Surveys	Latest Survey Record
Flowering Plants	Poaceae	<i>Sporobolus latzii</i>	Sporobolus	VU		0	Unknown	1	1993	0	Unknown
Flowering Plants	Cucurbitaceae	<i>Austrobryonia argillicola</i>	Tobermorey Melon	VU		0	Unknown	0	Unknown	0	Unknown
Snails	Bulimulidae	<i>Bothriembryon spenceri</i>	Spencer's Land Snail	VU		0	Unknown	0	Unknown	0	Unknown
Reptiles	Varanidae	<i>Varanus panoptes</i>	Yellow-spotted Monitor	VU		0	Unknown	1	Unknown	0	Unknown
Reptiles	Elapidae	<i>Acanthophis hawkei</i>	Plains Death Adder	VU	VU	0	Unknown	22	1985	0	Unknown
Birds	Falconidae	<i>Falco hypoleucos</i>	Grey Falcon	VU		9	2010	0	Unknown	0	Unknown
Birds	Tytonidae	<i>Tyto novaehollandiae kimberli</i>	Masked Owl (northern mainland)	VU	VU	1	2001	0	Unknown	0	Unknown
Birds	Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater	VU		1	1981	0	Unknown	0	Unknown
Mammals	Dasyuridae	<i>Dasyercus blythi</i>	Brush-tailed Mulgara	VU	VU	13	1998	2	1901	0	Unknown
Mammals	Dasyuridae	<i>Dasyercus cristicauda</i>	Crest-tailed Mulgara	VU	EN	1	1998	3	1905	0	Unknown
Mammals	Dasyuridae	<i>Dasyurus hallucatus</i>	Northern Quoll	CR	EN	2	1903	0	Unknown	0	Unknown
Mammals	Dasyuridae	<i>Pseudantechinus mimulus</i>	Carpentarian Antechinus		VU	2	1969	0	Unknown	0	Unknown
Mammals	Peramelidae	<i>Isoodon auratus</i>	Golden Bandicoot	EN	VU	11	1969	16	1936	0	Unknown
Mammals	Thylacomyidae	<i>Macrotis lagotis</i>	Greater Bilby	VU	VU	48	2009	4	1969	2	2004
Mammals	Phalangeridae	<i>Trichosurus vulpecula vulpecula</i>	Common Brushtail Possum (southern)	EN		7	1969	3	1901	0	Unknown
Mammals	Macropodidae	<i>Petrogale lateralis</i>	Black-footed Rock-wallaby		VU	14	1992	0	Unknown	2	2004
Mammals	Notoryctidae	<i>Notoryctes typhlops</i>	Southern Marsupial Mole	VU	EN	1	1990	0	Unknown	0	Unknown

EX = Extinct

EW = Extinct in the Wild

ER = Extinct in the NT

EN = Endangered

EN/VU = One Endangered subspecies/One Vulnerable subspecies

VU=Vulnerable

VU/- = One or more subspecies vulnerable EN/- = One or more subspecies endangered

Survey = this category refers to data collected using systematic survey methodology

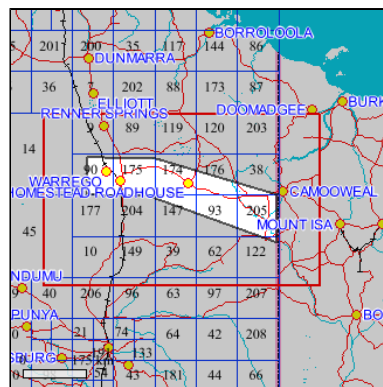
Specimen = this category refers to museum or other records where a specimen has been collected and lodged

Observation = this category refers to all other incidental recordings where systematic methodology may not have been used consistently.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=####

where #### is the ID number from the tables above for the species of interest.

Species listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Custom area



Custom area Weeds and Potential Weeds



Introduced plants recorded in the grid cell(s) in which Custom area occurs and that have been identified as problem weeds in one or more locations in northern Australia. Occurrence based on Northern Territory Government databases.

Family Name	Scientific Name	Common Name	NT Status	National Status	Other Status	#Surveys	Latest Record
Asteraceae	<i>Acanthospermum hispidum</i>	Starburr	B C			2	2001
Amaranthaceae	<i>Alternanthera pungens</i>	Khaki Weed	B C		DEU NSW SA	0	Unknown
Meliaceae	<i>Azadirachta indica</i>	Neem			MP K1 C&E G&M CYP WeedsAus	0	Unknown
Poaceae	<i>Bothriochloa pertusa</i>	Indian Bluegrass			DEU	0	Unknown
Apocynaceae	<i>Calotropis procera</i>	Rubber Bush	B C (S of 16 5 deg S)		WA1 WA2 G&M	0	Unknown
Poaceae	<i>Cenchrus biflorus</i>	Gallon`s Curse			NSW	2	2001
Poaceae	<i>Cenchrus ciliaris</i>	Buffel Grass			MP Gr G&M DEU	0	Unknown
Poaceae	<i>Cenchrus echinatus</i>	Mossman River Grass	B C		NSW	0	Unknown
Poaceae	<i>Cenchrus pedicellatus</i> subsp. unispiculus	Mission Grass (annual)			WeedsAus	0	Unknown
Poaceae	<i>Cenchrus setiger</i>	Birdwood Grass			DEU	0	Unknown
Poaceae	<i>Chloris barbata</i>	Purpletop Chloris			DEU	0	Unknown
Poaceae	<i>Chloris virgata</i>	Feathertop Rhodes Grass			DEU	0	Unknown
Cucurbitaceae	<i>Citrullus lanatus</i>	Camel Melon			G&M	0	Unknown
Brassicaceae	<i>Coronopus didymus</i>	Lesser Swinecress			G&M	0	Unknown
Cucurbitaceae	<i>Cucumis melo</i>	Ulcardo Melon			DEU	28	2001
Solanaceae	<i>Datura ferox</i>	Fierce Thornapple	A C		WA1 WA3 WA4 G&M	0	Unknown
Solanaceae	<i>Datura leichhardtii</i>	Native Thornapple	C		WA1 WA3 WA4	0	Unknown
Poaceae	<i>Echinochloa colona</i>	Awnless Barnyard Grass			DEU	11	2001
Poaceae	<i>Eragrostis tenuifolia</i>	Elastic Grass			DEU	0	Unknown
Amaranthaceae	<i>Gomphrena celosioides</i>	Gomphrena Weed			DEU	1	2001
Lamiaceae	<i>Hyptis suaveolens</i>	Hyptis	B C		G&M	0	Unknown
Euphorbiaceae	<i>Jatropha gossypifolia</i>	Bellyache Bush	B C	WONS	K2 WA1 WA4 Q2 C&E G&M CYP DEU	0	Unknown
Fabaceae	<i>Leucaena leucocephala</i> subsp. <i>leucocephala</i>	Coffee Bush			MP C&E G&M CYP	0	Unknown
Fabaceae	<i>Macroptilium atropurpureum</i>	Siratro			C&E	0	Unknown
Malvaceae	<i>Malvastrum americanum</i>	Spiked Malvastrum			DEU	39	2003
Malvaceae	<i>Malvastrum</i> <i>coromandelianum</i>	Prickly Malvastrum			DEU	0	Unknown
Poaceae	<i>Melinis repens</i>	Red Natal Grass			DEU	0	Unknown
Oxalidaceae	<i>Oxalis corniculata</i>	Creeping Wood-sorrel			NSW	0	Unknown

Family Name	Scientific Name	Common Name	NT Status	National Status	Other Status	#Surveys	Latest Record
Fabaceae	<i>Parkinsonia aculeata</i>	Parkinsonia	B C	WONS	MP K2 WA1 WA4 Q2 G&M CYP DEU NSW SA	14	2001
Fabaceae	<i>Prosopis pallida</i>	Mesquite	A C	WONS	K2 WA1 WA2 WA4 Q2 G&M NSW SA	1	2001
Fabaceae	<i>Senna occidentalis</i>	Coffee Senna	B C		G&M DEU	1	2001
Malvaceae	<i>Sida acuta</i>	Spiny-head Sida	B C		WA1 G&M	0	Unknown
Malvaceae	<i>Sida cordifolia</i>	Flannel Weed	B C		WA1 G&M DEU	0	Unknown
Malvaceae	<i>Sida spinosa</i>	Spiny Sida			DEU	57	2001
Poaceae	<i>Sporobolus africanus</i>	Parramatta grass			Q2 G&M	0	Unknown
Poaceae	<i>Sporobolus coromandelianus</i>	Madagascar Dropseed			DEU	0	Unknown
Fabaceae	<i>Stylosanthes hamata</i>	Caribbean Stylo			DEU	0	Unknown
Fabaceae	<i>Stylosanthes humilis</i>	Townsville Lucerne			DEU	1	2003
Zygophyllaceae	<i>Tribulus terrestris</i>	Caltrop	B C		CYP SA	8	1996
Poaceae	<i>Urochloa mosambicensis</i>	Sabi Grass			DEU	0	Unknown
Fabaceae	<i>Vachellia farnesiana</i>	Sweet Acacia			DEU	26	2001
Fabaceae	<i>Vachellia nilotica</i>	Prickly Acacia	A C	WONS	MP K2 Q2 G&M DEU NSW	0	Unknown
Asteraceae	<i>Xanthium strumarium</i>	Noogoora Burr	B C		MP WA1 WA2 WA4 DEU NSW SA	19	2001

WA4, WA Weed Class P4 (prevent spread)
WA5, WA Weed Class P3 (control infestations on public land) (www.landmanager.com.au/view/index.aspx?id=449884).

Survey = this category refers to data collected using systematic survey methodology
Specimen = this category refers to museum or other records where a specimen has been collected and lodged
Observation = this category refers to all other incidental recordings where systematic methodology may not have been used consistently.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=####
where #### is the ID number from the tables above for the species of interest.

Plants listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Custom area



Custom area Pest and Potential Pest Animals



Animals with pest potential recorded in the grid cell(s) in which Custom area occurs. Occurrence based on Northern Territory Government databases.

Common Name	Scientific Name	NT Status	National Status	ID	#Observations (Latest)	#Specimens (Latest)	#Surveys (Latest)
Asian House Gecko	<i>Hemidactylus frenatus</i>	P	.	188964	1 (1991)	4 (2000)	0 (Unknown)
Rock Dove	<i>Columba livia</i>	P	.	183336	2 (2001)	0 (Unknown)	0 (Unknown)
Red-tailed Black-cockatoo	<i>Calyptrorhynchus banksii macrorhynchus</i>	N	.	223765	3 (1998)	0 (Unknown)	2 (2004)
Sulphur-Crested Cockatoo	<i>Cacatua galerita</i>	N	.	223772	1 (1998)	0 (Unknown)	1 (1995)
House Sparrow	<i>Passer domesticus</i>	P	.	183322	28 (2004)	16 (Unknown)	0 (Unknown)
House Mouse	<i>Mus musculus</i>	P	.	187720	31 (1996)	32 (1996)	3 (2011)
Black Rat	<i>Rattus rattus</i>	P	.	183236	0 (Unknown)	2 (1960)	0 (Unknown)
Dingo / Wild dog	<i>Canis lupus</i>	N	.	183280	37 (2009)	59 (1970)	15 (2011)
Fox	<i>Vulpes vulpes</i>	P	.	183294	10 (2009)	0 (Unknown)	2 (2011)
Cat	<i>Felis catus</i>	P	.	183259	41 (2010)	4 (1980)	9 (2011)
Rabbit	<i>Oryctolagus cuniculus</i>	P	.	187331	14 (1996)	0 (Unknown)	0 (Unknown)
Donkey	<i>Equus asinus</i>	P	.	183287	18 (2009)	0 (Unknown)	3 (2004)
Horse	<i>Equus caballus</i>	P	.	183315	16 (1999)	0 (Unknown)	0 (Unknown)
Pig	<i>Sus scrofa</i>	P	.	183329	12 (1999)	0 (Unknown)	0 (Unknown)
Camel	<i>Camelus dromedarius</i>	P	.	183210	4 (2009)	0 (Unknown)	0 (Unknown)
Cattle	<i>Bos taurus</i>	P	.	183266	11 (2010)	0 (Unknown)	29 (2011)

NT STATUS CODES:

Int, Introduced species (all non-prohibited vertebrates, and all other exotic species (www.landmanager.com.au/view/index.aspx?id=280771))

N, Native species with pest potential.

P, Prohibited species (all exotic vertebrates except those listed as non-prohibited (www.landmanager.com.au/view/index.aspx?id=450509))

Survey = this category refers to data collected using systematic survey methodology

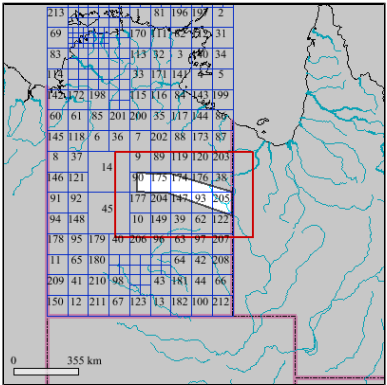
Specimen = this category refers to museum or other records where a specimen has been collected and lodged

Observation = this category refers to all other incidental recordings where systematic methodology may not have been used consistently.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=####

where #### is the ID number from the tables above for the species of interest.

Potential pest animals listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Custom area



Soils and vegetation graphs and tables refer to area of soils and vegetation only. Fire graphs and tables refer to entire selected area including sea if present. Calculations are derived from map images or vector data, and should be taken as a guide only. Accuracy cannot be guaranteed. For small areas, figures should be rounded to the nearest whole number.

Appendix F - Wildlife Online Search Results

Table 1. Wildlife Online records of EPBC listed species

Class	Scientific Name	Common Name	QLD status	Aus Status	Sighting Records	Specimen Records	Search Area
birds	<i>Erythroriorchis radiatus</i>	Red Goshawk	E	V	1	0	3
birds	<i>Erythrura gouldiae</i>	Gouldian finch	E	E	1	0	3
birds	<i>Rostratula australis</i>	Australian painted snipe	V	E	7	0	3

Table 2. Wildlife Online search area coordinates

Search Areas	Latitude:	Longitude:
1	20 - 21	138 - 139
2	21 - 22	138 - 139
3	20 - 21	139 - 140
4	21 - 22	139 - 140

Appendix E Threatened Species Likelihood of Occurrence Assessment

Appendix E – Threatened species likelihood analysis

This Appendix E aims to determine the likelihood of occurrence of threatened species within the Planning Corridor. It uses the threatened species output from the EPBC Protected Matters Search Tool report (Appendix B of NOI Appendix D) and the NT NRM Infonet online search tool (NOI Appendix A). By using species records data, modelled distributions, species ecology and habitat distribution it redefines likelihood of occurrence. This assessment has been undertaken using desktop information only, and results of this assessment will help identify which species will require special consideration (i.e. field work, management plans) during the environmental approvals process.

Method

The following procedure was used to determine the occurrence likelihood of threatened species within the Planning Corridor:

- 1) A search for Matters of National Environmental Significance (MNES) along the proposed pipeline route and within a 50 km buffer was undertaken using the Protected Matters Search Tool on 26 May 2015 (Appendix B of NOI Appendix D). A 50 km buffer was used to get a broad scale picture of the area through which the Planning Corridor would pass. A search of the Planning Corridor and approximately a 50km or more buffer area was also undertaken using the NT NRM Infonet online tool to generate a list of potential threatened species protected under the *Territory Parks and Wildlife Conservation Act* (NOI Appendix A).
- 2) The Planning Corridor for this project is a 20km buffer (the final pipeline will occur within this buffer after Traditional Owners and other landholder agreements and ecological and geotechnical survey); consequently, for each of the species in Step 1 above, a likelihood of occurrence analysis within the 20km Planning Corridor was undertaken.
- 3) To further examine likelihood of occurrence of threatened species within the Planning Corridor, literature on the ecology and distribution of each of the above species was reviewed.
- 4) Habitat data from within the Planning Corridor was collated from land unit data.
- 5) Threatened species records were obtained from the NTG threatened species dataset and the Atlas of Living Australia.
- 6) After examining the threatened species list and using distribution/habitat data, each species were allocated one of the following categories:
 - Known – there are recent records of the species within the Planning Corridor.
 - Likely – core habitat for the species occurs within the footprint but there are no records.
 - Unlikely – there is no core habitat for the species within the footprint; however, the species may be present on occasion.

It should be noted that resultant likelihood rankings may differ from those assigned in the EPBC Protected Matters Search Report because criteria in this assessment considers habitat present within the Planning Corridor, whereas the EPBC Report utilises coarser-scale filters.

- 7) For those species that are known or likely to occur, a more detailed analysis of the species ecology is provided to help assess and reduce impacts.

Results of likelihood analysis

Within the 50 km search area, the EPBC Act Protected Matters Search Report and the NT NRM Infonet lists combined list 22 threatened species. The following table details the likelihood analysis of the 22 species within the Planning Corridor.

Table 1. Likelihood of occurrence within the Planning Corridor summary

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
BIRDS				
Red Goshawk <i>Erythrotriorchis radiata</i>		VU	Habitat: Prefers tall open eucalypt forest and riparian areas. Nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water (Debus et al.1988; Aumann et al. 1991). Distribution: Sparsely distributed across much of the northern Australia, from the Kimberley to south-eastern QLD. PMST presence: Species or habitat may occur. QLD Wildlife online records: 1 record (unknown date) NT NRM Infonet records: 0 records	UNLIKELY • This species is picked up in the EPBC search due to the habitat and record in the QLD section of the 50 km buffer. • Although the project footprint intersects riverine vegetation along major rivers (EPBC Appendix A3 Figure 17) these do not contain permanent water and thus would not be suitable habitat. • Although the species' is sparsely distributed, its range incorporates the eastern section of the project footprint (EPBC Appendix A3 Figure 17). • There is a single record from within the Mt Isa Township this is outside the Planning Corridor.
Gouldian Finch <i>Erythrura gouldiae</i>	VU	EN	Habitat: Prefers annual and perennial grasses (especially Sorghum), a nearby source of surface water and, in the breeding season, unburnt hollow-bearing Eucalyptus trees (especially E. tintinnans, E. brevifolia and E. leucophloia) (Tidemann 1996; Higgins et al. 2006). Distribution: Sparsely distributed across northern Australia from the Kimberley to north-central QLD (Dostine 1998; Franklin 1999; Barrett et al. 2003). PMST presence: Species on habitat known to occur. QLD Wildlife online records: 1 record (unknown year) NT NRM Infonet Records: 0	UNLIKELY • This species is picked up in the EPBC search due to the habitat and record in the QLD section of the 50 km buffer. The one record shown in the NT section of the NT is outside of the 50km search buffer. • The possible distribution within the NT section is well outside the 50km search buffer. • Vegetation mapping indicates the project footprint passes regional ecosystems containing E. leucophloia near Mt. Isa

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			records	which could provide suitable habitat (EPBC Appendix A1 Figure 3 and Figure 4). There is no <i>E. leucophloia</i> shown in the NT section. There is only a single record of Gouldian Finch within the Wildlife Online search area. There are no records within the Infonet search area. The Atlas of Living Australia records approximately 14 birds were observed at Lady Loretta Mine Rd, NW of Mt. Isa in 2011 (ALA, 2015) this is outside of the Planning Corridor.
Night Parrot <i>Pezoporus occidentalis</i>		EN	Habitat: During the day it rests within clumps of spinifex. It also nests within spinifex hummocks, building a rough nest in which up to four white eggs are laid (Garnett & Crowley 2000). Distribution: No specimens of the night parrot have been taken in the NT; however, sightings were made up to 1923 at the Alice Springs Telegraph Station, Horseshoe Bend Station, Idracowra Station, Henbury Station and Hermannsburg (Whitlock 1924). PMST presence: Species or habitat likely to occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 0 records	UNLIKELY - Mapped areas of suitable hummock grassland habitat end approximately 30 km south of the Alignment Corridor. - The species' mapped distribution ends south of the proposed pipeline alignment (aligned with the hummock grassland habitat). This is well south of the Planning Corridor, which does not contain any suitable habitat. - There are no database records from within the search area; the closest record is over 200 km south of the Alignment Corridor.
Australian Painted Snipe <i>Rostratula australis</i>	VU	EN	Habitat: Inhabits fringes of permanent and temporary wetlands, swamps and inundated grasslands (Taylor	UNLIKELY There are suitable permanent and

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			et al. 2007). The species could occur on any shallow ephemeral wetlands in central or southern NT or western QLD. Distribution: The species has a distribution that covers nearly all of the NT and QLD (Garnett et al 2011). This species is nomadic and scattered across Australia with no predictable occurrence (Rogers 2001) but could occur at any wetland or inundated grassland across its distribution. PMST presence: Species or habitat likely to occur. QLD Wildlife online records: 7 records (unknown) NT NRM Infonet Records: 0 records	ephemeral wetlands within the search area however no large wetlands within the Planning corridor. Of note is the wetland area near Barkly and Lake Moondarra to the north east of Mt. Isa. Both of these areas are outside the Planning Corridor. • The species' distribution incorporates the entire Planning Corridor. • There are records of <i>Rostratula australis</i> within the search area but no records of the species within the Planning Corridor. The records within the search area are within QLD (there was also one spatially suspect record from the Atlas of Living Australia that may have come from the Tennant Creek Sewerage works this record was excluded from the analysis.
Masked Owl (Northern) <i>Tyto novaehollandiae kimberli</i>	VU	VU	Habitat: Occurs mainly in eucalypt tall open forests (especially those dominated by <i>Eucalyptus miniata</i> and <i>E. tetradonta</i>), but also roosts in monsoon rainforests, and forages in more open vegetation types, including grasslands (Woinarski & Ward 2006). Distribution: Poorly known, with few records from across its broad range in northern Australia. In the NT records known from the Top End, Kakadu, Coburg Peninsula (majority of records) and south-west Gulf country (Woinarski & Ward 2006). PMST presence: Species or	LIKELY • Suitable foraging habitat potentially occurs within the search area. • The single record from within the Planning Corridor is near tussock grassland and acacia open woodland habitat in the NT. • The area south of Avon Downs is included in the species' distribution and is within the Planning Corridor. • There is a single Infonet record (2001) from south of Avon Downs

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			species habitat known to occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 1 record (2001)	within the search area.
Grey Falcon <i>Falco hypoleucos</i>	VU		Habitat: Occurs in areas of lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm (Ward 2012). Distribution: Sparsely distributed through much of the arid and semi-arid areas of Australia but is recorded in all Australian mainland states and territories. In the NT, the majority of records are from the southern half, but there are records all the way up to Darwin (Ward 2012). PMST presence: Not present through PMS. NT NRM Infonet search presence due to species or habitat being likely to occur. NT NRM Infonet Records: 4	LIKELY - Suitable habitat potentially occurs within the search area. - There are four records from within the search area and a further five from within the grids in which the search area is in. - Distribution maps on ALA cover the Planning Corridor and buffer and occurrences within the search area suggest it is likely this species could be found within the Alignment Corridor.
Painted Honeyeater <i>Grantiella picta</i>	VU		Habitat: <i>Grantiella picta</i> inhabit Acacia and Eucalyptus-dominated woodlands and open forest and prefer habitats with more mature trees that host more mistletoe. Breeding times and seasonal movements (south-north) are thought to be governed by the fruiting of mistletoe (Garnett et al. 2011). Distribution: Found across eastern and northern parts of the country. Over spring and summer its distribution stretches from inland central Victoria through scattered parts of much of New South Wales and the ACT and into southern QLD. There is one recent record from within the QLD section of the Planning Corridor and an additional	UNLIKELY - Unlikely that suitable habitat potentially occurs within 50 km buffer. - There is one record from 1981 within the grids in which the search area is in. - The distribution maps on ALA do not cover any of the search area used in the NT NRM Infonet. The nearest are of distribution is approximately 120km east in QLD near Mt Isa.

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			record from where the Barkly Highway meets the Stuart Highway. PMST presence: Not present through PMS. NT NRM Infonet search presence due to species or habitat in search area. NT NRM Infonet Records:	
MAMMALS				
Greater Bilby <i>Macrotis lagotis</i>	VU	VU	Habitat: Found in hummock grasslands on sandy soils with a preference for drainage lines (Southgate 1990). Has large foraging area and will move home range in search for food (Johnson 2008) Distribution: Historically this species was widespread in arid Australia. Currently in the NT its strong holds are in the Tanami Desert (Pavey 2006). PMST presence: Species or habitat known to occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 54 records (2009)	UNLIKELY • An extremely small area of hummock grassland is located within the Planning Corridor (EPBC Appendix A3 Figure 16). • The majority of records are west of the Stuart Highway in the Tanami Desert outside the Planning Corridor. • There are 16 records from within the search area and 54 records from within the grid cells in which the search area occurs however only one of these (1990) occurs within the Planning Corridor (EPBC Appendix A3 Figure 16).
Southern Marsupial Mole <i>Notoryctes typhlops</i>	EN	EN	Habitat: This species is found in sandy deserts where it is mostly associated with dunes, sandy plains and river flats (Pavey 2006). Distribution: This species occurs in central Western Australia, northern South Australia and southern NT. Within the NT it has been found as far north as Barrow Creek (Pavey 2006) and appears and is confined to the southern and western sections of the Territory (Beshemesh 2008). PMST presence: Species or	UNLIKELY • Core habitat (desert sand dunes) does not occur within the Planning Corridor. The areas of suitable dunefield habitat occur to the west of the Planning Corridor (EPBC Appendix A3 Figure 18). • No areas of the Planning Corridor are included in the distribution of the

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			habitat likely to occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 1 records	species. - The species is known to occur within sandplains, however they are often found close to dune habitat which does not occur within the Planning Corridor. - There are no database records of the species within the search area. There is a single record from the grid cells in which the search area occurs.
Black-footed Rock-wallaby <i>Petrogale lateralis</i> (MacDonnell Ranges Race)	VU	VU	Habitat: This species occurs in upland rocky areas with associated steep slopes (Pavey 2006). Relevant to the project the sandstone hills and sandstone plains and rises habitat within the Davenport and Murchison Ranges SOC could provide suitable habitat (DNRETAS 2015). Distribution: In the NT this species is mostly found in the MacDonnell Ranges, but also occurs throughout the arid southern end of the NT (Pavey 2006) and may be found in the Davenport and Murchison Ranges. PMST presence: Species or habitat may occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 16 records (1988)	UNLIKELY - Potential habitat of upland rocky areas within the Davenport Ranges exists at the southern margin of the 50 km buffer but well outside the Planning Corridor. The Alignment Corridor will not pass through this area. - The distribution of the species is centred on the West MacDonald Ranges; however, the species is found in the Davenport Ranges south of the Planning Corridor. - There are only 3 records (1988) within the search area with the other 13 records occurring south of the Planning Corridor in the grid cells in which the search area sits.
Carpentarian Antechinus <i>Pseudantechinus mimulus</i>	VU	VU	Habitat: The few records of this species show a preference for a range of vegetation types associated with a high cover of rocks and boulders. Within QLD the records come from rocky habitat with open woodland	UNLIKELY This species is picked up in the EPBC search due to the habitat and records in the QLD section of the 50 km

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			dominated by <i>Eucalyptus leucophloia</i>, <i>E. normantonensis</i> and <i>Corymbia terminalis</i>. Distribution: At the present time this species is only known from Sir Edward Pellew group of islands in the NT (Kitchener 1991; Johnson & Kerle 1991; Taylor et al. 2004) and around Mount Isa (Wonarski 2004) and Pungalina Station (Woinarski & Ward 2012). PMST presence: Species or habitat known to occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 2 records (1969) (within grid cells)	buffer. The one record shown in the NT section is well outside of the 50km search buffer (EPBC Appendix A1 Figure 5). • The sandstone hills and boulders to the west of Mt. Isa within the Planning Corridor potentially provide suitable habitat for the species. • The distribution of the species incorporates the eastern section of the Planning Corridor (EPBC Appendix A1 Figure 5). • There are no records of the species within Wildlife online database however this may not be complete. • There are three records in the vicinity of Mt. Isa within the ALA database. These are outside the Planning Corridor. There are two old records from within the grid cells in which the search area sits from the NT but no records from within the search area.
Golden Bandicoot <i>Isoodon auratus</i>	EN	VU	Habitat: Mainly in heathland and shrubland on sandstone sheaths and avoids vegetation with greater tree cover (Palmer et al. 2012; Southgate et al. 1996) Distribution: In the NT (NT), the golden bandicoot was known from only one location, Marchinbar Island on the Wessel chain, north-eastern Arnhem Land (Palmer et al. 2012). There are now translocated populations on	UNLIKELY • There are very minimal areas of shrubland across the Planning Corridor that would be suitable habitat for this species. • There are no known/spatially valid records within the Planning Corridor. • The records shown on ALA and the NT

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			Raragala and Guluwuru Islands in the Wessels. Also in the Kimberley. There are no occurrences within the Planning Corridor. PMST presence: Not present through PMS. NT NRM Infonet search presence due to species or habitat within search area. NT NRM Infonet Records:24	Threatened Species Information sheet for the <i>Isoodon auratus</i> show only one nearby record at Tennant Creek which is from 1901. The most recent records for this species within the NT are all located on Marchinbar and Guluwuru Islands.
Brush-tailed Mulgara <i>Dasycercus blythi</i>	VU	VU	Habitat: Occur in a range of vegetation types but prefer mature hummock grasslands of spinifex, especially <i>Triodia basedowii</i> and <i>T. pungens</i> (Pavey et al. 2006; Masters et. al. 2003). The species digs burrows between sand dunes more likely found in the Western Tanami and West of Alice Springs (Van Dyke and Strahan 2008). Distribution: The brush-tailed mulgara is known from at least the western and Simpson deserts, with confirmed records in the NT from Haast Bluff, Uluru, Papunya, Tanami Desert, Illamurta, Charlotte Waters and Crown Point (Pavey et al. 2006). Predominately the species occurs to the south and West of the Planning Corridor though there is a single record from 1993 within the Planning Corridor. PMST presence: Not present through PMS. NT NRM Infonet search presence due to species or habitat present. NT NRM Infonet Records:5	UNLIKELY - There are very minimal areas of arid spinifex grasslands across the Planning Corridor that would be suitable habitat for this species. - Because most previous records did not distinguish among the two species of mulgara now recognized, there is ambiguity about the distribution of both species. There is one known record on ALA approximately 20km south of the Planning Corridor along the Barkly Hwy from 1993, and two at Tennant Creek from 1901 and 1904.
Crest-tailed Mulgara <i>Dasycercus cristicauda</i>	VU	EN	Habitat: Thought to prefer sand dune habitats in the Simpson Desert especially where vegetated with canegrass (<i>Zygochloa paradoxa</i>) and <i>Triodia basedowii</i> in the interludes or	UNLIKELY - There isn't expected to be any suitable habitat for this species within the Planning Corridor. - There are no known

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			areas around salt lakes containing (<i>Nitratia billardierei</i>) (Van Dyke and Strahan 2008). There are no records of either of these plant species are found within close proximity to the Planning Corridor. Dune and salt lake habitat is more commonly found to the west and the south of the Planning Corridor. Distribution: Distribution is not well known but is confirmed in the Simpson and Tanami Deserts (Pavey et al. 2006). Most records are from the Simpson Desert, well south of the Planning Corridor with some records to the west of the Stuart Highway. The modelled distribution of the species extends towards the southern edge of the Planning Corridor but the species is unlikely to occur in the Alignment Corridor. PMST presence: Not present through PMS. NT NRM Infonet search presence due to species or habitat within search area. NT NRM Infonet Records:3	records recorded in the Planning Corridor on the ALA database. The distribution and records are mostly restricted to the Simpson Desert which is approximately 290 km south of the Planning Corridor.
Common Brushtail Possum (Southern N.T.)<i>Trichosurus vulpecula vulpecula</i>	EN		Habitat: Common Brushtail Possums are found in many types of habitats, the central Australian population occupies riverine habitat close to rocky outcrops or ranges (Kerle et al. 1992). The habitat is characterized by a diverse assemblage of plant species that are sensitive to fire (Pavey 2006). Distribution: <i>Trichosurus vulpecula vulpecula</i> is most common in the southern NT within the MacDonald Ranges (Pavey 2012). PMST presence: NT NRM Infonet search presence due to	UNLIKELY - The vegetation communities through the Planning Corridor are largely grasslands with limited riverine habitat. The only section of the Planning Corridor where potential habitat occurs is within the Davenport Ranges which will be avoided by the Alignment Corridor. - There are no records on the ALA within the Planning Corridor.

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			species or habitat presence. NT NRM Infonet Records: 5	There are records from the Davenport Ranges and the rocky hills around Tennant Creek but these are historic records and range contraction indicates that the species is unlikely to occur in these areas currently.
REPTILES				
Plains Death Adder <i>Acanthophis hawkei</i>	VU	VU	Habitat: Occurs on floodplains and cracking soil plains (Webb et al. 2002). Distribution: Occurs across mainland northern Australia in a disjointed pattern. In the NT, it is known from floodplains of the Adelaide, Mary and Alligator Rivers as well as the Barkly Tableland on the NT (NT)/QLD (QLD) border. PMST presence: Species or habitat known to occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 23 records (1985)	LIKELY - There is an area of potentially suitable habitat towards the eastern end of the Planning Corridor (EPBC Appendix A1 Figure 6). This section of Vertosols/cracking clay soils across tussock grassland could be habitat for the species. - The distribution of the species extends across a section of the eastern end of the Planning Corridor though the core distribution is north of the Barkly Highway within the Barkly Tablelands. - There is one record just north of the Planning Corridor in the NT (EPBC Appendix A1 Figure 6).
Great Desert Skink <i>Liopholis kintorei</i>	VU	VU	Habitat: The species generally occurs on tall open shubland and hummock grasslands on red sandplains and sand ridges (Cogger et al. 1993). However, in some locations (e.g. the Gibson Desert) they are found on sandplains with fine gravel. Distribution: Currently known	UNLIKELY - The current distribution of the species is confined to the western NT particularly the western Tanami; well outside the Alignment Corridor. - There are hummock

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			from seven populations (McAlpin 2001) but originally known to occur within a broad range extending from the desert parts of south western NT, eastern interior of WA and north western south Australia (Cogger et al. 1993). However the precise habitat range is unknown (McAlpin 2001). PMST presence: Species or habitat may occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 0 records	grasslands in the western section of the Planning Corridor however these are well outside the species range. There are no database records from within the search area (or grid cells). There are two old records 1906 from within the Planning Corridor on the Atlas of Living Australia.
Gulf Snapping Turtle <i>Elseya lavarockorum</i>		EN	Habitat: The species inhabits large rivers and their associated overflow lagoons and oxbow lakes (Cogger 2000). The Gulf Snapping turtle is found in deeper permanent pools most often with muddy, sandy or rocky bottoms. The species is also found in the middle reaches of rivers, upstream of saline regions and downstream of escarpments, including plunge pools. Steep rocky gorges, and river reaches with intact river banks seem to be preferred habitats for Gulf Snapping Turtles (Thomson et al. 1997). Distribution: The Gulf Snapping Turtle is known from the Calvert River to the Nicholson River systems, including the Roper, Limmen Bight, Robinson and Nicholson Rivers all of which discharge into the Gulf of Carpentaria (Georges & Adams 1996; Thomson et al. 1997). PMST presence: Species or habitat known to occur.	UNLIKELY - The only section of Planning Corridor that overlaps with the species' potential distribution is the very eastern section around Mt Isa and confined to the Leichardt River. - From the potential distribution (above) there is unlikely to be potential habitat for the species in the very upper reaches of the Leichardt River above Lake Moondarra. - There are no records of the species from within the search area or grid cells in which the search area sits. There are no records of the species within the Leichardt River. The closest records are from the Lawn Hill area approximately 200 km from the Planning Corridor.

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			QLD Wildlife online records: 0 records NT NRM Infonet Records: 0 records	
FISH				
Large-tooth Sawfish, Freshwater Sawfish <i>Pristis pristis (microdon)</i>	VU	VU	Habitat: Juveniles and sub-adults predominantly occur in rivers and estuaries, while large mature animals tend to occur more often in coastal and offshore waters up to 25 m depth (Giles et al. 2006; Stevens et al. 2005). Distribution: This is known from several drainages in northern Australia from Western Australia to QLD. In the NT, it is known from at least eight catchments in the NT, this species has the potential to occur in more. Currently it is known from the Adelaide, Alligator (East and South), Daly, Darwin, Goomadeer, McArthur, Robinson & Victoria Rivers (Larson et al. 2007). PMST presence: Species or habitat likely to occur. QLD Wildlife online records: 0 records NT NRM Infonet Records: 0 records	UNLIKELY - The Planning Corridor primarily sits in Lake Eyre drainages i.e. flowing south away from the river systems that this species uses. - The only area overlapping with potential distribution is the Leichardt River near Mt Isa. - This section of the Leichardt River is upstream of Lake Moondarra and thus does not provide suitable habitat for the species. The upper reaches of the Leichardt River does not present suitable habitat for <i>Pristis pristis</i>. - There are no database records of the species within the Planning Corridor. One study (Peverell 2009) has recorded the species in the Leichardt but well downstream of the project site and Moondarra Dam. Impact of the project such a distance downstream and below the dam is unlikely.
SNAILS				
Spencer's Land Snail <i>Bothriembryon spenceri</i>	VU		Habitat: This snail is found in in leaf litter under fig trees and/or rocky areas. During unfavourable periods it buries in the soil (Wilson et al. 2006).	UNLIKELY There are no records of the species from within the search area or grid cells in which the

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
			Distribution: This species is largely restricted to the Krichauff and Chewings Ranges west of Alice Springs, notably occurring in Palm Valley (Solem 1988). It was first collected and described in the Horn Expedition of 1894 (Wilson et al. 2006). PMST presence: NT NRM Infonet search presence due to species or habitat within search area. NT NRM Infonet Records: 0	search area sits. - There are minimal rocky areas within the Planning Corridor that would provide suitable habitat for this species. The rocky outcrops that do occur around the Tennant Creek area will be avoided due to issues posed to pipeline construction through rocky outcrops. - The nearest record for this species on ALA is located west of Alice Springs in the West MacDonnell National Park.
FLOWERING PLANTS				
<i>Austrobryonia argillicola</i>	VU		Habitat: <i>Austrobryonia argillicola</i> occurs along creeks and poorly drained areas. Recorded from Bluebush swamps, Gidgee shrubland and <i>Eucalyptus camaldulensis</i> dominated riparian woodlands (Nano et al. 2012). Distribution: The species is distributed through northern Australia from the Barkly Tablelands to Central western QLD. The species is currently only known from 5 locations within the NT (Nano 2012). One of these locations is within the Planning Corridor and is located close to the Barkly Highway. There is an additional record on ALA from 1995 which is west of the known locations described in Nano (2012). PMST presence: NT NRM Infonet search presence due to species or habitat within search area. NT NRM Infonet Records: 0	LIKELY - There is potential for there to be suitable habitat within the Planning Corridor for this species, especially in the eastern area near the Qld border where there are numerous small ephemeral creeks and cracking clay soils, with some intermittent lakes. - There is one known record shown in the NT Threatened Species Info sheet for this species which lies just outside the Planning Corridor and one record from ALA which is further west and is from 1995.

Species	TPWC Act	EPBC Act	Species details	Likelihood of occurrence
<i>Sporobolus latzii</i>	VU		Habitat: <i>Sporobolus latzii</i> is only known to occur on clay soil at the edge of a seasonal swamp surrounded by <i>Eucalyptus coolabah</i> (Albrecht et al. 2012). Distribution: The species is endemic to the NT and is currently only known from one site (Albrecht et al. 2012). This site is within the Planning Corridor just south of the Barkly Highway. PMST presence: NT NRM Infonet search presence due to species or habitat within search area. NT NRM Infonet Records: 1	LIKELY - There is potential for there to be suitable habitat within the Planning Corridor for this species, especially in the eastern area near the Qld border where there are numerous small ephemeral creeks and cracking clay soils, with some intermittent lakes. - There is one record located within the Planning Corridor just south of the Barkly Hwy

Appendix F *APGA Code of Environmental Practice 2013*



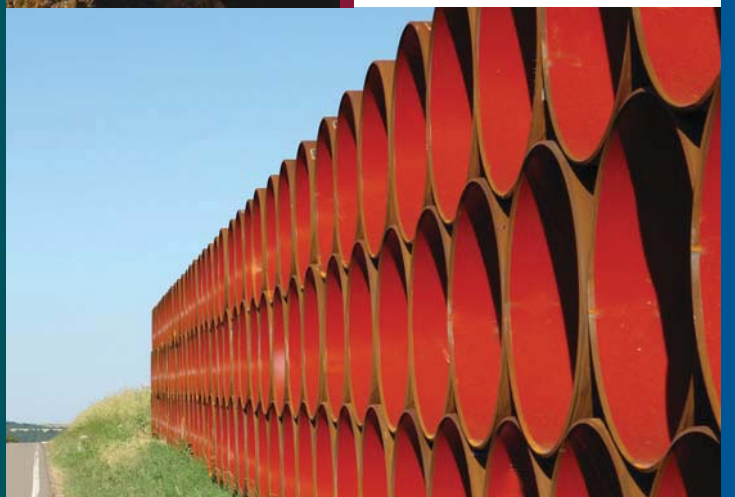
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CODE OF ENVIRONMENTAL PRACTICE

ONSHORE PIPELINES

OCTOBER 2013



ENSURING THE FUTURE OF AUSTRALIA'S DYNAMIC PIPELINE INDUSTRY

Published by Australian Pipeline Industry Association Ltd

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This third revision and update specifically focuses on currency issues within the industry, particularly legislative and Australian Standards currency, standardising industry terminologies, practices and control measures; this revision includes recognition of water and other product transmission pipelines in order to ensure holistic coverage of the above-mentioned practices and processes used by the pipeline industry.

The continued development of the Code is only possible thanks to the work of earlier contributions and APIA gratefully recognises the efforts made by all those who have participated in the Code's original development and revisions.

During the development of the original Code, membership of the APIA Environmental Affairs Committee included: Jim McDonald, Lindsay Goodwin, John Balint, Ken Berry, Craig Bonar, Ross Calvert, Megan Lawson, Tom Lyon, Julie Mitchell, Bruce Ride, Mike Sotak and Mark Watson.

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PREFACE

The pipeline industry has a vital role in the economic and environmental wellbeing of Australia. Over many decades it has evolved techniques which now place it at the forefront of best practice in the construction, operation and decommissioning of pipelines. This enviable reputation is now recognised internationally and our experience is increasingly sought in many countries.

This Code is intended to encapsulate the best and most appropriate techniques and methods presently available to mitigate or eliminate the environmental impact of our activities and is based on the collective knowledge and experience of pipeline industry participants. APIA intends that the Code is viewed in the Australian pipeline industry as the minimum acceptable standard.

All pipeline construction is different and, consequently, it is not possible to set prescriptions on any particular course of action. Rather, we have assembled options for action, which, together, form a 'tool kit'. It is from these tool kits that the planners and the construction teams in the field will select the options best suited to their needs.

The Code demonstrates the industry's commitment to be leaders in the move to ecologically sustainable development and to be an active contributor to national goals for biodiversity protection and greenhouse mitigation.

The Code is a living, evolving document, and as such, will be reviewed frequently in light of new science, technology and regulation, to ensure that it reflects the most sensible, practical and effective practice of the time. By this continuing process of improvement, we believe our industry will maintain its position at the leading edge of environment protection in Australia.

This Code has been developed by APIA in consultation with its membership, the former Australian Gas Association, the Australian Petroleum Production and Exploration Association and pipeline regulating authorities in each Australian State and Territory. APIA Members are encouraged to adopt this Code and to provide feedback on its application. Community members are also invited to provide feedback to APIA on this initiative.

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1 INTRODUCTION

Supplying energy, water and mineral resources to communities and industry, pipelines play a vital role in Australia, directly contributing to national economic growth. Pipelines play an integral part in supplying critical commodities and energy sources to domestic and international markets. They play a major role in drought mitigation and support the development and commercialisation of primary industries throughout Australia. Pipelines are synonymous with the generation of a low carbon economy with efficiently transported commodities such as natural gas providing an important, low emission fuel with a long-term role in transitioning Australia to a low emission future. Pipelines are also providing the link between CO₂ source and sequestration sites to enable carbon capture and storage technologies and will move fuels of the future, such as hydrogen.

Pipelines continue to be the most energy efficient method of transportation for the commodities that they transfer and distribute throughout Australia.

In Australia, pipelines are used for a range of purposes, including:

- domestic and industrial water supply
- sewage and waste water removal, including recycled water
- gas transmission, storage and distribution
- petroleum and petrochemical liquids transmission
- slurry transportation
- powerline and cable conduits.

In 2012, the gas transmission pipelines that are APIA's core focus transported over 1,300 petajoules (PJ) of the natural gas that is used in the Australian economy each year.

One PJ, or 278 gigawatt hours, is the heat energy content of about 43 000 tonnes of black coal or 29 million litres of petrol. 740PJ of natural gas are consumed directly for energy in Australia every year, and another 600PJ are used for electricity generation and in manufacturing processes where the gas is used as feedstock to create products such as fertilizers, explosives and other chemicals.

It is not often recognised that the 740 PJ of energy delivered directly by Australia's gas transmission and distribution pipelines is roughly equivalent to the entire energy output of the electricity sector, which in 2012 was 870 PJ or 242TWh. When the fact that 15% of the electricity was generated by natural gas-fired power stations is considered, it is apparent that natural gas supplies an equal amount of energy to the Australian economy as the electricity sector. Natural gas does this cleanly and efficiently and gas transportation by pipeline is the most efficient way to transport energy. In terms of transmission losses, an average of 1% of energy is used by a transmission pipeline to transport gas in comparison with an average loss in electricity networks of 7%.

The Australian pipeline industry is committed to ensuring that, as well as being a highly efficient mode of transport, pipelines have a low physical impact on the environments they pass through, and that they continue to do this throughout their lifespan, from construction through their operating life to decommissioning.

Pipelines constructed, operated and decommissioned in an appropriate manner have no lasting impact on the surrounding environment, and in almost all circumstances do not prevent the continued availability of any land they pass through for current or future uses.

1.1 ECOLOGICALLY-SUSTAINABLE DEVELOPMENT

Sustainability is a powerful global and national goal and is also a moral imperative influencing Australia's construction industry. With increasing community concern for the environment, over social impacts and climate change, as well as an increased focus on energy consumption in a carbon regulated world, the pipeline industry will need to take steps to ensure its facilities and operations are developed with ecological sustainability in mind.

While there is no universally accepted definition of ecologically sustainable development (ESD), in 1992 the Commonwealth Government suggested the following definition for ESD in Australia:

'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.

Put more simply, ESD is development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. To do this, we need to develop ways of using those environmental resources which form the basis of our economy in a way which maintains, and where possible improves, their range, variety and quality. At the same time we need to apply those resources to develop industry and generate employment.

Embracing ESD principles within pipeline projects will contribute to achieving more economically sustainable projects and operations, while meeting community social and environmental objectives and being in accord with international agreements, national legislation, standards and codes of practice. On this basis, it can be said that the long-term future of the Australian pipeline industry is dependent on its members giving due consideration to ESD.

The pipeline industry is in a unique position within the infrastructure and energy sectors to do so. As pipelines are, in the vast majority of cases, buried infrastructure, the industry has the opportunity to minimise environmental and social impacts in ways not available to other forms of infrastructure. It is APIA's goal that Australia's pipeline industry is seen as a national and global leader in ESD.

1.1.1 PRINCIPLES FOR ESD IN AUSTRALIA'S PIPELINE INDUSTRY

Within the National Strategy for Ecologically Sustainable Development are seven guiding principles. APIA has adapted these for Australia's pipeline industry and encourages all pipeline proponents to recognise the following principles in their decision-making processes:

- Decision-making processes should effectively integrate both long- and short-term economic, environmental, social and equity considerations
- where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- the national dimension of the potential environmental impacts of actions and activities should be recognised and considered
- the pipeline industry should contribute to the development of a strong, growing and diversified economy which can enhance the capacity for environmental protection to be recognised
- the need to maintain and enhance competitiveness in an environmentally-sound manner should be recognised
- cost-effective and flexible approaches should be adopted
- decisions and actions should provide for broad community involvement on issues which affect it.

The effective adoption of these principles will enable Australia's pipeline industry to achieve APIA's goal of having Australia's pipeline industry recognised as a national and global leader in ESD.

1.2 PURPOSE AND SCOPE OF THIS CODE

This Code aims to assist the industry by establishing a minimum acceptable standard to be applied to the onshore pipeline construction, operation and decommissioning phases, encouraging the adoption and integration of sensible, practical and effective environmental management systems and procedures. It is APIA's view that the application of the standards in this Code will enable onshore pipeline proponents to exceed Commonwealth and State regulatory requirements, with the result that the consistent application of this Code across the pipeline industry will generate a lasting legacy of sustainability for existing projects and will help generate a positive reception for new pipeline projects.

Offshore pipelines outside State/Territory waters and within Commonwealth waters are regulated by Joint Authorities (consisting of the relevant State/Territory and Commonwealth ministers) under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and other legislation and are not considered by this Code. Similarly, pipelines within state territorial seas are managed under legislation that generally mirrors the Commonwealth legislation referred to above, and is a specialised regulatory area not covered by the Code.

In line with APIA's current core membership base, this Code has been written with high pressure gas transmission pipelines as its priority. It should however be noted that many of the project activities and environmental guidelines outlined in the Code are readily adaptable to other transmission or distribution pipelines, including oil, water and slurry.

1.3 INTENDED USE OF THIS CODE

This Code provides guidance on the development and implementation of internationally-recognised Environmental Management System standards and provides comprehensive environmental management guidance for onshore pipeline construction, operation and decommissioning.

The Code applies to the Australian onshore pipeline industry (refer to Appendix 1); in particular, pipeline planning, design, construction, operation and decommissioning. The Code is intended to complement the principles of Australian Standards that apply to pipelines and the environment.

The Code should be used as a minimum acceptable standard from which to develop environmental management plans and procedures for a variety of pipelines, as well as a resource for all stages of the pipeline design, planning, construction, operation (maintenance) and decommissioning phases.

The Code does not contain the full and final detail on any aspect of environmental management and, while it provides an excellent starting point, is not a substitute for a comprehensive and project-specific environmental management plan. It is expected that pipeline proponents and operators will use the Code as a guide, which they apply to their own specific circumstances to achieve sound outcomes for the environment using their in-house resources.

1.4 LAYOUT OF THIS CODE

This Code aims to provide guidance and direction in the management of the environmental aspects of pipeline planning, construction, operation and decommissioning.

Section 1 – Introduction outlines the purpose and intended use of the code.

Section 2 – Legislative and Regulatory Governance identifies and discusses the key elements of legislation and regulatory processes associated with pipeline planning, construction, operation and decommissioning.

Section 3 – Environmental Management Systems provides guidance on the development of Environmental Management Systems consistent with internationally-recognised standards such as *AS/NZS ISO 14001 Environmental Management Systems – Requirements with guidance for use*.

Section 4 – Establishment and Evaluation of Risk provides guidance on environmental risk through all stage of the project lifecycle.

Section 5 – Pipeline Planning provides a description of the environmental considerations during pipeline planning and approvals process, from pipeline design and route selection to preparation of an environmental impact assessment.

Section 6 – Pipeline Construction provides a detailed description of the various activities undertaken as part of the pipeline construction phase.

Section 7 – Pipeline Operation and Easement Management describes the key environmental considerations associated with an operational pipeline, including management of facilities, safety and emergency response and pipeline failure response.

Section 8 - Decommissioning Process provides a detailed description of the key environmental considerations associated with pipeline decommissioning. In this code ‘Decommissioning’ has the same definition as ‘Abandonment’ when used in applicable Standards and State legislation.

Section 9 – Environmental Guidelines: Impacts and Best Practice Management provides guidance on the management of potential environmental impacts associated with pipeline planning, construction, operation and decommissioning.

In order to maintain the Code as the primary reference point for the minimum acceptable industry standards, it will be reviewed and updated on a regular basis, with no more than three years between reviews. This will allow the timely incorporation of advances in technology and of legislative changes and will help ensure the currency of listed environmental control measures.

1.4.1 PROJECT LIFECYCLE

This Code of Environmental Practice recognises four distinct phases in a pipeline’s lifecycle; Planning, Construction, Operation and Decommissioning; these phases include the elements summarised below.

Planning: Pipeline and facilities design, route selection and facility siting, environmental impact assessment, stakeholder and community consultation and development of construction and operations environmental management plans (CEMP and OEMP respectively).

Construction: Continuous stakeholder engagement, implementation of CEMP, stakeholder and community consultation, creation of borrow pits, establishment of construction camps and work sites, clearing, grading, trenching, blasting, water course crossings, floating of machinery, construction of facilities, stringing, coating, welding, pipelaying, backfilling, pipe-testing and final coating, hydrostatic testing, pipeline purging, final commissioning and disturbed area rehabilitation.

Operations: Implementation of OEMP, ongoing easement and facilities management, additional earthworks, safety and emergency planning, pipeline failure and incident response and ongoing stakeholder engagement.

Decommissioning: Implementation of decommissioning strategy.

Sections 5-8 of this code address industry best practice measures for managing pipeline activities at each stage of the project lifecycle. Each activity has the potential to create environmental impact,

Section 9 of this code identifies key environmental management aspects and their associated issues and outlines recommended management measures to address each one. Key environmental management requirements have been identified as:

- Flora Management
- Weed Management
- Fauna Management
- Biosecurity Management
- Heritage Management – Natural and Built Environments
- Soils Management
- Aboriginal Cultural Heritage Management
- Drainage, Erosion and Sediment Management
- Water Management
- Waste Management
- Noise Management
- Traffic Management
- Dust and other Air Emissions Management
- Fuel and Chemical Management
- Fire Prevention Management

1.4.2 CODE OF PRACTICE FOR STAKEHOLDER ENGAGEMENT

During 2013, APIA will be developing a stand-alone Code of Practice for Stakeholder Engagement to provide guidance to the pipeline industry on developing and managing relationships with the wide range of stakeholders that a pipeline project can affect. The management of these relationships is often closely related to the management of environmental issues and had been included in previous editions of the Code of Environmental Practice; with the development of a stand-alone Code of Practice for Stakeholder Engagement, however, this Code will no longer specify particular stakeholder engagement techniques, but rather will contain timely reminders of the importance of effective stakeholder engagement practices..

2 LEGISLATIVE AND REGULATORY GOVERNANCE

2.1 REGULATORY CONTEXT

Regulatory authority for the construction, operation, maintenance and decommissioning of onshore pipelines in Australia is held by each State and Territory jurisdiction under the applicable pipeline or infrastructure legislation. Commonwealth approvals and legislative procedures may also be applicable, particularly the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Native Title Act 1993*. Smaller pipelines, including distribution pipelines or pipelines carrying non-petroleum products, may be subject to local government approval through the preparation and submission of a Development Application with supporting documentation. A list of relevant legislation, current as at the date of this edition is provided in Appendix 3. To ensure currency and consistency with existing legislation, APIA advises its members to undertake a review prior to commencement of planning each new project.

Due to varying requirements and the often complex nature of pipeline approvals processes, APIA advises its members to seek clarification on approvals processes from personnel with experience in these processes and from the relevant Commonwealth, State/ Territory or Local Government regulatory authorities.

A proposed pipeline which crosses more than one jurisdiction will require a coordinated approach to planning approvals. This involves an environmental assessment process that meets the statutory requirements of each jurisdiction. Commonwealth involvement in the review of proposed pipelines within the States or Territories may be initiated where the project will impact on Commonwealth land or if the project is likely to have significant impact on a listed Matter of National Environmental Significance¹. If such impacts are likely, the proponent must refer the project to the Commonwealth Government for a decision on whether the activity is a “controlled action” and therefore requires approval under the Act. If there is any likelihood that EPBC approval will be required, it is recommended that engagement with Commonwealth and state or territory regulators is undertaken simultaneously, with the aim of allowing the Commonwealth to accept the relevant state or territory processes (as either a one-off or under a bilateral agreement) as a suitable vehicle for project assessment. This will avoid the possibility of being required to undertake separate

¹ The seven Matters of National Environmental Significance under the EPBC Act 1999 are, World Heritage properties, National Heritage places, wetlands of international importance, listed threatened species and ecological communities, migratory species protected under international agreements, Commonwealth marine areas and nuclear actions (including uranium mines).

state and Commonwealth impact assessment processes, and will eliminate the possibility of Commonwealth intervention taking place after state approval has been granted.

All jurisdictions require that native vegetation clearance is quantified and minimised as far as possible, and most require some form of native vegetation offset (replacement of cleared vegetation with an equivalent or greater, securely protected substitute area) as part of project approval. The various state and Commonwealth offsetting requirements are summarised in Section 2.2.

Licensing for any onshore pipeline in Australia requires the proponent of the project to obtain planning approval, hold appropriate tenure and undertake detailed risk and environmental impact assessments for the proposed construction, operation and maintenance of the pipeline.

State / Territory and Commonwealth planning approval to construct a new pipeline will be conditional by nature. As part of any conditional planning approval, the regulating authorities may require the proponent to prepare additional management plans and obtain subsequent approvals and/or additional permits/licences. These may be required prior to the commencement of construction, during construction or upon completion of the work. Secondary regulatory approvals should be identified and obtained prior to commencement of construction activity. Some permitting conditions, such as permissions for watercourse crossings or hot works, may only be valid for a limited time or season, so must be applied for in a timely fashion to avoid interruption to the construction schedule.

When a pipeline is approved for construction, operation or decommissioning, the authority to construct, operate or decommission will be accompanied by State and/or Commonwealth regulatory conditions that must be met as part of the approval. These can require significant additional studies, further analysis or detailed plans to be compiled or completed prior to the commencement of work. Approval conditions will also outline the level of compliance required, and can often be extensive for larger or longer pipelines - so it is important that sufficient resourcing and timeframes are applied to be able to achieve compliance. Regulatory authorities themselves may be under pressure from external stakeholders to rigorously enforce approval conditions, so it is important for all parties that project proponents have effective compliance management systems in place.

Although a contractor may be designated regulatory responsibilities – such as obtaining day-to-day approvals for crossing minor waterways - ultimate environmental responsibility lies with the proponent, and so the proponent's compliance management systems must include a system for checking contractor compliance performance.

An Environmental Management Plan (EMP) is the standard tool used to outline the expected environmental performance standards for the project to its contractor(s). The EMP should be reflective of any approval conditions and outline clear responsibilities for compliance with each approval condition. It is common for a proponent to include a draft EMP as part of its project application documentation, and for the principal contractor to finalise this (producing

either a Construction EMP (CEMP), or an Operations EMP (OEMP)) by including details of its own measures to ensure compliance with both the commitments of the draft EMP and also with approval conditions. CEMPs and OEMPs will need to document specific management measures that will be implemented at identified sites of sensitivity on individual projects.

Typically EMPs, both CEMP and OEMP, will contain a summary description of the project and legislative requirements, will define project roles and responsibilities, will detail guidelines for specific operational activities and will provide an outline of conditional requirements and how they will be mitigated, as well as defining monitoring, auditing and reporting provisions.

An Environmental Management System (EMS) is a tool which is used to enable an organisation to systematically manage its impact control mechanisms and thereby increase its operating efficiency. There are likely to be ongoing reporting requirements throughout pipeline construction and operation to ensure compliance with approval conditions. The EMS should describe requirements for auditing, training, documentation, communications, monitoring and continual improvement of the system; Section 3 outlines the key criteria for an EMS.

2.1.1 AUSTRALIAN STANDARDS FOR ONSHORE PIPELINES

The AS 2885 series of Australian Standards identifies best practice requirements for steel pipelines and associated piping components that are used to transmit single phase and multiphase hydrocarbon fluids. The basis of the series of Standards is to provide important principles, practices and practical guidelines for use by competent persons and organisations involved with high-pressure gas and petroleum pipelines. The Standards currently in this series are:

- AS 2885.0 Pipelines – Gas and liquid petroleum – General Requirements
- AS 2885.1 Pipelines – Gas and liquid petroleum – Design and construction
- AS 2885.2 Pipelines – Gas and liquid petroleum – Welding
- AS 2885.3 Pipelines – Gas and liquid petroleum – Operation and maintenance
- AS 2885.5 Pipelines – Gas and liquid petroleum – Field pressure testing

In 1994 all Australian Governments, through the Council of Australian Governments, adopted AS 2885 as the single national standard to guide the design, construction and operation of high pressure gas transmission pipelines in this country.

The AS/NZS 2566 *Buried Flexible Pipelines* series was prepared by the joint Standards Australia/Standards New Zealand committee; the objective of this series is to provide designers and installers with uniform procedures for the structural design of buried flexible pipelines. These standards apply to flexible pipes conveying low pressure gas, water, wastewater, stormwater or slurry for pressure or non-pressure applications, or for flexible pipes serving as conduits for the later installation of cables or pipes. The standards currently in this series are:

- AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design

- AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design – Commentary (Supplement to AS/NZS 2566.1:1998)
- AS/NZS 2566.2 Buried Flexible Pipelines – Part 2: Installation

It is intended that this Code is read (and applied) as a best practice adjunct to the generally more technical specifications of AS 2885 and AS/NZS 2566, rather than as a technical alternative or substitute.

For further guidance on where additional codes or guidelines may be apply, please refer to Appendix 4.

2.2 ENVIRONMENTAL OFFSETS

Pipeline projects are assessed in terms of their potential to cause environmental impacts to protected Matters of National Environmental Significance (MNES), as identified under the EPBC Act, and to native flora, fauna and biodiversity values under relevant State and Territory legislation. Projects with significant impacts on important native vegetation or biodiversity values - which cannot be readily mitigated through other mechanisms - are likely to be subject to environmental offsetting requirements.

This section outlines the Commonwealth environmental offset policy, sets out the fundamental differences between each state's policies, reviews the principles, when the policies apply, and the key elements required in an offset plan.

Commonwealth

When negative environmental impacts (significant impact upon a protected matter) are unavoidable, a proposed development is determined a 'controlled action' and it is likely to be subject to a requirement for an offset if the impacts are associated with damage to listed ecosystems, flora or fauna. This process is described in the Commonwealth's Biodiversity Offsets Policy, the *Environment Protection and Conservation Act 1999* Environmental Offsets Policy October 2012.

An environmental offset is a conservation management action whereby an area of the same or similar ecological equivalence to the area being impacted is protected or regenerated.

Proposed actions likely to cause unavoidable and significant environmental impact on any of the following matters can attract a requirement for an offset from the Commonwealth regulator;

- World heritage properties
- Wetlands of international importance (Ramsar)
- Listed threatened species and communities
- Listed migratory species
- Commonwealth marine environment

- The whole of environment on commonwealth land
- The whole of environment where it relates to actions carried out by a commonwealth agency
- The whole of environment where it relates to nuclear actions
- National Heritage places
- Great Barrier Reef Marine Park

Offsets are not a *carte blanche* for proponents to develop proposals with otherwise unacceptable impacts, but are an effective mechanism for neutralising the remaining environmental impact of a proposed action, once avoidance and minimisation principles have been applied.

The objective of environmental offsetting is to protect and improve conservation outcomes for the impacted matter, through direct or indirect conservation measures. The Environmental Offset Policy outlines two offset types.

Direct Offset

To improve the environmental value of the land through conservation management actions; the proposed offset must be land-based or monetary.

Indirect Offset

To improve the environmental value of the impacted protected matter through indirect means, such as contributing to relevant research or education programs, or reducing threats to a protected matter of equal concern that is not part of the direct offset.

For an offset to be accepted as compensation to the impact, the offset must have transparent governance arrangements. The offset must be quantifiable, monitored, auditable and enforced.

An acceptable offset can be quantified as;

- Being commensurate to the impact in both size and scale; and
- Delivering a positive conservation outcome.

and each 'controlled action' (impact) will have an offset equal to or greater than its value.

The Commonwealth environment regulator (at the time of writing, this is the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)) is currently devising a method of quantifying proposed actions and offsets, by assigning a scoring and point system. At the time of writing this code, the Commonwealth offset requirement is to source at least 75% of the total offset value from direct offsets with up to 25% being sourced from indirect offsets.

The performance of the direct and indirect offset conservation management action must be measured, reviewed and audited. Establishment costs, ongoing management of the offset, data collection and integration into Commonwealth departmental databases are the responsibility of the proponent for the term of the offset.

Integration of Commonwealth and State/Territory Offset Policies

While the EPBC Act concentrates on the protection of MNES, offsets at the State/Territory level are concentrated on the level of impact on a wider range of native vegetation and biodiversity values conserved under State/Territory legislation.

If a proposed pipeline project activates the ‘controlled action’ trigger under Commonwealth legislation, consultation with both the relevant State/Territory and Commonwealth regulators is strongly recommended in order that their respective offset requirements can be coordinated and aligned.

State and Territory Policies

Appendix 8 provides a summary of the State/Territory policies, reviewing their respective principles, methods, application criteria and other key elements.

3 ENVIRONMENTAL MANAGEMENT SYSTEMS

APIA places a strong emphasis on effective environmental management through self-regulation and encourages its member companies to maintain a high standard of environmental performance. The development and implementation of an integrated Environmental Management System (EMS) is a key step towards achieving this goal through the control and management of environmental aspects and impacts.

An EMS is a tool that is used to provide a comprehensive and systematic approach to the environmental management of an organisation's activities, forming part of the overall business management process and covering all levels of operation. APIA encourages its member companies to develop and maintain an appropriate EMS which is tailored to suit their operations and is consistent with a recognised international standard; *AS/NZS ISO 14001 Environmental management systems – Requirements with guidance for use* is recommended.

3.1 EMS STRUCTURE AND OUTLINE

EMSs are generally structured into five key areas:

1. **Environmental Policy**

- Implementation of an Environmental Policy signed off by the director

2. **Planning**

The following are recommended:

- An environmental aspects register
- A legal register
- Environmental objectives and targets

3. **Implementation and Operation**

The following are recommended:

- Appointment of an EMS representative
- Definition of roles, responsibilities and levels of decision-making delegation
- Identification of training needs related to tasks identified as having potential to impact on the environment
- Development and implementation of communications, documentation, control, operational and emergency procedures

4. **Checking**

Implementation of auditing procedures to monitor and measure performance of key components of the EMS including:

- Compliance with legal requirements
- Dealing with actual and potential nonconformity(ies) and taking corrective and preventive action(s)

5. Management Review

The following are recommended:

- Provision for top management review, to ensure adequacy, suitability and effectiveness of EMS
- Capacity to demonstrate of Continual Improvement.

The EMS should be used to form the organisational environmental management structure under which a pipeline project would be constructed and operated. The EMS allows for the development and implementation of policy, objectives and targets and facilitates a systematic approach to training, compliance, monitoring and auditing, amongst other measures. The organisational EMS should be a living document that is consistently referenced in project environmental management plans and regularly reviewed to maintain consistency and currency. Figure 1 presents the model outline for an EMS established under ISO 14001.

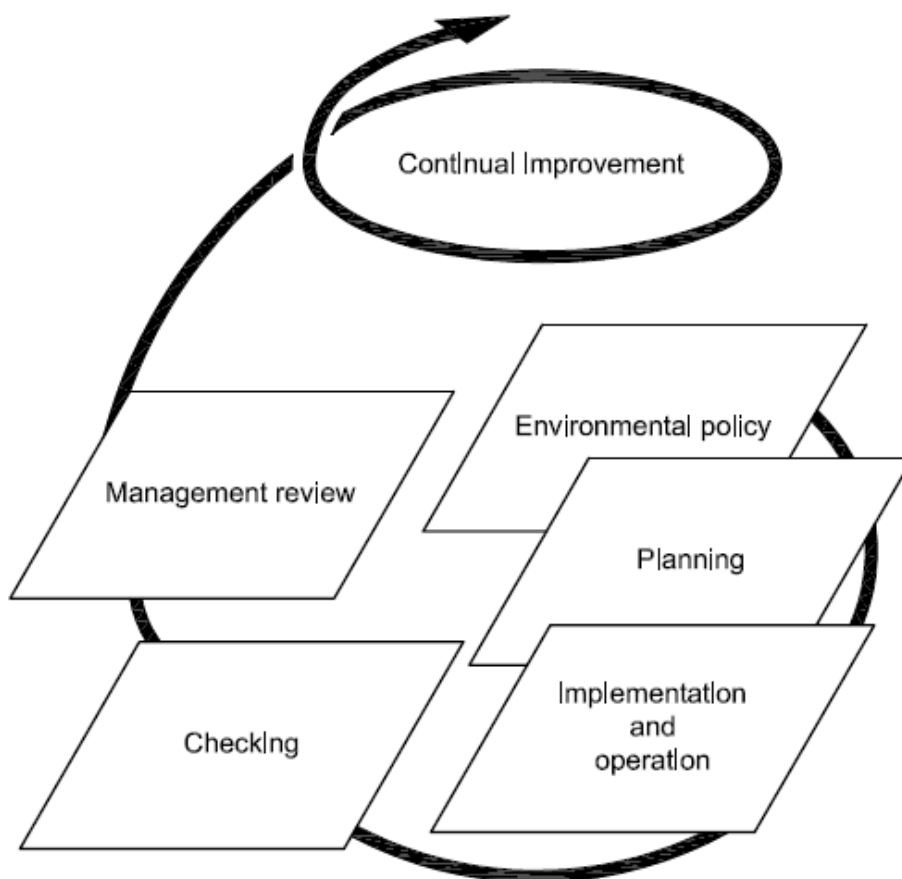


Figure 1: Environmental Management System outline (Sourced from ISO14001:2004)

Benefits of an effective EMS

An EMS that is appropriate to the nature of the business and the scale of its activities can deliver the following benefits:

- It provides a means for the organisation to control and improve its environmental performance, thereby assisting it to contribute to improvements in the quality of project and environmental performance
- It can facilitate improved time management, cost and quality control, through an improved understanding of process input requirements, greater process control and more efficient activity, product and service management
- It can reduce operating costs: In nearly every case, an EMS reduces operating costs through waste reduction, energy and time conservation, and other savings
- It can reduce legal risk and potential liabilities: An EMS provides a structured framework for identifying and meeting regulatory requirements, resulting in the likelihood of fewer non-compliance findings or other regulatory complications
- It can deliver improved relations with stakeholders, including customers/clients, employees, service providers, shareholders, regulators, lenders and neighbours
- It can increase regulator and other stakeholder confidence that the project is being managed in a systematic and responsible manner.

Integrated Management Systems

AS/NZS ISO 14001 Environmental management systems – Requirements with guidance for use has strong parallels with ISO 9001: Quality Management Systems and AS 4801: Occupational Health and Safety Management Systems standards.

An EMS can form part of an integrated management system (IMS) that can incorporate Quality Management and Occupational Health and Safety management. An effectively established IMS can provide a clear picture of all aspects of an organisation, how they affect each other and their inter-related risks. There is strong commonality between the principles of a QMS, OHS and EMS and by integrating the systems, proponents can ensure standardisation of approach to each system allowing more efficient and effective project control.

It should be noted that the similarity in approach between the ISO 9000 and ISO 14000 standards series has been recognised by the development of the ISO 19000 series, which describes auditing procedures applicable to both.

3.2 RELATED STANDARDS

ISO 14001 is part of a series of standards related to environmental management that exists to help an organisation minimise the negative effect of its operations on the environment, to ensure compliance with applicable laws and regulations and to facilitate continual improvement. The most prominent standards with the ISO14000 series include:

- ISO 14004 Environmental management systems—General guidelines on principles, systems and support techniques
- ISO 14015 Environmental assessment of sites and organizations
- ISO 14020 series (14020 to 14025) Environmental labels and declarations
- ISO 14030 Post production environmental assessment
- ISO 14031 Environmental performance evaluation—Guidelines
- ISO 14040 series (14040 to 14049), Life Cycle Assessment (LCA) discusses pre-production planning and environment goal setting
- ISO 14050 Terms and definitions
- ISO 14062 Improvements to environmental impact goals
- ISO 14063 Environmental communication—Guidelines and examples
- ISO 14064 Measuring, quantifying, and reducing Greenhouse Gas emissions
- ISO 19011 Audit protocol for both 14000 and 9000 series standards.

The ISO series of standards, whilst the most recognised, are not exclusive to EMS in Australia. Other systems exist that also form an acceptable basis from which to establish an effective EMS.

Related sections:

Section 3: Legislative and Regulatory Governance

Appendix 4: Relevant Codes and Standards

3.3 TRAINING

Training is essential to the successful implementation of an EMS and also as part of an individual pipeline construction project. It provides personnel with the necessary skills and knowledge to fulfil their environmental responsibilities and to meet the organisation's environmental objectives. Implementation of a training program leads to increased environmental awareness in the workforce and encourages continual improvement of the behaviour and performance of individual employees.

An effective environmental training program should be developed and implemented as part of the EMS, should cover the full range of environmental management issues relevant to an organisation's activities and should target all relevant personnel. The relevant portions of the training program should be referenced in Project Environmental Management Plans (EMP, CEMP or OEMP) or equivalent. Training program documentation should also describe the role and content of inductions and should include descriptions of job-specific training requirements for all members of the project team, including an outline of the content and schedules for necessary training refreshment.

Specific training requirements should be identified during the development of site procedures and training should be conducted on an 'as needs' basis. Training can be delivered by using internal or external resources, but attendance records and the issue of applicable certification or qualification should be documented to act as a record of organisational competency.

Environmental Professional Characteristics

Environmental practitioners typically work across all levels of an organisation or project to deliver effective environmental management and deliver positive environmental outcomes. Skills and training required will vary according to each environmental discipline.

Any environment professional working in the pipeline industry should be suitably qualified and should be able to demonstrate the following capabilities:

- Competency in understanding the organisation and its activities and the level to which environmental laws and regulations apply
- The ability to apply effective environmental management systems and controls
- The demonstration of integrity towards environmental values
- The demonstration of competency within their specific environmental discipline.

3.3.1 TRAINING MATRIX

Implementation of a training matrix clearly demonstrates the level(s) of training needs within a project or organisation against set criteria, tasks or roles. A training matrix can take the form of a table or chart that clearly shows what types of training are required for all members of the project team. This should include training requirements that are mandatory for the entire project team, as well as task-specific training. The training matrix should include a schedule, as well as reminders of any dates where training currency expires and a forward forecast of when these require renewal. A matrix should clearly show where training is required to fulfill competency and compliance requirements, and should include the capability to show where such training has been completed.

3.3.2 ENVIRONMENTAL INDUCTION

Environmental inductions should be conducted for all site staff who will be actively involved with a pipeline project. Inductions must be undertaken prior to an individual's commencement on the work site and should include coverage of environmental management information such as the following (recommended):

Organisational

- the organisation's environmental and related policies
- overview of the organisation's operations and its EMS
- the organisation's statutory, organisational, project and community commitments/obligations
- the organisation's representatives with responsibilities, authority, resources to achieve environmental performance at all levels, throughout the project's lifecycle.

Site-based

- general background of the project, the area and its environment
- identification of site-specific environmental risks and proposed mitigation measures
- summary of relevant regulatory requirements
- the individual's general work-related obligations and behavioural expectations
- project-specific performance requirements

- land access and landowner engagement requirements
- specific work procedures and project protocols relevant to the site or project (e.g. waste management, biosecurity, access to site, spill response)
- attention to incident reporting requirements and procedures
- introduction to specific training and awareness tools (e.g. Project handbooks, EMS materials, procedures and forms, project alerts and project noticeboards).

Environmental inductions should be conducted as part of an organisation's overall induction program. It is recommended that the induction contains a questionnaire or similar to reinforce some key requirements and ensure that inductees can demonstrate that induction contents have been understood at the time of induction. Completed questionnaires and records of attendance should be retained.

3.3.3 JOB-SPECIFIC TRAINING

Job-specific environmental training is designed to target particular personnel whose duties have a greater potential to result in environmental impacts, such as equipment operators, watercourse crossing crews, hydro-testing crews and rehabilitation crews.

Where appropriate, training should be conducted on-site, with sessions tailored to be task-oriented and addressing the environmental risks relevant to a particular trade or activity, including (recommended):

- erosion and sediment control
- clearing techniques and limits
- topsoil and soil management
- weed control requirements
- pest fauna management
- biosecurity measures
- spill kit and spill response
- sensitive site management
- incident and near-miss reporting
- rehabilitation techniques.

It is recommended that where feasible, job-specific training is conducted by specialists, regulators (where appropriate) or nationally-accredited training providers. Training should also identify the required expectations for individuals who complete the training and the criteria against which their performance will be measured.

3.3.4 ENVIRONMENTAL AWARENESS

Environmental awareness programs maintain and enhance the environmental ethics of the organisation's corporate culture. Generally, programs will focus on topics relevant to the organisation, including:

- changing legislation
- current environmental issues relevant to the project / organisation, especially site-specific issues

- an understanding of how specific company activities impact on the environment
- the environmental expectations of stakeholders
- industry best practice or innovations.

By participating in such programs, individuals may enhance their knowledge and learn new skills, which in turn enables them to better understand and address ongoing issues, to better align on-ground activities with organisational expectations and to contribute to the achievement of organisational / project environmental goals.

3.3.5 SITE-BASED TRAINING

Site-based training, or ‘toolbox training’, can be extremely valuable in reinforcing important environmental aspects on a pipeline construction site. This can be applied through specific toolbox talks that are dedicated to an aspect of environmental management, or as part of a daily pre-start meeting for construction crews and other site personnel to recap or reinforce site-specific environmental matters.

Site-based training is the best method of re-emphasising important elements of training, inductions and specific regulatory requirements. Procedures can also be reiterated (spill response, weed hygiene, etc) to increase awareness and focus on important issues on site.

3.4 COMPLIANCE

The role of compliance as part of an EMS is to pro-actively establish and quantify the extent to which regulatory requirements, organisational commitments, targets and objectives or contractual commitments are being reached. The establishment of a compliance program should consist of a regular review of onsite activities and maintenance of records to gauge a measurement of performance against regulatory and management expectations.

3.4.1 INTERNAL MONITORING AND AUDITING

Internal monitoring and auditing forms an integral part of a company’s EMS. Internal monitoring and auditing of project activities on a regular basis provide ongoing assurance and timely insight into risk and compliance issues and assist in quantifying continual improvement.

Internal monitoring and auditing will identify areas where performance improvement would be appropriate. These areas should be assigned to a responsible person, who will have the task of overseeing the improvement and implementing a close-out timeframe. Follow-up audits should be undertaken to ensure that recommendations for improvement have been implemented and that action items have been closed-out inside designated timeframes. Records should be maintained for use in reporting and in demonstrating compliance during external audits.

Internal environmental auditing can take place against all or any of the following:

- Pipeline EMP, CEMP or OEMP commitments
- EMS standard or requirements

- Environmental legislation requirements
- Environmental licence conditions
- Environmental permit requirements
- Environmental conditions within construction contract
- Industry Guidelines and Code(s) of Practice.

It is recommended that the guidance provided in the ISO 19000 standard series is used to design and conduct internal audits

3.4.2 EXTERNAL AUDITING

State and Commonwealth regulatory authorities have the authority to conduct compliance audits on pipeline projects to ensure adherence to approval conditions and applicable legislation. External audits can consist of a review of any on-site activities, as well as inspection of project records relating to approval conditions.

Non-compliance can give rise to a range of enforcement mechanisms, including the following:

- Remediation orders, notices or determinations to repair or mitigate environmental damage or improve environmental performance
- Enforceable undertakings to negate civil penalties and provide for future compliance
- Civil or criminal penalties that can apply to individuals and corporations that contravene the requirements for environmental approvals under the applicable legislation, including penalties that may relate to the provision of false or misleading information.

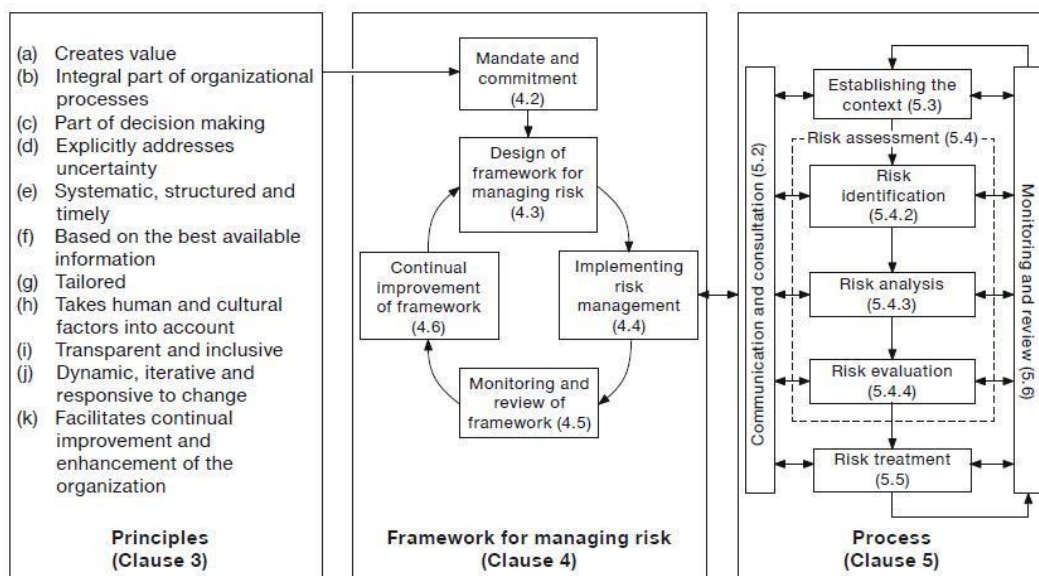
Any non-conformances or recommendations for improvement received as a result of an external audit should be addressed at the earliest opportunity.

4 ESTABLISHMENT AND EVALUATION OF RISK

Environmental risk deals with the probability of an event causing a potentially undesirable effect on the environment. AS/NZS ISO 31000 defines risk as ‘the effect of uncertainty on objectives’. Uncertainties within a pipeline project can arise from:

- Pipeline construction and operational activities
- Confidence in available technologies
- Natural variability
- Short and long term economic, health, social and commercial outcomes
- The current political environment
- Present and future values held by people and societies - and factors that may cause these to change, or
- The effectiveness of control and planned risk treatments.

The Australian Standards Environment Management Handbook HB 203:2012 discusses how the standard can be used to help an organisation manage environment-related risk, which includes risks either to or from the environment, by understanding the relationship between principle, framework and process.



NOTE: Clause references are to the Standard.

Figure 2. Relationships between risk management principles, risk management framework and risk management process (sourced from HB203:2012)

The Risk Management Process

The largest risk exists during the construction phase and this should be accurately reflected in any risk assessment. Appendix I of AS2885.1 outlines the process for managing environmental threats and should be consulted when undertaking pipeline environmental risk assessment.

The risk management process should be:

- an integral part of management (which facilitates all decision making); and
- tailored to the processes of the organization.

Parts of the risk management process are often carried out by multi-disciplinary teams, and would usually include contributions from a variety of experts, stakeholder organizations and other sources.

The steps of the generic risk management process are described below.

Communication and consultation

Consult the internal and external stakeholders over the risk management process as a whole, and as appropriate during each step.

Establishing the context

Determine the external and internal context of the organization and the particular application to which the risk management process is being applied. Establish the structure of the analysis and define the criteria against which risk will be evaluated. Identify stakeholders and define consultation mechanisms.

Risk identification

Identify, as the basis for further analysis, what can happen or what circumstances might change, when, where, why and how. This may include identifying hazards, environmental aspects and environmental impacts, and how uncertainty might affect decisions.

Risk analysis

Develop an understanding of the risks and the controls in place. Analyse risks in terms of the controls, the range of consequences in the context of those controls, and the likelihood of those consequences arising. Consequence/severity and likelihood/frequency may be combined to produce an estimated level of risk.

The Risk Matrix

Qualitative risk analysis is beneficial to pipeline projects where many risks have been identified. A risk matrix based on qualitative or adjudged measures of consequence and likelihood may be used as a means of combining consequence and likelihood to give a measure of risk. This allows for screening of minor risks from major risks in order to prioritise risks so

that resources can be applied to issues of higher importance. Adoption of a quantitative risk assessment tool will help apply a numerical identity to each risk, allowing a hierarchy to be established - which may aid response prioritisation

Risk evaluation

Compare analysis results against the pre-established criteria. Decisions on whether to treat risk are based on this comparison and other factors identified when the context was established.

Risk treatment

Select options for treating risk and develop and implement a management plan, which should include consideration of funding and other resources, as well as response time frames and a schedule. Once treatment actions have been implemented, review the residual levels of risk to see if they are now tolerable.

Monitoring and review

Regularly monitor and review the risks and controls, and any changes that may affect them.

Benefits of managing environment-related risk effectively

Using a structured, systematic and defensible approach to environmental risk management can prioritise project risk and ensure that focus and resources are applied to areas of greatest risk. The strength of this approach is that it focuses on reducing risk, applies available technical knowledge, takes into account the results of consultation with stakeholders and has ongoing monitoring and review built in, which provides a means of responding to any changes in internal and external circumstances. Furthermore, it is guided by clear principles, ensures there is an adequate supporting framework, and can provide a baseline from which to establish performance indicators. Organisational benefits of an inclusive risk management approach can include the following:

- improved environmental outcomes
- improved profitability and efficiency
- improved top management understanding of environmental risk and its mitigation
- reduced risk of production interference from environmental issues
- realistic stakeholders expectations about environment-related risk
- enhanced reputation
- demonstrable conformance with an accepted International Standard on the management of risk
- enhanced consistency, transparency and accountability
- compliance with legal obligations (including avoidance of liabilities through tort)
- obtaining or protecting regulatory approvals
- greater flexibility
- greater ability to attract external support or resourcing
- lower risk financing costs

- avoidance of disruption
- avoidance of incidents and associated costs
- more effective and safer incident control, and
- enhanced resilience.

4.1 RISK WITHIN THE PROJECT LIFECYCLE

Sound environmental risk management techniques should guide decision-making within a pipeline project through each stage of its lifecycle. Key project elements where risk should be considered include the following:

Planning

- Scoping of a project
- Deciding stakeholder engagement techniques and strategies
- Pipeline and facility design, route and facility selection
- Deciding on constructability constraints and best option selection
- Deciding on alternative engineering options for impact mitigation and minimisation
- Deciding on relevant environmental performance indicators, requirements
- Allocation of management responsibility, programs and resources for risk management in pipeline lifecycle.

Construction

- Sites set-up
- Access through private property and along easement
- Clearing and earthworks, obtaining materials along selected route
- Determining construction methodology
- Determining watercourse crossing methodology
- Safety and emergency planning
- Soil management measures
- Drainage, erosion and sediment control measures
- Flora, fauna and biosecurity control measures
- Cultural Heritage control measures
- Traffic and socio-economic impact management measures
- Monitoring and auditing regime
- Emergency, incident / near miss and significant natural event response and investigation processes.

Operation

- Safety and emergency planning
- Inspection and management of easement and facilities
- Flora and fauna management measures
- Cultural Heritage management measures
- Drainage, erosion and sediment control measures
- Monitoring and auditing regime
- Emergency, incident / near miss response

- Natural event responses along and adjacent to the easement

Decommissioning

- Determining suitability of pipeline removal or decommissioning techniques
- Access through private property and along easement
- Removal of above-ground infrastructure
- Monitoring and auditing regime

4.2 RISK MATRIX

Techniques for determining risk severity and frequency are outlined in Appendix F of AS2885.1; this system is recommended for adoption as the basis for preparing and undertaking onshore pipeline risk analyses.

5 PIPELINE PLANNING ACTIVITIES

Pipeline planning is a detailed process requiring diverse specialist resources, including engineers, surveyors, draftspersons, planners, marketers, environmental practitioners, legal advisers, land use advisers and community relations specialists; it also involves establishing a relationship with government and community stakeholders as part of the planning process.

This section discusses typical pipeline development planning processes, providing an outline of the regulatory, environmental, social and engineering considerations that should be applied during the planning phase of a new pipeline.

5.1 PIPELINE ROUTE SELECTION AND DESIGN

Physical characteristics of a pipeline corridor should be subjected to a constraints analysis (or similar), using route selection criteria to develop the most appropriate pipeline alignment. It is important to note that during the route selection phase other factors, such as political or community focussed issues, can have a major bearing on any alignment corridor and must be included alongside analysis of physical, environmental, heritage and regulatory constraints.

Sometimes common infrastructure corridors (CICs) may be utilised, where the proposed pipeline follows a proposed or existing energy, communications or other easement. CICs can pose a series of constraints which must be overcome including construction hazards associated with existing infrastructure (e.g. overhead power lines), the potential for third party interference with adjacent utilities (e.g. pipelines, fibre optic cable), incremental alienation of freehold land through additional easements and potential impacts to environmentally sensitive areas within or adjacent to the corridor. Constructing a pipeline within a CIC can introduce ongoing hazards through the operational phase, such as cathodic protection interference, which must be considered as far as possible during the alignment selection phase.

Ultimately, a preferred pipeline route will be defined, based on consideration of the criteria outlined in Table 1 below. The selection of an appropriate pipeline route requires balancing these factors, whilst ensuring that the project's safety, economic, engineering and environmental objectives are fulfilled. Standard expectations of route selection are also detailed in s.4.2.3 of AS2885.1.

Table 1: Pipeline Route Selection Criteria

Aspect	Route Selection Criteria
Regulatory	- identify applicable environmental legislation, regulatory policies and strategies - establish location of protected lands - establish permissibility within planning context - identify, avoid and minimise impacts on regulatory planning

Aspect	Route Selection Criteria
	constraints ▪ undertake review of regulatory timeframes against identified project time targets ▪ consider relevant commonwealth/state/territory offset policies
Strategic Justification	▪ establish the need for the pipeline ▪ review of impacts and cost/benefit
Environmental (including social aspects)	▪ acquire knowledge of the likely presence of listed species and ecosystems and avoid as far as possible ▪ generally conserve native terrestrial and aquatic flora and fauna ▪ minimise impacts on habitat and ecosystem integrity ▪ minimise impacts on surface and ground water quality ▪ conserve soils and protect land surface stability ▪ minimise impact on existing and future land use ▪ assess potential for successful rehabilitation ▪ quantify and minimise air and noise emissions ▪ avoid or ameliorate impacts on historical and indigenous cultural heritage values. ▪ assess and mitigate impacts on landowners, adjacent residents and existing/proposed infrastructure ▪ protect landscape values ▪ analysis of environmental threats
Safety	▪ review relevant safety standards ▪ assessment of safety risks ▪ design and plan implementation of risk reduction programs
Commercial Justification	▪ review current market requirements ▪ assess the ability to meet future consumer needs ▪ review construction and operating costs ▪ consider approval timing and requirements
Engineering	▪ review required engineering, construction and operation standards ▪ assess terrain, seismic and geotechnical constraints and hazards ▪ assess climate influences, such as cyclones, flood location and period, tidal and storm surges, etc ▪ assess engineering and construction options ▪ access requirements for construction and operation ▪ review of available construction methodologies to reduce construction risk

5.2 PROJECT PLANNING AND APPROVAL

Pipeline developments require government approval. The environmental impact assessment (EIA or similar) prepared by the project proponent will be considered by relevant government authorities prior to a decision being made on the licence application. For major projects, public exhibition of the EIA forms part of the planning process, and allows regulatory authorities and members of the public to review and submit comments on the proposal. The regulator may require the proponent to prepare a supplementary EIA (or similar) to address issues that arise during a public comment period. The regulator will review the supplementary document and assess whether comments received have been adequately addressed prior to reaching a decision on the pipeline application.

5.3 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Detail of the EIA process for proposed pipelines varies between the Commonwealth, States and Territories, however some form of formal review of the project's potential environmental impacts is a common requirement. The pipeline approval process requires the proponent to identify and assess potential environmental impacts on the existing environment and to provide details of proposed management measures, customarily in the form of an Environmental Management Plan or similar, that will mitigate likely impacts to an acceptable level.

A proposed pipeline which crosses more than one jurisdiction requires a coordinated approvals process, involving satisfaction of the statutory requirements of each jurisdiction. Section 2 Legislative and Regulatory Governance contains further detail on such processes.

The basic elements of an EIA (or similar) include the following:

- a detailed project description
- project justification
- an evaluation of project alternatives
- an evaluation of the project against the principles of ecologically sustainable development
- a description of the existing environment
- identification and assessment of potential environmental impacts
- identification of environmental impact mitigation measures
- presentation of a draft environmental management plan, which includes the impact mitigation measures and commitments developed in the previous EIA sections.

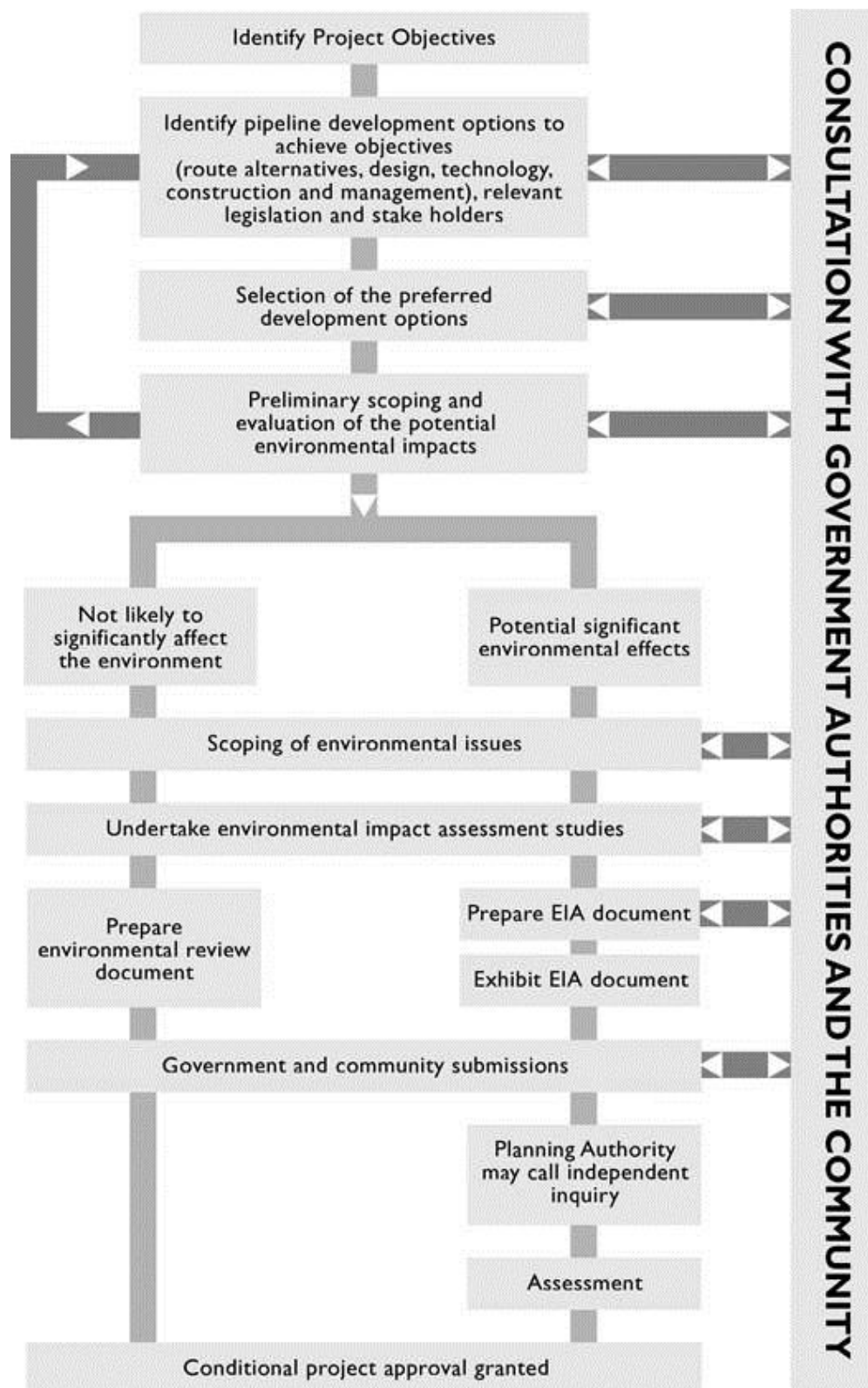
The assessment process evaluates the environmental risk (and usually the social risk as well) that the proposal represents to the existing environment. Major points for consideration would usually include the following aspects:

- project justification
- flora, fauna and ecology, including biosecurity issues
- soils, geology, terrain and seismic risk
- risks to water resources

- noise issues
- impacts on air quality
- social issues, including land use, economics, infrastructure, transport or social change
- heritage (indigenous and European)
- visual amenity.

Preliminary investigations during the project feasibility stage and consultation with all relevant stakeholders will assist in scoping the studies required for the assessment.

Figure 3 Key Stages in the environmental approval process.



5.4 CUMULATIVE IMPACT

Cumulative impact assessment in the context of a pipeline proposal can be described as an evaluation of the anticipated incremental impact caused by the proposed pipeline in consideration of the aggregate of past, present, and reasonably-foreseeable future actions on the existing environment..

This involves evaluation of the level of impact on resources, ecosystems and communities caused by existing and proposed land use activities in the wider landscape and contextualising the level to which the new proposal will contribute to this wider ‘cumulative’ impact.

Cumulative impact analysis of a new pipeline should be undertaken as part of the EIA for the project.

5.5 STAKEHOLDER AND COMMUNITY CONSULTATION

The pipeline industry recognises the growing need for effective stakeholder and community consultation as a key component of project planning and an important contributor to project acceptance by the regulators. Stakeholder and community consultation should continue throughout the life of a pipeline project, to ensure a proper understanding of the pipeline and its performance.

In response to growing community expectations and increased regulatory requirements, APIA has developed its own Code of Practice for Stakeholder and Community Engagement. This code of practice should be reviewed for further detailed information on stakeholder and community engagement standards.

Figure 2: Typical pipeline construction corridor for a large transmission pipeline (>800 mm diameter). MacDow



Typical pipeline construction corridor for a large transmission pipeline (>800 mm diameter). MacDow

5.5.1 ENVIRONMENTAL MANAGEMENT PLANS

Most regulatory agencies require the preparation and approval of a Construction Environmental Management Plan (CEMP) prior to commencement of construction and of an Operational Environmental Management Plan (OEMP) prior to commencement of pipeline operations.

Usually, a draft EMP will be included in the project EIA, and would be used by the appointed Construction Contractor to develop the CEMP required as a pre-start approval condition. Although the contents may vary between jurisdictions, an EMP typically includes descriptions of legislative requirements, the environmental management system, project roles and responsibilities, detailed guidelines for specific construction activities, a list of impact mitigation commitments, a list of approval conditions and how they will be fulfilled, as well as monitoring, auditing and reporting provisions.

An EMP should be used by a project proponent to outline the expected environmental performance standards for the project to its contractor(s). The EMP should be reflective of any approval conditions and outline clear responsibilities for compliance with each condition.

It is common for a principal contractor to finalise the EMP into a Construction Environmental Management Plan (CEMP) to outline proposed measures and procedures that will be employed to ensure compliance with the requirements of the EMP and any other regulatory or contractual environmental responsibilities. CEMPs should be used to outline site-specific management measures that will be implemented at identified sites of sensitivity on individual projects. It is important to the regulator that undertakings and commitments presented in the EIA as part of the EMP are carried over into the CEMP.

In the case of a commissioned pipeline, an OEMP must be approved prior to commencement of operations, and must be kept up to date throughout the life of the pipeline. The OEMP should contain a description of legislative requirements, should define project roles and responsibilities, should detail guidelines for specific operational activities, should include a list of impact mitigation commitments, a list of approval conditions and how they will be fulfilled, as well as monitoring, auditing and reporting provisions.

This Code does not contain the full and final detail on any aspect of environmental management and is not a substitute for a comprehensive environmental management plan, CEMP or OEMP. It is recommended that all pipeline proponents, construction contractors and pipeline operators seek appropriate expertise and advice to ensure they develop and implement environmental management documentation that is suitable to their activities and acceptable to regulators.

6 PIPELINE CONSTRUCTION ACTIVITIES

Onshore pipeline construction involves a range of specialist tasks, which are generally undertaken by pipeline construction companies and specialist service companies, in a defined construction corridor. This section addresses the many construction activities and environmental management issues that may be relevant to a particular pipeline project and presents a range of environmental management guidelines which represent good industry practice. The guidelines have been developed with the full range of project objectives in mind, including safety, environmental, engineering and economic factors. This section applies to both new pipelines and to the looping (or extensive replacement of) existing pipelines.

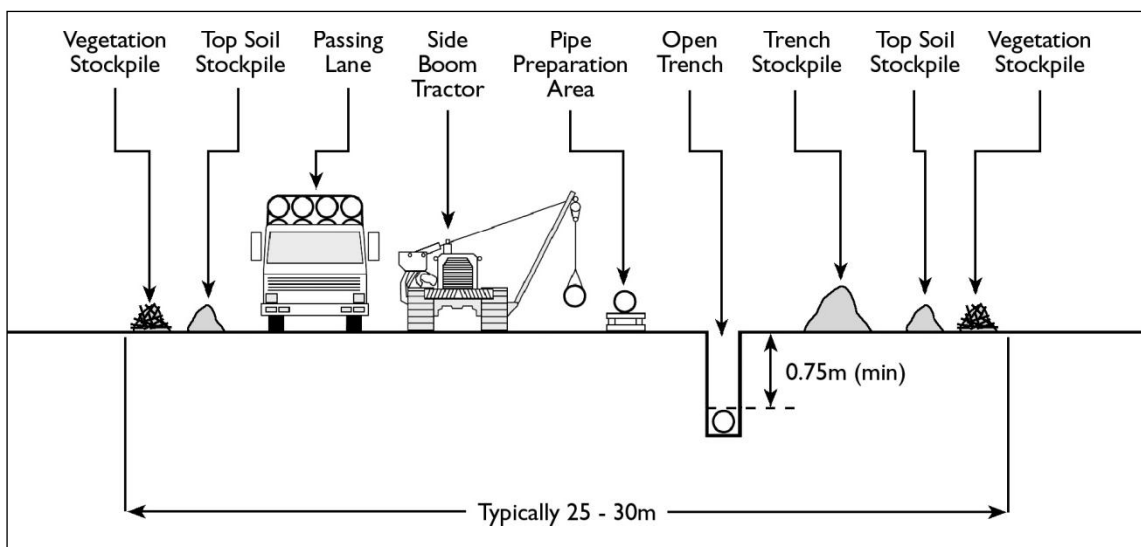


Figure 4: Typical construction corridor layout for small diameter pipeline construction

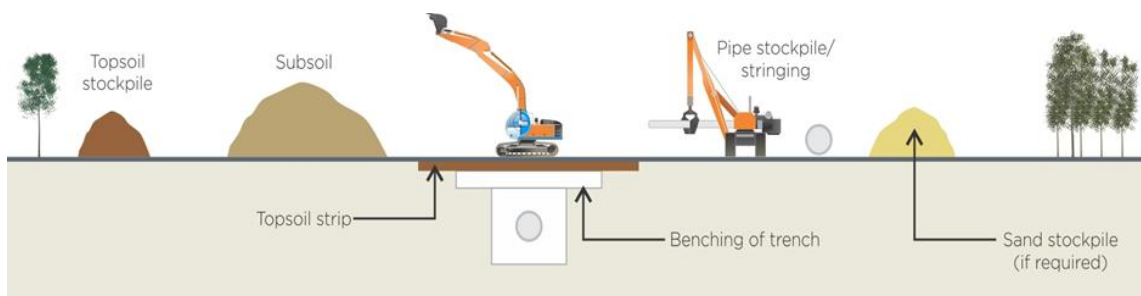


Figure 5: Typical construction corridor layout for large diameter pipeline construction

6.1 ACCESS TO SITE

During construction, access to project areas, such as pipeline easements, work and camp sites is required on a regular basis by transport, construction, proponent and regulatory personnel. Proponents may also find it useful to facilitate access to the construction areas for landowners, to encourage their understanding and acceptance of the construction process.

This section details the environmental management measures which need to be taken into account when obtaining access to the pipeline corridor - in addition to the safety requirements stipulated by legislation and in project Safety Management Plans.

For looping or replacement projects, it should also be remembered that the operation of an existing pipeline may mandate access to the pipeline easement for:

- pipeline surveillance and inspections to identify areas of erosion and subsidence, areas requiring vegetation management, check cathodic protection, identify possible leaks, monitoring third party activity and identifying any unacceptable risks to the pipeline
- monitoring and auditing of environmental conditions
- maintenance activities
- construction of facilities or additional infrastructure, or
- emergency access.

The nature and frequency of access will vary according to site environmental conditions, maintenance program requirements and corresponding amount of repairs needed. A higher frequency of access to an operational pipeline may be required immediately following ground disturbance activities, to ensure that all environmental protection measures are functioning as intended. Access may be undertaken by vehicle or on foot and can include several pieces of equipment or machinery where access for ongoing maintenance or repair is required.

The following tables are checklists of issues to be considered when designing and building access for pipeline construction.

ACCESS TO SITE

ACCESS TO SITE – KEY ENVIRONMENTAL ISSUES	Related Code Sections
Soil compaction, erosion and sediment release to land and water	Soil/Ground Stability and Land Disturbance Drainage, Erosion and Sediment Management
Disturbance of problematic soils such as dispersive, acid sulphate or contaminated soils	Soils Management
Potential modification to surface water flows (drainage lines and streams)	Water Management Drainage, Erosion and Sediment Management
Potential for site run-off into drainage lines and watercourses	Water Management Drainage, Erosion and Sediment Management
Disturbance of significant flora or wildlife habitat	Flora Management Fauna Management

ACCESS TO SITE

Introduction of disease, weeds, vermin or destructive influences to the site	Biosecurity Management
Damage to agricultural production or other land uses	Soils Management Biosecurity Management
Temporary disruption to landowners (access, noise and dust)	Traffic Management Noise Management Dust & other Air Emissions Management
Degradation of existing road infrastructure	Traffic Management
Increased safety hazard resulting from increases in traffic volume	Traffic Management
Unauthorised access track proliferation	Soils Management Drainage, Erosion and Sediment Management

ACCESS TO SITE – ENVIRONMENTAL OBJECTIVES

1. To avoid location of site access points in sensitive areas
 2. To minimise disturbance to ecosystems
 3. To minimise direct impacts to flora and fauna
 4. To minimise impacts on soil, drainage lines and watercourses
 5. To minimise the spread of noxious weeds, pests and pathogens
 6. To avoid adverse impacts on cultural and historic heritage sites
 7. To minimise impacts on visual amenity when creating access points
 8. To minimise disruption to landowners and third parties (sensitive receptors)
 9. To ensure site access can be retained during operations of the completed pipeline
 10. To achieve satisfactory road, track and site rehabilitation where required
-

ACCESS TO SITE– ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Planning and Design	Access planning shall include: ▪ Documentation of proposed temporary and permanent access locations in environmental planning documentation. ▪ Documentation of the current status of existing infrastructure, such as fences, tracks, gates, grids, etc ▪ Inclusion of temporary and permanent access locations in EIA field surveys – so that potential impacts and their mitigation can be

ACCESS TO SITE

included in environmental planning documentation.

- Use of existing roads, tracks and areas of disturbance where practicable. The location and design of new access tracks and roads should avoid or minimise impacts on high risk sites or sensitive receptors such as homesteads or residential areas.
 - Application of relevant legislative and design requirements where appropriate. Pipeline access must be designed and maintained to accommodate the intended traffic volume.
 - Consideration of scheduling, so that where practicable, pipeline construction activities minimise potential impacts on landowners.
 - Scheduling so that, where practicable, the length of time between creation and rehabilitation of temporary access tracks is minimal.
 - Identification of the permits required from local and state government authorities for access installation and of the construction standard required for access intersections and turning lanes from existing roads.
-

Construction Access

- The width of the access track shall be kept to the minimum practicable in order to enable safe vehicle movement (generally maximum of 4m).
 - Access to and along the pipeline easement should be minimised during and immediately after periods of prolonged or heavy rainfall.
 - In sensitive environmental areas, site-specific environmental management procedures shall be adopted to minimise environmental impacts caused by access to site.
 - Consideration shall be given to employing access measures and controls which minimise impacts to landowners and to protect stock (such as the installation of temporary fencing, gates and cattle grids).
 - Modified tracks, property fences or gates shall be reinstated to a condition equal or better than the pre-existing condition unless otherwise agreed with the landowner.
 - As a general rule, gates shall be left as they are found or as sign posted or stated in the construction line list. If closed gates are required to be opened for extended periods (e.g. convoy passage) they shall not be left unattended unless otherwise agreed with the landowner.
 - The width of the access track shall be kept to the minimum practicable in order to enable safe vehicle movement (generally maximum of 4m).
 - During construction, access infrastructure shall be maintained to
-

ACCESS TO SITE

appropriate standards.

Reinstatement of Access

- Public and private tracks used during construction shall be reinstated to their pre-construction condition or as otherwise agreed with the relevant landowner or authority.
 - Rehabilitation procedures shall include:
 - Reinstatement of original land contour;
 - Installation of appropriate sediment and erosion control measures;
 - Installation of appropriate measures which discourage access to restored tracks such as signs, fences, earth mounds or ditches, or other physical barriers such as rocks or cleared vegetation. These may be temporary or permanent measures.
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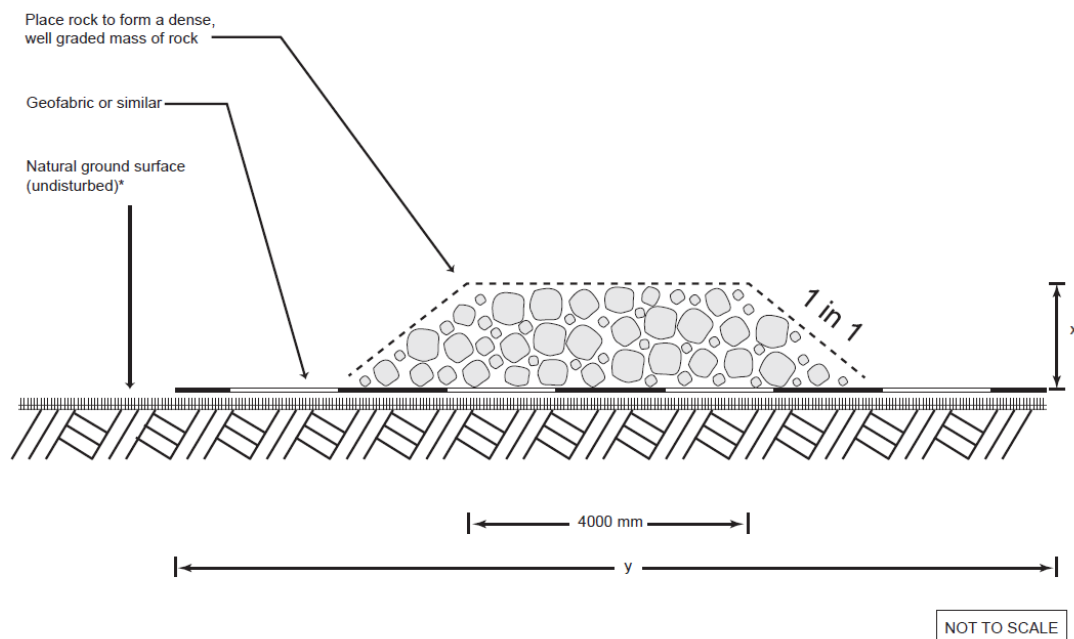
Operational Pipeline Access Track General Provisions

- The pipeline easement shall only be used as an access for activities essential to ensuring the continued safe operation of the pipeline and protection of the local environment.
 - Access to the pipeline easement shall, as far as is practicable, be via existing tracks, and any access to the pipeline easement through private property shall only occur with individual landowner and/or occupier approval and in a manner consistent with pre-established access arrangements.
 - Public access along the pipeline easement shall not be permitted unless that right already exists. Public access to the pipeline easement shall be restricted by physical barriers (e.g. gates, fences, other practical barriers) and by pipeline signs/ markers.
 - Any use of internal farm tracks or private roads for pipeline surveillance must be by pre-established agreement with the landowner. Typically, the landowner should be notified at least 24 hours before access is required, or otherwise as agreed. Where regular/ ongoing access is required, acceptable terms should be pre-established, to the satisfaction of the landowner.
 - In sensitive environments, vehicle access should be avoided if possible. Where there is no alternative, access should be restricted as far as possible, with frequency of access minimised to an 'as required' basis.
 - Access to and along the pipeline easement should be avoided where possible during and immediately following periods of prolonged or heavy rainfall.
-

ACCESS TO SITE

- Access to the pipeline easement shall be conducted in a manner that adequately considers potential noise or vibration impacts (refer to section 9.10). In some areas, access may need to be restricted to specific times, as determined in consultation with local authorities or landowners.
- Seasonal land use activity and other local timing requirements relating to existing land use activities should be considered during the scheduling of operational access.
- Potential easement access impacts and their mitigation should be managed as part of an OEMP.

Temporary Access Track Construction.



TEMPORARY ACCESS TRACK: CONSTRUCTION

Lay geofabric or similar over undisturbed* ground

- x – Depth, sizings and type of rock to be determined by suitably qualified person
- y – Geofabric to extend minimum of 1500 mm beyond the width of the proposed track, to facilitate removal of track material once the track is no longer required
- * In some cases topsoil can be removed: in such cases the stockpiled topsoil can be covered and used to prevent surface overland flow from reaching the temporary track itself

Clearing

Clearing of the pipeline construction area involves trimming or removal of trees, shrubs, stumps and other obstacles, to provide unobstructed and safe construction access. Disturbance to native vegetation and wildlife habitat is avoided or minimised to the greatest extent practicable through careful route selection and the application of appropriate management procedures.

The working space available for pipeline construction is generally reliant upon the width of easement specified in the planning approval conditions. The amount of working space needed is worked out during the planning phase by analysis of the following aspects:

- maintaining appropriate safety standards
- requirements for construction equipment and vehicle movement
- environmental sensitivities
- terrain and geotechnical constraints
- pipeline diameter and trench depth
- the number of pipelines being installed
- proximity to existing infrastructure such as roads
- maximising construction productivity
- minimising risk to adjacent land uses or users



Trimming overhanging vegetation on a pipeline corridor as part of clearing activities. Ecos

The normal working width in Australia for a major pipeline is approximately 20-40 metres, however this may vary depending upon the particular project or site-specific considerations and should be minimised where practical. It is a common requirement to reduce working width through areas of sensitivity – and this can require an adjustment in construction methodology. Reduced working width should be considered on a case-by-case basis, based on a risk assessment of the environmental sensitivities and associated construction constraints.

CLEARING

CLEARING – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion	Soils Management Drainage, Erosion and Sediment Management
Sediment release to land or water	Water Management Soils Management Drainage, Erosion and Sediment Management

CLEARING	
Removal of significant flora and wildlife habitat	Flora Management Fauna Management
Fragmentation of wildlife habitat and dislocation of wildlife corridors	Flora Management Fauna Management
Increased potential for feral animal movement along new corridors	Biosecurity Management
Increased potential for weed species introduction	Biosecurity Management
Disturbance to heritage sites	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Potential impacts to visual amenity	Visual Amenity Management
Unauthorised third party access to previously inaccessible areas	Traffic Management
Rehabilitation of cleared areas	Flora Management Fauna Management Reinstatement and Rehabilitation
CLEARING – ENVIRONMENTAL OBJECTIVES	
	1. To minimise disturbance to flora 2. To minimise impacts on fauna 3. To minimise impacts on soil and water 4. To minimise impacts on visual amenity 5. To minimise impacts on sites of cultural and historic heritage significance 6. To optimise rehabilitation success
CLEARING – ENVIRONMENTAL MANAGEMENT	
Activity	Management Measures
Planning	▪ Significant ecosystem patches or individual trees that are identified as having significant natural, heritage or visual amenity values should be avoided by the alignment during the planning phase. ▪ The pipeline proponent shall specify the pipeline construction working width for the entire length of the pipeline. This may vary at different locations. Note: while the main clearing area is 20 - 40m, turn-around and working areas may need to be wider in certain locations.

CLEARING

- Clearing boundaries shall be delineated on project drawings and in the field to define the extent of authorised clearing. These boundaries will widen at locations where additional spoil will be generated (e.g. bell holes, corners, deep crossings).
- Relevant stakeholders and landowners shall be consulted in relation to the level of clearing required during the planning phase - to assist in minimising impacts on property land use and management and loss of amenity.
- Areas should be identified where additional workspace is required early in the planning process (lay down areas, vehicle turn around areas). These should be located in pre-disturbed areas of low or no vegetative value where possible, and their locations must be negotiated with the relevant landowner.
- Where a pipeline passes through sensitive environmental areas, site-specific environmental management procedures should be adopted to minimise environmental impacts.
- Measures shall be employed which identify, make safe and protect other third party infrastructure in the vicinity of the clearing works
- Necessary permits and clearances are to be obtained prior to commencement of clearing activities. A copy should be carried on site with clearing crews where possible.
- Clear and grade crews should be inducted on the marking methods used to delineate work area widths and important environmental features.

Construction

- Vegetation clearance should be minimised as far as practical, particularly at watercourses. Retention of vegetation, avoidance of native grasses and trees and selective trimming are preferable to clearing.
 - Wildlife habitat fragmentation effects can be minimised by retaining tree canopy connectivity where practicable, particularly at watercourses and where there are roadside ecosystem remnants.
 - Consideration should be given to retention of significant ecosystem patches or individual trees within the approved corridor, where they have significant natural, heritage or visual amenity values.
 - In the case of protected or retained vegetation within (or adjacent to) the pipeline construction area, where there is significant natural, heritage or visual amenity values to protect, the vegetation shall be marked with flagging or marker tape to indicate that it should be avoided. Marker paint should not be used.
-

CLEARING

- Flagging or marker tape used to identify sites shall be standardised throughout the project. The roles of flagging or marker tape shall be explained during project inductions.
- Clearing shall aim to retain roots in riparian zones and other sensitive areas where possible, to retain stability. Slashing may be undertaken as a means of vegetation clearing, particularly in sown pastures or at water courses.

6.2 GRADING

Grading involves the removal of topsoil and, in some instances, sub-soil from the pipeline construction area and associated work and camp sites. Topsoil, also referred to as the A horizon, is the surface soil layer and is rich in organic and mineral matter. Topsoil has a high value as it contains nutrients and the majority of seed stock that can quickly germinate and contribute to effective rehabilitation following reinstatement of the pipeline corridor.

Grading is required where:

- construction is likely to unduly damage topsoil and inhibit rehabilitation or primary production activities
- the topography does not permit safe and practical access to the pipeline construction area or work sites
- the soil conditions cannot accommodate construction activities.

Generally, topsoil is removed to the next soil horizon (i.e. sub-soil). The extent and depth of topsoil removal from the pipeline construction area (e.g. full stripping or partial stripping) shall be determined on the basis of best practice for the specific site, in consultation with landowners, the project CEMP and relevant regulatory authorities, as appropriate.



Grading of pipeline corridors. W. Mathieson/Ecos

Removal of topsoil from the entire pipeline construction area is the general industry standard. In some instances, topsoil stripping shall be restricted to the trench line, so as not to expose highly acidic/ erodible subsoils.

Depending on the soil condition, some soil types are more erodible than others. Light soils for example can be more prone to wind erosion, and in such instances, the length of time between initial grading and reinstatement should be minimised.

Topsoil stripping measures commonly applied in pipeline construction are listed in Table 2, 6.2 and 9.6 below. Prior to the commencement of grading activities, appropriate topsoil management techniques shall be determined in consultation with the Proponent/Asset owner, affected landowners and relevant regulatory authorities, as required. It may be necessary to vary application of the techniques listed below on a site-by-site basis.

Table 2: Common Topsoil Stripping Measures

TOPSOIL MANAGEMENT	
Topsoil Management Technique	Description
Trench line	Topsoil is graded to a blade width over the trench line only and the soil stockpiled in windrows adjacent to the pipeline construction area
Trench And Work Side	Topsoil is graded over the trench and work side only
Trench And Spoil Side	Topsoil is graded over the trench and spoil side only
Full Stripping	Topsoil is graded over the full width of the pipeline construction area
No Stripping	Direct trench excavation or plough-in with no topsoil stripping
GRADING	
GRADING – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion and sediment release to land or water	Water Management Soils Management Drainage, Erosion and Sediment Management
Degradation of soil structure through soil mixing, compaction and topsoil loss	Soils Management Drainage, Erosion and Sediment Management
Disturbance of problematic soils such as Acid Sulphate Soil, dispersive soil or contaminated soil and consequent release of acid or contaminated	Soils Management

GRADING

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Removal of wildlife habitat

Flora Management

Fauna Management

Disturbance to Cultural Heritage

Heritage – Natural and Built
Environments

Aboriginal Cultural Heritage
Management

Increased potential for the spread of weeds and
pathogens

Biosecurity Management

Potential impacts to visual amenity

Visual Amenity Management

Unauthorised third party access to previously
inaccessible areas

Traffic Management

Potential temporary disruption to existing land uses

Stakeholder Code of Practice

GRADING – ENVIRONMENTAL OBJECTIVES

1. To minimise soil profile damage
 2. To minimise sedimentation and acidification of land and water
 3. To minimise disturbance to native flora
 4. To minimise impacts on fauna and fauna habitat values
 5. To minimise impacts on sites of cultural and historic heritage
significance
 6. To minimise impacts on visual amenity
 7. To minimise disruption of landowners and third parties
 8. To optimise rehabilitation success
 9. To minimise the time between clearing and restoration of pre-
clearing land use
-

GRADING – ENVIRONMENTAL MANAGEMENT

GRADING	
Activity	Management Measures
Planning	▪ Soil analysis prior to construction should be undertaken to determine the pre-existing soil profile and structure and allow effective soil conservation measures to be determined. A Soil Assessment and Management Plan (or equivalent) should be produced. ▪ Activities should be scheduled to minimise the length of time between ground disturbance and reinstatement. ▪ Where topsoil is predicted to be removed for longer than one month, stripped topsoil should be covered with a stabiliser such as geotextile material, temporary seed cover or equivalent, to retain the topsoil for use when reinstatement occurs. ▪ Planting a cover crop over topsoil stockpiles not expected to be re-used for longer periods of time (a year or more) should be considered.
Construction	▪ Topsoil should be graded and stockpiled separately to subsoil and should not be compacted or otherwise impacted during construction. ▪ Weather conditions should be considered in terms of soil management prior to and during construction. ▪ Graded soil shall not be stockpiled where it has the potential to result in sedimentation or acidification of land or surface water (e.g. on slopes which drain immediately to a watercourse). ▪ Topsoil containment measures (e.g. berms and sediment fencing) shall be used as necessary. Grading and stockpiling of soil shall not, as far as practicable, impede surface drainage or water flows. ▪ Grading of watercourse beds and banks shall be minimised - leaving an undisturbed organic mat within the riparian zone - or delayed until construction of the crossing is imminent, thus minimising risk associated with sediment release into watercourses - refer section 6.11 Watercourse Crossings for detail.

6.3 STRINGING, COATING AND JOINTING

Following clearing and grading activities, pipe materials are delivered to site. The term pipe-stringing is used to describe laying lengths of pipe alongside the prepared trench in preparation for welding into continuous lengths. Polyethylene (PE) pipe may be delivered to site in lengths or in rolled spools, while polyvinyl chloride (PVC) piping is delivered in a similar fashion to steel (rigid pre-determined lengths). The length of stringing along the alignment should be assessed on a case-by-case basis and should include provisions for gaps at crossing points.



Pipe stringing. Ecos

PE pipe can be joined by heat fusion or with mechanical fittings. Thermal Heat Fusion methods include; butt fusion, saddle fusion, socket fusion and electrofusion. The principal of heat fusion is to heat two surfaces to a designated temperature, then by application of a sufficient force, cause the melted materials to fuse together. This fusion, when done in accordance with the manufacturer's specifications, results in a joint that is as strong as or stronger than the pipe itself. The newly-joined pipe can be handled as soon as it has cooled to near ambient temperature. Prior to attempting heat fusion, the operator must confirm that the fusion equipment selected is designed to operate with the pipe in question.

Mechanical joining methods for PE/PVC piping include mechanical compression couplings and stab type mechanical fittings.

PVC piping is joined by using solvents. Pipe ends are cut evenly, the ends are then cleaned and a primer applied before using a solvent to join two pipe ends together with the aid of a connector. The process is essentially one of chemical fusion.

For steel or ductile iron, pipe joints are welded. Once completed, each weld is inspected visually and using x-ray or ultrasonic equipment. The surface at the joint is then cleaned by grit-blasting or wire brushing, and a corrosion inhibitor - a tape wrapping, plastic sleeve or protective coating - is applied.

Coating is the primary means of corrosion protection for steel and ductile iron pipelines. Any internal lining or external coating should be fit-for-purpose and applied to the individual pipes prior to their arrival on site.

Waste products generated by pipe stringing, coating and welding activities can include PE and PVC end caps and offcuts, mild steel offcuts and defective pipe, metal filings, timber skids and sandbags, chemical containers (such as epoxy coating cans), abrasive blasting residue and welding residue (such as welding rod scraps, welding stubs, electrode butts, radiography chemicals and packaging). Recycling opportunities and the appropriate methodologies for the

gathering and disposal of generated waste, including hazardous materials, should be described in the EMP/CEMP/OEMP prior to the commencement of works.

STRINGING, COATING AND JOINTING

STRINGING, COATING AND JOINTING – KEY ENVIRONMENTAL ISSUES

Related Sections

Dust and noise emissions resulting from pipe transport	Noise Management Traffic Management Dust & other Air Emissions Management
Temporary obstruction of other land uses	Stakeholder Code of Practice
Damage to existing road networks and infrastructure	Traffic Management
Potential fire hazard associated with construction welding and grinding	Fire Prevention Management
Appropriate management of waste materials	Waste Management
Pipe stringing impeding emergency vehicles, landowner access or fauna movements including stock	Fauna Management Traffic Management
Hazardous waste generation from abrasive blasting	Fuel and Chemical Management Waste Management
Waste from spent rods, spray paint etc	Fuel and Chemical Management Waste Management

STRINGING, COATING AND JOINTING – ENVIRONMENTAL OBJECTIVES

1. To minimise disruption to landowners and third parties
2. To minimise the risk of bushfire
3. To minimise waste generation/ littering
4. To effectively manage wastes, including maximising recycle / reuse opportunities
5. To avoid damage to existing road networks from pipe trucks and other vehicular traffic

STRINGING, COATING AND JOINTING – ENVIRONMENTAL MANAGEMENT

Activity

Management Measures

Planning	▪ Consultation shall be undertaken with relevant landowners and regulatory authorities with regard to locating pipe storage laydown and worksites - refer to Section 6.10 Construction Camps and Worksites.

STRINGING, COATING AND JOINTING

	Need for and location of access gaps in the pipeline strings should be pre-determined in consultation with stakeholders (fire authority, landowners).
Pipe Stringing	Pipe strings should avoid areas of native vegetation and should be strung on to areas of the RoW where clearing and grading is complete, unless otherwise agreed.
Pipe Jointing	Epoxy containers or other hazardous containers or materials to be collected and disposed of in an appropriate manner, which is described in the EMP/CEMP/OEMP.
Abrasive Blasting	Abrasive blasting shall be conducted in accordance with applicable codes of practice and regulatory conditions.
Pipe Welding	- All welding, welding procedures, welder qualifications, the use of welding consumables, and the removal of weld defects shall conform to relevant Australian Standards, particularly AS2885.2. - Ferrous and non-ferrous materials generated from pipe welding and cutting process should be recycled as far as possible. - PE/PVC pipe solvents and waste materials generated from welding, joining and cutting activities should be recycled or disposed of in an appropriate manner that is described in the EMP/CEMP/OEMP. - Abrasive blasting shall be conducted in accordance with the applicable national standards, with blasting wastes handled in a manner appropriate to the medium used.



6.4 TRENCHING

Trenching may be undertaken either prior to, during or after pipe stringing, depending upon project schedules, terrain and other logistical factors. Trench excavation depth may vary depending on:

- the product being transported (e.g. gas, petroleum liquids, water)
- the maximum operating pressure of the pipeline
- the nature of the terrain (e.g. rock, open pasture, rivers)
- the proximity to infrastructure and buried utilities (e.g. roads, railways, other pipelines, fibre optic cable)
- land use and the potential risk of third party interference (e.g. rupture during deep-ripping or excavation).



Trenching machine in action Ecos

General trench depth parameters are specified in Australian Standards, while site-specific requirements will be obtained from infrastructure owners (i.e. road and rail authorities, etc).

TRENCHING

TRENCHING – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion and sedimentation of land and water (including discharge waters)	Water Management Soils Management Drainage, Erosion and Sediment Management
Problematic soils (Acid Sulphate Soil) or contaminated soil disturbance	Soils Management
Potential for stock and wildlife entering the open trench	Fauna Management
Disturbance to sub-surface artefacts, heritage sites or skeletal remains	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Disturbance to root structures of mature vegetation	Flora Management Soils Management

TRENCHING

Temporary obstruction of other land uses	Stakeholder Code of Practice
Potential impact to water sources (groundwater and surface water)	Water Management Drainage, Erosion and Sediment Management Fuel and Chemical Management

TRENCHING – ENVIRONMENTAL OBJECTIVES

1. To minimise adverse impacts on soil, particularly impacts to the soil profile through topsoil mixing or burial
 2. To minimise adverse impacts on water
 3. To minimise adverse impacts on stock or wildlife
 4. To minimise impacts on sites of cultural and historic heritage significance
 5. To minimise disruption of landowners and third parties or to their activities
 6. To minimise environmental risk associated with third party interference
-

TRENCHING – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Planning	▪ Third party infrastructure, including pipelines, fibre optic cables and private infrastructure shall be identified and relevant impact management measures applied prior to commencement of trenching activities.
Construction	▪ The open trench shall be checked regularly for fauna, with their removal being managed in accordance with Section 9.5.
Alternative techniques	▪ Boring or HDD should be used as required where the pipeline crosses sensitive areas, major watercourses or significant built infrastructure.

6.5 BLASTING

In ground where the use of conventional excavation or ripping equipment is not feasible, it may be necessary to use controlled blasting. The handling, storage and use of explosives is governed by prescriptive State and Territory legislation and Australian Standards.

BLASTING	
BLASTING – KEY ENVIRONMENTAL ISSUES	Related Sections
Impacts on terrestrial and aquatic fauna	Fauna Management Drainage, Erosion and Sediment Management
Noise disturbance	Noise Management
Vibration disturbance	Noise Management
Dust generation	Dust & other Air Emissions Management
Appropriate management of debris	Waste Management
Infrastructure damage	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
BLASTING – ENVIRONMENTAL OBJECTIVES	
	1. To minimise adverse impacts on fauna and significant habitat areas 2. To minimise associated noise impacts 3. To minimise associated vibration impacts 4. To minimise associated dust generation 5. To safely contain blast debris 6. To avoid damage to adjacent infrastructure, cultural material or third party assets
BLASTING – ENVIRONMENTAL MANAGEMENT	
Activity	Management Measures
Planning and Design	▪ Alignment selection shall minimise encounters with areas of rock that require blasting. ▪ A Blasting Operations Management Plan shall be prepared, detailing the proposed method of blasting, including safety, drill pattern, charges, explosives, detonation methods, debris control, climactic conditions etc. ▪ Prior notice shall be given to adjacent residents, nearby work crews and other potentially-affected parties (e.g. adjacent utility operators) in accordance with applicable standards and regulatory requirements. ▪ Risk assessment to identify threats to environment, adjacent landowners and infrastructure/assets should be undertaken to

BLASTING

ensure scale of blasting is appropriate.

Blasting Operations	▪ Blasting procedures shall be conducted in strict compliance with relevant State or Territory legislation and Australian Standards. ▪ Measures such as appropriate blast design, blanketing and collaring, shall be employed as required on a site-by-site basis to prevent possible damage to nearby structures, utilities and sensitive habitat/fauna. ▪ Avoid blasting in sensitive fauna/flora/groundwater /wetlands/river crossing areas.

6.6 TRENCHLESS TECHNOLOGY

Trenchless technology is a viable alternative where there are significant surface constraints which limit or exclude standard trenching as a construction methodology. Trenchless technology is a collective term that includes techniques such as tunnelling, thrust boring, Horizontal Directional Drilling (HDD) and the plough-in method. These methods of construction cause minimal disruption to the surface environment, making them ideal for areas where there are environmental sensitivities, heritage constraints, social complexities or where existing infrastructure cannot be passed by trenching; the main drawbacks to trenchless technologies are increased unit cost and risk, and the risk of failure must be considered when considering use of a trenchless technology.

The planning and phasing of trenchless activities during construction requires an understanding of where these methods would be most feasible. A thorough risk assessment for the proposed technology, including consideration of environment and technical issues, cost and the area/s zoned for trenchless methodologies should be conducted during the initial design and planning stages. Geotechnological analysis will be required, to inform this risk assessment and to confirm the appropriateness of the trenchless technology proposed.

For further guidance on trenchless technology, it is recommended the website of the Australian Society for Trenchless Technology (ASTT) is consulted (refer to http://www.astt.com.au/trenchless_technology/guidelines/astt_guidelines/).

6.6.1 MICROTUNNELLING (CLOSED-FACE BORING)

Overview of the technique

Microtunnelling, sometimes called “closed-face” boring, is a form of trenchless construction that uses a remotely-operated microtunnelling machine which is guided between two pits or shafts. Once the microtunnelling machine is in place and starts to create a microtunnel, pipe is pushed in behind the machine using a pipe jack, with the advance of the machine controlled by the speed with which the pipe is fed in. Microtunnelling is typically used in situations where a

pipeline needs to cross under rail, road or other sensitive features and the geology is un-cohesive, granular and/or water charged.

The potential benefits/where the method can be applied

Microtunnelling can avoid surface disturbance across road and rail corridors and at other sensitive locations. It allows deep installation under existing utilities (fibre optic, gas pipelines, water pipelines) and is able to penetrate groundwater tables without a requirement for dewatering. Microtunnelling can also be used through contaminated soils and can be a cost effective option in such instances.

Limitations

Microtunnelling can only take place on a relatively flat and constant grade surface, and it requires the sinking of pits or shafts, which can be expensive; the technique cannot be used to negotiate tight vertical or horizontal curves. It is also a technically elaborate process and is relatively slow. All of the factors listed above contribute to cost, and the microtunnelling technique can be relatively expensive.

Potential Risk

The main risk when undertaking microtunnelling is surface settlement caused by disturbance to the sub-surface geology following installation of the pipe. Other environmental issues can arise from mismanagement of excavated topsoil and spoil from each service shaft or pit, from fauna entrapment, from ineffective control of waste and from the risk posed by a significant rainfall event.

Risk Management

Undertake careful examination of geology and hydrogeology at defined locations during the initial planning stages to determine the sub-surface characteristics. This will inform a decision on whether microtunnelling is the most suitable method of construction.

If sensitive structures are present on site (i.e. railway line), settlement monitoring should be undertaken during the works. A contingency plan for resolving potential settlement issues should be prepared by suitably-credentialed specialists and approved by the project proponent and relevant stakeholders/regulators prior to commencement of microtunnelling works.

Stockpile areas should be located away from sensitive locations and managed in accordance with 9.7.

Spoil and topsoil stockpiles shall be managed in accordance with Section 9.6 Soils Management whilst waste management and management of drilling muds should be undertaken in accordance with provisions in Section 9.9 Waste Management). Dewatering of bellholes should be managed in accordance with provisions of Section 9.8 Water Management.

6.6.2 THRUST BORING

Overview of the technique

Thrust boring is a low impact technique involving drilling short distances to join two enlarged trenches, or bellholes, located within the pipeline construction area (see figure 7). A bellhole is required on each side of the proposed crossing (road or railway or watercourse), one will be the entry bellhole (containing the thrust bore rig) whilst the other is used as the receiver. The entry bellhole is typically 25m or more long and 4-5m wide to allow it to hold the rig and a full length of pipe. The receiving bell hole is typically 4-5m long and 3m wide.

The potential benefits/where the method can be applied

The technique of thrust boring is commonly applied to install pipelines beneath infrastructure such as roads, railways, buried utilities (e.g. fibre optic cable) and, in some circumstances, for watercourse crossings. Thrust boring can be used in areas of high environmental, heritage and social significance where surface impact is not acceptable.

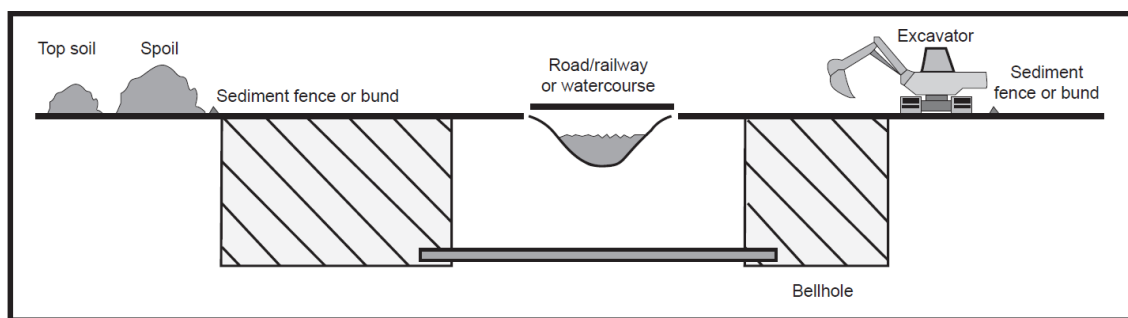


Figure 7: Schematic profile of a bored crossing

Limitations Use of a thrust bore is limited by site conditions, including geology, landform, soil type, soil depth and width of the required bore. Thrust boring works best in soils that are above the water table, with special dewatering measures needed when groundwater is encountered. The thrust bore is not suitable over long distances due to increased cost and risk of failure, and over longer distances where surface disturbance is not desired, permitted or possible, crossing methodologies such as HDD technology and microtunnelling have become more suitable options. Thrust boring is also limited to construction in one plain of direction, which can also limit its suitability.

Potential Risk

Environmental risks include potential mis-management of excavated topsoil and spoil from each bellhole, fauna/livestock entrapment, ineffective control of waste and risk of a significant rainfall event filling the bellholes leading to runoff with an unacceptable sediment level.

Risk Management

Evaluation of geology and/or hydrogeology and analysis of alternative construction techniques should be undertaken in the initial planning stages to determine if thrust boring is the most suitable method of construction.

Stockpile areas should be located outside of sensitive lands and managed in accordance with Section 9.7 Drainage, Erosion and Sediment Control provisions. Fauna management should be undertaken in accordance with Section 9.2.

Spoil and topsoil stockpiles shall be managed in accordance with Section 9.6 Soils Management, whilst waste management and management of drilling muds should be undertaken in accordance with provisions in Section 9.9 Waste Management). Dewatering of bellholes should be managed in accordance with provisions of Section 9.8 Water Management.

6.6.3 DIRECTIONAL DRILLING

Overview

The installation of the pipeline by Horizontal Directional Drilling (HDD) involves drilling a hole at a shallow angle beneath the surface, then pulling the welded pipe string back through the drill hole. Drilling is conducted by a specially designed drill rig, operated by a specialist contractor. A variety of associated equipment and infrastructure is required, and a cuttings settlement pit and drilling mud containment pit at the drill entry and exit points are needed.

The size of the HDD rig and its associated footprint depends upon the size of the pipe, the nature of the subsurface geology and the length of the drill. Smaller, self-contained rigs (e.g. on the back of a semi-trailer) are often used for applications such as road crossings, while larger HDDs require more sizeable equipment and static drill rigs.

Potential Benefits/where the method can be applied

The use of HDD decreases the risk of impact to areas where surface disturbance must be avoided as far as possible. HDD is generally used to cross major watercourses (refer to Section 6.10 Watercourse Crossings) or at sites where standard open cut methods are not feasible or appropriate. It may also be used to negotiate or introduce subsurface curves or bends – in 3 dimensions - for road or railway crossings or to facilitate coastal crossings where a pipeline crosses beneath the intertidal or shoreline region (i.e. land to water crossings).

Limitations

The feasibility of using HDD is strongly limited by site conditions such as soil stability, slope, access, available workspace and the nature of subsurface rock. Directional drilling is also relatively costly in comparison to conventional trenching, but may be more economical in certain conditions.

Risks

While directional drilling can reduce above-ground impacts, it is still important to apply effective drill site sediment control and waste management processes.

Failure of the HDD, resulting in the release of drilling muds and/or collapse of the pilot drill hole, is a risk which increases where the geology is un-cohesive, granular and/or water charged. Failure of an HDD, or 'frack out', generally requires either a secondary HDD or replacement by a more intrusive construction technique.

Pullback operations are a major source of risk in HDD, where the product pipestring sticks during pullback leading to partial hole collapse and other complications.

Issues such as noise and increased duration of construction and workforce numbers also need to be managed, and are considered in Section 6.9 Construction Camps and Worksites, Section 9.9 Waste Management and Section 9.19.10 Noise Management.

Risk Management

As part of determining if HDD is the most suitable method of construction, geotechnical analysis should be undertaken, together with a review of the limitations of the HDD technology for the areas where it is proposed for use.

A HDD failure scenario should be included in the risk management analysis during the planning stages and should include emergency management and response, as well as remediation measures.

Site specific environmental management procedures should be prepared for all HDD sites prior to drilling; these should deal with identified risks and specify mitigation and management measures.

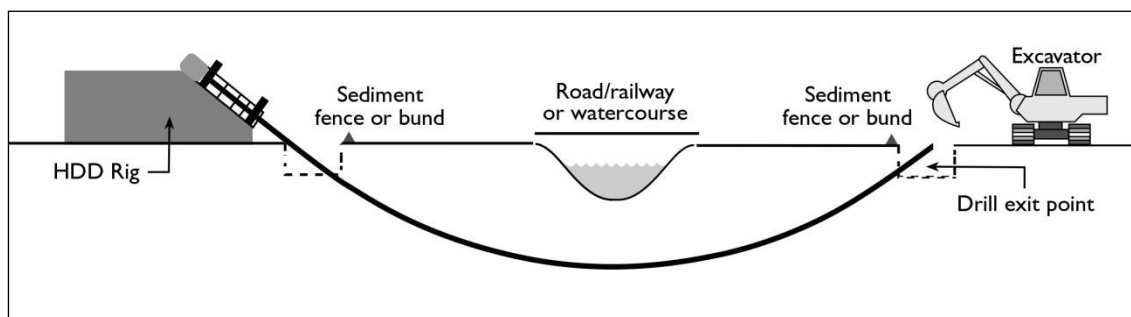


Figure 8 Schematic profile of Horizontal Directional Drilling



Small horizontal directional drilling rig.
Ecos



Large horizontal directional drilling rig on pad. MacDow

6.6.4 PLOUGH-IN METHOD

Overview

Plough-in construction is an emerging technique predominantly applied to the installation of small diameter gas and water pipelines. The method employs a deep ripper and heavy duty keel which contains a chute. The keel slices through the soil leaving the pipe extruded from the chute outlet in its trailing edge. Depth and direction can be controlled by the guidance system. The keel can adopt a vibratory capacity to ease soil cutting. Bellholes are required at regular intervals to join spools of pipeline together, with their spacing dependent on the length of PE rolls being installed.

Potential Benefits/where can it be applied

Plough-in methodology can prove to be a lower cost, lower impact and faster form of installation when the construction circumstances allow. It can be applied to areas of better agricultural soils where trenching would be more disruptive, can negotiate curves and has the fastest recovery time. It does not require topsoil stripping in advance, and in some situations the pipe spool can be mounted on the plough-in rig, negating any requirement for a pipe-stringing area.

Limitations

Plough-in construction is not suitable for terrain containing a lot of sub-surface rock; in addition, currently there are technical limits to the diameter of pipeline that is suitable for plough-in and it is only suitable for PE pipelines. Set-up costs mean that plough-in may not be cost-effective for applications requiring only short pipe lengths.

Risks

Too much rock present in the subsoil can damage both the equipment and the PE pipe itself. Other environmental risks are associated with the necessary bellholes, including potential for

soil mismanagement, risk of fauna/livestock entrapment, ineffective control of waste and potential impacts from a significant rainfall event.

Risk Management

Geotechnical analysis should be undertaken during project planning to determine if plough-in is a suitable construction methodology.

Spoil and topsoil stockpiles shall be managed in accordance with Section 9.6 Soils Management. Fauna management should be undertaken in accordance with Section 9.2 Fauna Management, whilst waste management and management of drilling muds should be undertaken in accordance with provisions in Section 9.9 Waste Management. Dewatering of bellholes should be managed in accordance with provisions of Section 9.8 Water Management.

6.7 PIPELAYING AND BACKFILLING

In a conventional trenched installation, the joined pipe string is lowered into place using side-boom tractors or excavators. Prior to pipelaying, it may be necessary to dewater the trench if rain water or groundwater has accumulated and to inspect it for any entrapped fauna.

Padding machines may be used as an alternative to imported bedding materials, to sift the excavated subsoil and provide fine material to pad beneath, beside and above the buried pipe - to protect the pipe coating. In some instances, such as very rocky soils, imported sand or foam pillows may be used for padding to protect the pipeline and its coating.

The trench is generally backfilled using previously excavated material, and then compaction is an important key to minimising settlement or slumping following construction.



Pipe being lowered into the trench Ecos

PIPELAYING AND BACKFILLING

PIPELAYING AND BACKFILLING – KEY ENVIRONMENTAL ISSUES

Related Sections

Soil erosion and sedimentation of land and water

Water Management

Soils Management

Drainage, Erosion and Sediment Management

PIPELAYING AND BACKFILLING

Management of potentially contaminated trench water discharge	Water Management Drainage, Erosion and Sediment Management Soils Management
Entrapment of stock and wildlife in the open trench	Fauna Management
Temporary obstruction of other land uses	Stakeholder code of practice
Backfilling problem areas and soils (acid soils, salinity, settlement, surface water or high groundwater table)	Soils Management

PIPELAYING AND BACKFILLING – ENVIRONMENTAL OBJECTIVES

1. To minimise adverse impacts on soil and water
 2. To minimise adverse impacts on stock and wildlife
 3. To prevent erosion and slumping following backfill
 4. To minimise disruption of and to landowners and third parties
-

PIPELAYING AND BACKFILLING – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Planning	- Where backfill is required in contaminated soils (e.g. hazardous chemical disposal sites, potential or known acid sulphate soil areas), appropriate site specific management guidelines shall be developed in consultation with relevant regulatory authorities. - Where a pipeline is planned through problematic soils, temporary and permanent impact management methodologies should be developed.
Pipelaying	Appropriate measures shall be taken to protect the pipe coating from damage when in the trench, such as the use of suitable bedding and padding material (e.g. sand, or screened trench soil, placed around the pipe), the use of protective fabrics or the application of concrete sleeves over the pipe's corrosion prevention coating.
Backfilling	- The period of time between trenching and backfilling shall be minimised as far as possible to prevent erosion of exposed soils, to minimise the likelihood of trench collapse, to minimise risk of heavy rainfall affecting the open trench, to minimise the likelihood of fauna falling in and to minimise inconvenience to third parties such as landowners. - The open trench shall be checked for fauna prior to backfill and any trapped animals must be safely removed.

PIPELAYING AND BACKFILLING

- Subsurface water flows and erosion along the backfilled trench shall be prevented by appropriate means such as trench blocks (i.e. trench/sack breakers) and / or by compaction of backfilled soils.
 - Backfill soils shall be compacted to a level consistent with surrounding soils, with the aim of preventing trench subsidence. During final re-profiling of the pipeline construction area, a low crown of soil mounded over the trench may be necessary to compensate for potential future subsidence.
 - Appropriate measures shall be adopted for managing problem soils, e.g. saline or acid sulphate soils.
 - If fill has to be imported from off-site, it should be certified, where possible, or inspected to ensure it is free of weeds or their seeds. Wherever possible and appropriate, fill should be sourced from as close to the trench as possible.
 - As a precaution in order to prevent damage during future excavation, plastic warning tape, used to alert third parties to the presence of a buried pipeline, may be laid within the trench above the pipeline. Where non-metallic materials are used, the plastic warning tape should have a metallic strip embedded into it to facilitate its future detection.
-



Padding machine returning spoil to the trench. Ecos

6.8 BORROW PITS

Borrow pits, or small quarry sites, may be required during pipeline construction as a source of the following:

- soft earth or sand for pipeline padding during trench backfilling
- road base material for constructing or upgrading roads and access tracks
- rubble material for the construction of above-ground pipeline infrastructure, e.g. hard stands and lined fuel/chemical storage bunding
- rip-rap for stream bank stabilisation.

Where practicable, borrow material will be sourced from existing sites. Larger borrow pits are likely to require additional approvals under State legislation, suggesting that a better alternative may be for borrow to be sourced from existing licenced quarries.

In the event that new source pits are required, they shall be located, operated and restored in accordance with the management measures detailed below.

BORROW PITS

BORROW PITS – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion, sediment release to land and water	Soils Management Drainage, Erosion and Sediment Management
Removal of significant flora and wildlife habitat	Flora Management Fauna Management
Disturbance to heritage sites	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Dust and noise emissions resulting from borrow material excavation and transport	Noise Management Dust & other Air Emissions Management
Potential impacts on visual amenity	Visual Amenity Management
Temporary obstruction of other land uses	Stakeholder code of practice
Proliferation of borrow sites	Drainage, Erosion and Sediment Management
Site rehabilitation	Reinstatement and Rehabilitation
BORROW PITS – ENVIRONMENTAL OBJECTIVES	
1. To minimise clearing or other disturbance of flora	
2. To minimise impacts on fauna	

BORROW PITS

3. To minimise adverse impacts on soil and water
 4. To minimise impacts on cultural and historical heritage
 5. To minimise impacts on visual amenity
 6. To achieve satisfactory rehabilitation
 7. To minimise disruption of and to landowners and third parties
-

BORROW PITS – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Borrow Pit Planning	▪ Borrow pit sites shall be selected in consultation with relevant regulatory authorities and landowners, and the necessary regulatory approvals obtained prior to site work commencing. ▪ Borrow pit number and location should be provided in planning documentation, together with an estimate of the anticipated volume of material required and a rehabilitation plan for each new pit. ▪ Site management plans identifying topsoil, vegetation and spoil storage areas, dimensions of borrow removal area and the locations of access tracks and excavation boundaries shall be prepared prior to commencement of borrow pit operations.
Borrow Pit Operation	▪ Borrow pit operations shall comply with the requirements of relevant licensing and approvals. ▪ Site access shall be designed, constructed, operated and restored in accordance with the guidelines detailed in section 6.1 Access to Site. ▪ Where significant quantities of padding or rubble material are required from a single borrow pit, a progressive shallow strip mining technique should be adopted. ▪ Where any wastes are proposed to be deposited in borrow pits, establish procedures for their selection, treatment and separation, including identification of any additional permits or approval to conduct such burials.
Borrow Pit Rehabilitation	▪ Site rehabilitation shall be undertaken as soon as possible following completion of extraction. Subject to approval from the relevant statutory authorities and at the request of landowners, borrow pits may be left in a condition suitable for appropriate alternative uses, such as water storage dams. ▪ Where strip mining techniques are applied or large pits opened, they shall be progressively restored during extraction operations. ▪ Where required, borrow pits will be suitably remediated in agreement with the landowner and the regulator, with care taken to

BORROW PITS

ensure they do not become waterlogged or filled with extraneous materials.

6.9 CONSTRUCTION CAMPS AND WORKSITES

Pipeline construction involves a wide range of skills and personnel, such as project managers, welders, machinery operators, safety and paramedical staff, supervisors and inspectors, environmental advisors, catering staff, surveyors, field engineers and so on.

The size of a construction workforce varies according to:

- the size of the pipeline project (e.g. a short infield flowline versus a major cross country transmission line divided into several 'construction spreads')
- the nature of the environment traversed (e.g. complexity)
- project timeframe and resourcing
- the required construction techniques (e.g. trenching, trenchless crossings).



Temporary storage of fuel and oils at a yard/campsite. Ecos

Construction workforces on pipeline projects in Australia have ranged in size from about 50 to 1,000 personnel, with 250 personnel being typical for a single spread, medium length pipeline of around 300km. This workforce may be accommodated in hotels, motels and caravan parks in the vicinity of the pipeline route, or alternatively, in temporary construction camps.

Campsites become a preferred option for housing the construction workforce when the project is in an isolated location or where accommodation pressures in the area are high.

Positive outcomes derived from installation of construction camps can include the following:

- Reduction in driver fatigue (reduced travel time to and from site)
- Reduction in traffic levels on and impacts to public roads
- Reduced greenhouse gas emissions from commuting work force
- Reduction in occupancy pressure on other local accommodation options (ie, motels caravan parks, etc)
- Reduction of noise disturbance to residences and sensitive receptors in townships
- Socio-economic benefits from increased demand on local services such as food and fuel
- Economic benefit to landowners on whose land camps are located.

Construction worksites, such as site offices, directional drilling sites, pipe storage areas and machinery and equipment lay down yards will also be required. These sites are generally

treated in a manner similar to campsites and are therefore also addressed in this section. The procedures for the planning, design, cultural heritage clearance, site preparation, operation and rehabilitation of construction camps, worksites and pipe-yards are considered in the following table.

Construction camps and worksites would be established after obtaining all required approvals - including landowner consent, cultural heritage survey and clearing permits. It is important to establish during the planning process whether camps, site buildings or other off-easement developments are considered to be 'miscellaneous activity' under the local planning procedures – and therefore requiring their own approval - or if they are included under an umbrella project planning approval.

CONSTRUCTION CAMPS AND WORKSITES

CONSTRUCTION CAMPS AND WORKSITES – KEY ENVIRONMENTAL ISSUES

Related Sections

Soil erosion, sediment release to land and water

Soils Management
Drainage, Erosion and Sediment Management

Removal of significant flora and wildlife habitat

Flora Management
Fauna Management

Dust and noise emissions

Noise Management
Dust & other Air Emissions Management

Potential impacts on visual amenity

Visual Amenity Management

Temporary obstruction of other land uses

Stakeholder code of practice

Site rehabilitation

Rehabilitation and Reinstatement

Waste Management and disposal

Fuel and Chemical Management
Waste Management

Increased traffic volumes entering and leaving site

Traffic Management

CONSTRUCTION CAMPS AND WORKSITES – ENVIRONMENTAL OBJECTIVES

1. To minimise clearing or other disturbance to flora
 2. To minimise impacts on fauna
 3. To minimise adverse impacts on soil and water
 4. To minimise impacts on cultural and historical heritage
 5. To minimise impacts on visual amenity
 6. To minimise disruption to landowners and third parties
 7. To minimise the area of disturbance
-

CONSTRUCTION CAMPS AND WORKSITES

CONSTRUCTION CAMPS AND WORKSITES – ENVIRONMENTAL MANAGEMENT	
Activity	Management Measures
Site Planning and Design	▪ The necessary planning and other statutory approvals shall be obtained prior to establishing construction camps, laydown areas, pipe-yards or other worksites ▪ Where practicable, sites shall be located close to the pipeline easement and adjacent to pre-existing access tracks or roads, or at existing construction sites (e.g. local work areas) ▪ Sites shall be located so as to avoid disturbance to features of natural, scientific, indigenous or historical heritage significance or to significant agricultural land ▪ Sustainability of operations (inclusion in EMS or other) should be considered, and related to the scale or anticipated lifespan of the camp ▪ Sediment, erosion and drainage controls suitable to the size and scale of the operation shall be implemented
Site Construction	▪ Site access shall be designed, constructed, operated and restored in accordance with the guidelines detailed in Section 6.1 Access to site. ▪ The extent of a site shall be clearly defined on project plans and at the site. ▪ Topsoil should be stockpiled separately during camp construction, and should then be sufficiently protected and conserved so it retains its functioning capability for reuse during eventual camp site rehabilitation.
Site Management	▪ Servicing of machinery and equipment shall be undertaken at a facility that is able to correctly manage waste oils and filters. ▪ Wherever practical, site management should cater for waste stream separation and for waste recycling.
Site Reinstatement and Rehabilitation	▪ Requirements for the restoration of campsites, worksites, laydown areas and pipe-yards shall be determined in consultation with relevant regulatory authorities and landowners. In some instances, landowners and/or regulatory authorities may choose to retain the site in its cleared state for future uses, in which case, partial site rehabilitation may be acceptable.

6.10 WATERCOURSE CROSSINGS

A range of pipeline construction methods are available to facilitate river, stream and other watercourse or drainage line crossings. These include above-ground or aerial options, where the pipeline is suspended across the waterway by existing or purpose-built piles or bridges; by below-ground options achieved through either standard trenching, watercourse flow diversion or the adoption of a suitable trenchless technology.



Temporary vehicle crossing across watercourse. Ecos

The preferred crossing technique should be identified by conducting a comprehensive risk assessment, considering the environmental, social and financial benefits and impacts. Site-specific factors for determining crossing methodology can include safety requirements, hydrology, watercourse substrate and geology, hydrogeology, environmental sensitivities, engineering feasibility, availability of land for suitable pipe launch and retrieval sites and cost.

An important factor in consideration of construction methodology is the efficiency of construction, and often the least environmental impact during the construction of minor watercourse crossings is achieved by open cut trenching techniques - as they can often be completed in a shorter time frame when compared to alternatives.

Some typical crossing methodologies are considered below.

Aerial Crossings are applied intermittently on water pipelines and have been successfully used for hydrocarbon pipelines. This involves strapping the pipeline to existing or purpose built pilings or bridge infrastructure. A key engineering and environmental consideration is the risk associated with the pipeline being exposed to potential floodwaters. Where the risk is unacceptable, other crossing options are considered.

Standard 'Open Cut' Trenching involves in-stream excavation of a trench in the standard manner. Excavators or backhoes are generally used for this technique, enabling trench spoil to be stockpiled away from the stream bed. The prefabricated pipe is placed across the waterway, lowered in and the trench backfilled immediately. This method is often applied in dry or shallow, low flow watercourses, but may also be applied in sensitive watercourses where rapid construction is considered the best means of minimising environmental impacts.

Watercourse Flow Diversion techniques involve construction of temporary dams upstream and downstream of the crossing and the diversion of water around the site, thus creating a dry construction area between the dams. Water flow is maintained by pumping the water around the dammed crossing site (i.e. 'dam and pump') or by diverting the water flow through a flume pipe installed between the dams (i.e. 'fluming'). Both methods have limitations depending

upon site-specific factors such as flow volume, velocity and rate, watercourse profile and substrate permeability. This method is generally applied at crossings where water flow is required to be maintained for ecological, social or engineering reasons.

Horizontal Directional Drilling involves drilling a hole at a shallow angle under the watercourse through which the pipeline is threaded. Directional drilling is a costly technique, which may be used for major river crossings; however it can be limited by geotechnical or physical constraints and its adoption can introduce additional environmental considerations such as management of drilling muds and the positioning and management of drilling pads.

Microtunneling is similar to HDD but can be utilised for much larger pipelines and can be used on longer crossings (please refer to Section 6.6 for more detailed descriptions of trenchless technologies).

WATER COURSE CROSSINGS

WATER COURSE CROSSINGS – KEY ENVIRONMENTAL ISSUES

Related Section(s)

Soil erosion and sedimentation of land and water	Soils Management Drainage, Erosion and Sediment Management
Bank degradation	Soils Management Drainage, Erosion and Sediment Management
Flood events	Water Management Drainage, Erosion and Sediment Management
Impacts on riparian and aquatic flora and fauna	Water Management Drainage, Erosion and Sediment Management
Disturbance to heritage sites	Heritage Management– Natural and Built Environments Aboriginal Cultural Heritage Management
Temporary obstruction of other land users	Stakeholder code of practice

WATERCOURSE CROSSINGS – ENVIRONMENTAL OBJECTIVES

1. To minimise impacts on riparian, aquatic and water-dependent flora and fauna
 2. To minimise impacts on the bed and banks of the watercourse
 3. To minimise erosion and sedimentation impacts
 4. To maintain water quality and water flow requirements
-

WATER COURSE CROSSINGS

5. To minimise impacts on heritage sites
 6. To minimise the impacts from significant rainfall events during crossing construction
 7. To maximise rehabilitation success and restore long term site stability
-

WATERCOURSE CROSSINGS – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Planning and Design	▪ Pipeline alignments shall be selected so as to minimise, where practicable, the number of watercourse crossings. ▪ Open cut crossing locations should take advantage of existing areas of cleared riparian vegetation and should be located away from active erosion channels or bends as far as possible. ▪ Site-specific watercourse crossing techniques shall be determined by the pipeline proponent/contractor in consultation with relevant regulatory authorities and landowners; technology decisions shall be informed by a comprehensive risk assessment that has considered environmental and social impacts and the relative costs of technical alternatives. ▪ For major crossings, hydrological and hydraulic modelling should be undertaken during the initial planning and design stages to determine watercourse characteristics and to inform consideration of technology alternatives. ▪ Hydrology data captured in the planning and design stage, (flow rates, catchment size) shall be used to develop a post-crossing reinstatement plan (rock size, type of erosion control matting, etc). ▪ Where open cut methodology is proposed, survey details of the original contours of water crossings should be incorporated into the “As-Built” documentation to assist in rehabilitation of site. As-built documentation may include details such as top and toe, invert, over bends, sags, bank slopes, watercourse substrata and position of the pipe. ▪ The necessary approvals or permits must be determined during the planning stage, and must be obtained from relevant authorities prior to the commencement of crossing construction. ▪ The need for additional area for sediment and erosion control structures at water crossings should be considered at the planning stage. ▪ Understand surface and groundwater hydraulics to ensure that

WATER COURSE CROSSINGS

design will be appropriately robust to account for future flooding events.

- Where appropriate, monitoring programs - designed and conducted by suitably-qualified personnel - should be implemented, to quantify any effects on riparian, aquatic and water-dependant flora and fauna.
 - Crossings shall be completed as quickly as is reasonably practical in order to minimise impacts.
 - Crossing planners shall remain vigilant regarding seasonality and rainfall events, receiving daily weather reports, evaluating long range forecasts and subscribing to flood warning services where relevant. Planners should also ensure landowners are consulted over the historic behaviour of the waterway in question, and should consider any advice received as a high quality source of information.
 - The storage of fuels, chemicals and lubricants should be as far away as is reasonably practical from any waterway, to reduce the risk of contamination in the event of an accidental spill.
 - All equipment required for the crossing shall be on-site and in good working order prior to work commencing on the crossing.
 - The refuelling or maintenance of equipment, machinery and vehicles should be conducted as far away as is reasonably practical from any waterway, to reduce the risk of contamination in the event of accidental spill.
-

Vehicle Access

- Access tracks/roads shall, where practicable, avoid crossing waterways. Where necessary, watercourse crossings shall be:
 - via existing crossings where possible
 - through the stream bed within the pipeline construction area corridor in accordance with Figure 9. Access shall be limited, where practicable, to vehicles and equipment essential to construction at the site, or
 - via culvert causeways, bridges or other such crossing structures.
-

Clearing at Watercourses

In addition to the guidelines detailed in Section 0 Clearing, the following measures shall be applied:

- Mature vegetation shall be trimmed in preference to felling where possible.
 - Additional workspace may be required adjacent to watercourse crossings for materials laydown, for sediment basins, for stringing of pipe or stockpiling excavated spoil or topsoil. This extra area should be located outside of the riparian zone and in previously cleared or
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WATER COURSE CROSSINGS

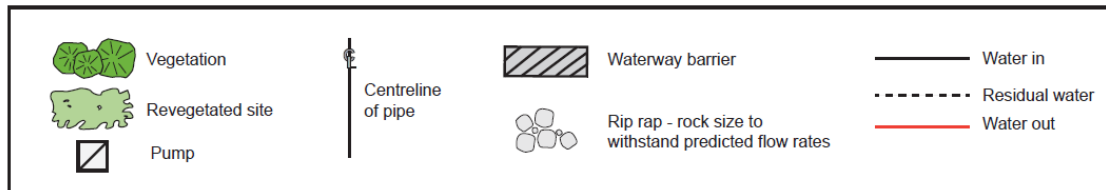
	disturbed areas where possible. ▪ Installation of Erosion and Sediment Control measures as per Section 9.7 Drainage, Erosions and Sediment Control. ▪ Where the stream bed consists of rocks, pebbles or coarse gravel overlaying finer material, this material shall be removed and stockpiled separately and replaced as part of crossing reinstatement.
Pipelaying in Watercourses	▪ The pipe section designated for the crossing shall be fabricated prior to trenching or directional drill completion, to enable rapid installation. ▪ Appropriate measures, such as concrete coated pipe or bolt-on weights, shall be employed to anchor the pipeline in the trench as necessary.
Rehabilitation and Revegetation	In addition to the guidelines in Section 6.12, the following measures shall be applied: ▪ Ensure bed and banks of watercourse are reinstated to pre-existing conditions to facilitate safe passage of fish and other aquatic species. ▪ Banks shall be revegetated to minimise fragmentation of vegetation corridors and to avoid interrupting the movement of fauna. Appropriate species selection is required for the exclusion zone above the buried pipe. • Appropriate stabilisation measures will be required on both the banks and bed of watercourses. Such measures shall be determined on a site-specific basis during the planning stage, and following consideration of site-specific factors such as stream hydrology, soil type, rainfall, vegetation regeneration potential, land use, etc. • Stabilisation measures shall be applied based on site-specific requirements, and are likely to include a selection of the following: ○ restoring watercourse banks to their original profiles. ○ re-spreading topsoil over the area from which it was removed and seeding areas of disturbance. ○ replacing or introducing a surface layer of cobbles, coarse gravel or rock over disturbed areas as rip-rap. Particular care shall be taken to ensure that the material is replaced on the river bed to a depth equivalent to the original conditions and so that it is not likely to act as a barrier to the passage of aquatic fauna. ○ spreading light, stockpiled timber from pipeline construction clearing activities randomly over the pipeline construction area leading down to the watercourse crossing.

WATER COURSE CROSSINGS

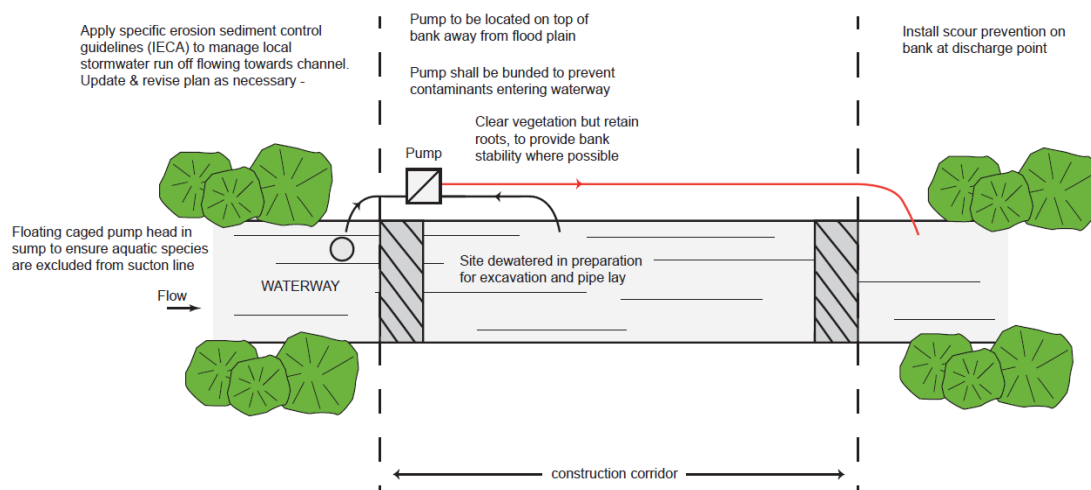
- applying sandbag, gabion or other means of scour protection to conform with existing natural contours, as appropriate, with topsoil then respread over the sandbags or gabions
 - preventing access to sites, through the appropriate deployment of fencing or barriers, to assist site recovery.
 - Additional, site-specific reinstatement measures may include:
 - the installation of terracing and surface water diversion berms along the top and at intermediate points down the bank slope. Run-off from disturbed areas shall be diverted to stable (e.g. vegetated) areas or to settling basins and should not be allowed to flow directly into the watercourse
 - the installation of silt and sediment fences on slopes to filter surface run-off water
 - the reseedling or replanting of disturbed banks
 - the application of stabilising materials such as hydromulch, jute or coir matting or other suitable geotextile materials
 - avoiding vehicle access to rehabilitation areas.
-

FIGURE 9 DIAGRMATIC REPRESENTATION OF A TYPICAL OPEN CUT WATER CROSSING

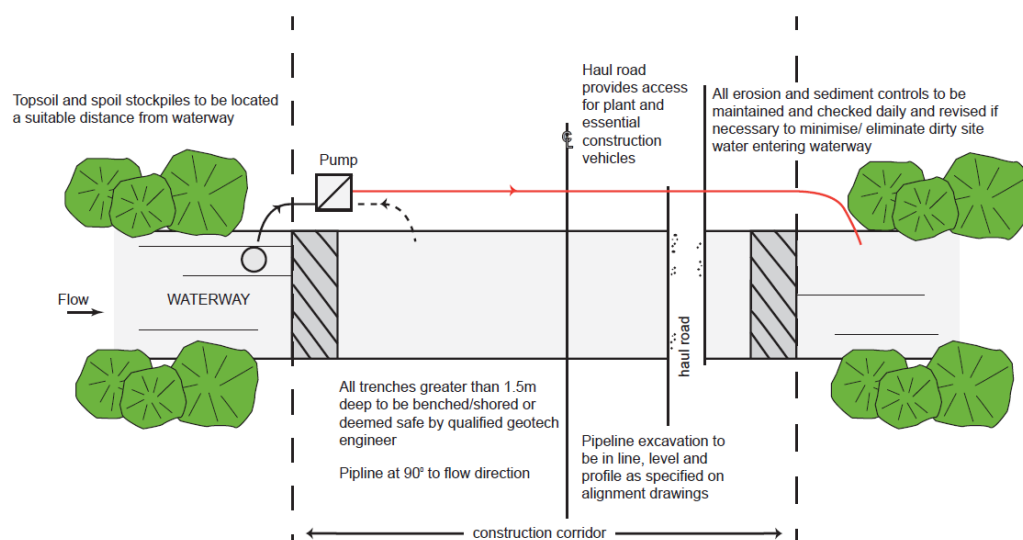
LEGEND

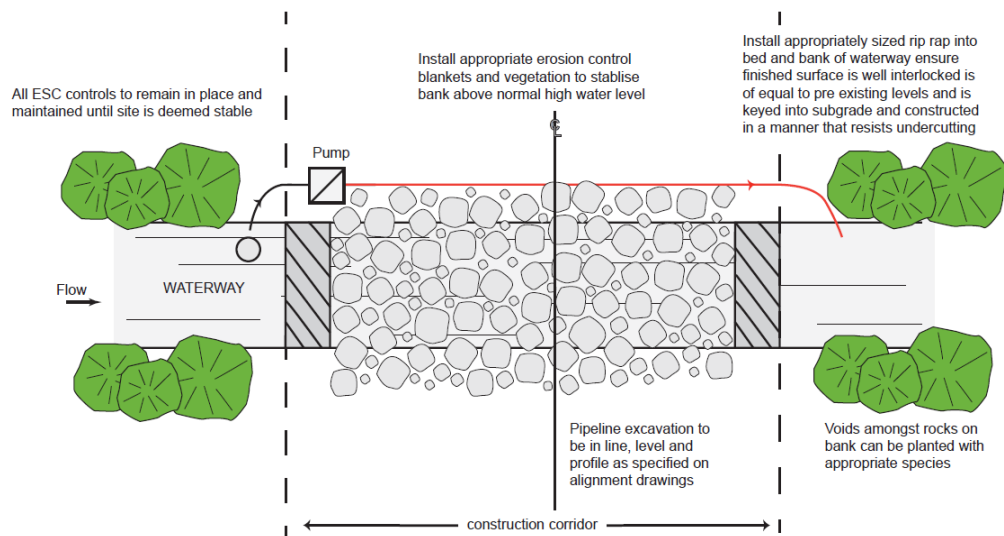
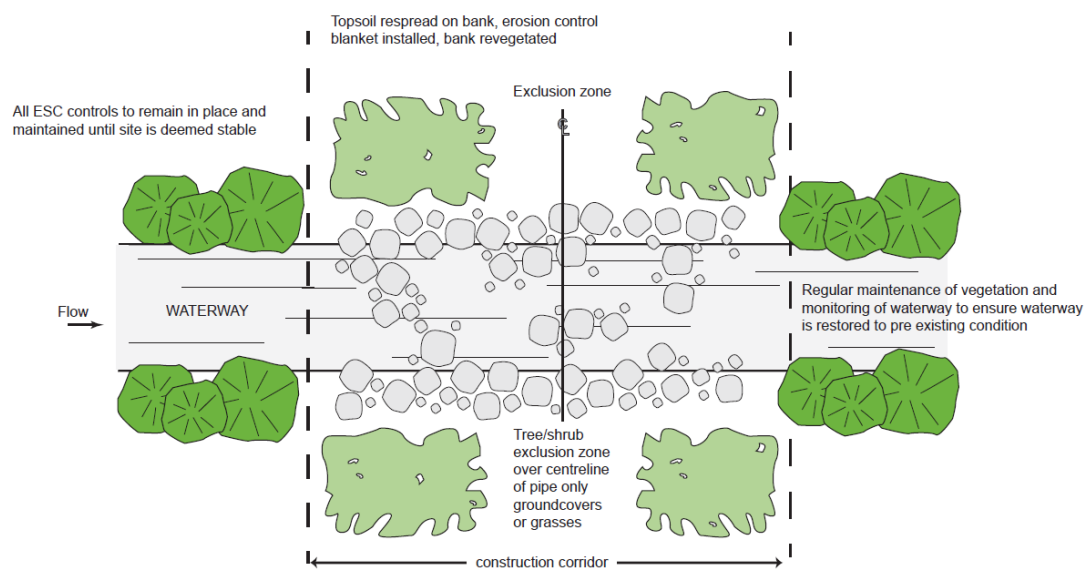


STEP 1



STEP 2



STEP 3**STEP 4**

The potential impacts, advantages and disadvantages of Open cut trenching across a watercourse and Horizontal Directional Drilling under a watercourse are set out in Table 3.

Table 3: Construction potential impacts, advantages and disadvantages for large diameter pipelines

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
Minor Crossings				
Open Cut - Low Banks and Mostly Dry	Soils integrity Sedimentation and erosion Riparian ecosystem integrity	Completed by Mainline crew with shorter timeframe before rehabilitation Economical use of resource Less Noise and Air emissions than HDD alternative Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian vegetation	Bulldozer, excavators, side booms ,padding machine, welding machines, rockbreaker, drill and blast if required, compressor and sandblasting pot, pumps(for possible ground water)
Minor Water Course Crossings with no Water Flow	Soils integrity Sedimentation and erosion Riparian ecosystem integrity	Completed by Mainline crew with shorter timeframe before rehabilitation Economical use of resource Less Noise and Air emissions than HDD alternative Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian veg	
Minor Water Course Crossings with crossing to be constructed by crossing crew	Soils integrity Sedimentation and erosion Riparian ecosystem integrity	Specialist crew for more difficult crossings(depth of feature and amount of earthworks) Economical use	Have equipment working in the crossing May require some clearing of riparian veg	

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
	Aquatic ecosystem integrity Water quality	of resource Less Noise and Air emissions than HDD alternative Maintain access through crossing	Having to divert and or dam water flow and maintain water quality and ecosystems. (Flume or Pump methodologies)	breaker, compressor and sand blasting pot
Major Watercourse Crossings				
Open cut methodology	Soils integrity Sedimentation and erosion Riparian ecosystem integrity Impact on aquatic ecosystems Water quality	More economical than HDD Less Equipment and resource required than for HDD. Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian vegetation. Having to divert or dam water flow and maintain water quality and ecosystems.	As above with additional pumps and compressors for pre-test
Pipe installation by floating method	Soils integrity Sedimentation and erosion Riparian ecosystem integrity Aquatic ecosystem integrity Water quality	Can use where flow through wide feature low. Minimises equipment required for lowering in. Maintain access through crossing	Have equipment working in the crossing May require some clearing of riparian veg. Having to divert or dam water flow and maintain water quality and ecosystems.	As above
Pipe installation by bottom pull method	Soils integrity Sedimentation and erosion Riparian ecosystem	Can use where significant flow through wide feature Minimises equipment	Having to divert or dam water flow and maintain water quality and ecosystems.	As above

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
	integrity Aquatic ecosystem integrity Water quality	required for lowering in Maintain access through crossing		
Horizontal Directional Drilling (large diameter pipes)	Soils integrity Sedimentation and erosion Aquatic ecosystem integrity (Frac-outs) Water quality Drill site sediment control Waste management Noise	Can avoid riparian vegetation and cultural heritage features Minimum disturbance to watercourse if successful Can use for large water flows or volumes	Significant extra clearing required for pipe string. Time frame 3-4 weeks plus to complete. Additional access requirements both sides of crossing. More equipment required to achieve result. Risk of failure of HDD to complete, uncertain outcomes. Possibility of Frac-out and polluting watercourse with Bentonite (difficult to determine in turbid water). Possible coating and pipe damage going unnoticed due to process. Extra earthworks for pipe stringing area Managing treatment and disposal of drilling	Power packs for Directional Drill, mud recycling pumps and screens, mobile crane, excavators, generators, pumps, vibro hammer for installation of sheet piles, side booms for welding of pipe string, compressor and blasting pot, side booms for pipe installation, pumps and compressor for pre-test.

Crossing Method	Potential Constraints	Advantages of the Method	Disadvantages	Equipment Required
			chemicals Very expensive - particularly in consideration of large diameter pipelines compared to other methodologies.	

6.11 PIPELINE TESTING AND COMMISSIONING

Hydrostatic testing is normally undertaken on pipelines at the completion of backfill operations. Water pipelines also require completion of air and scour valves (high point drains and low point drains) for the defined test sections.

Pipeline commissioning can take place after the pipeline has undergone a series of safety and operational tests. Appropriate notification and licencing by the relevant regulatory authority is required prior to a pipeline being commissioned and declared operational.

6.11.1 HYDROSTATIC TESTING

Hydrostatic testing (hydrotesting) involves pressure testing pipelines with water or another suitable test medium, to verify pipeline strength and detect leaks. For gas pipelines, the process involves the temporary installation of test manifolds in sections of the newly constructed pipeline and filling the pipeline with the testing medium; the pipe section is then pressurised, allowing detection of any leaks and weak spots in the test section.

Following hydrostatic testing, the pipeline will require final cleaning, gauging and drying, particularly in the case of hydrocarbon pipelines. This is achieved using air pressure to push cleaning and drying Pipeline Inspection Gauges (PIGs) through the pipeline to remove residual water, welding slag and sediment.



Hydrostatic testing a section of pipeline. Ecos

HYDROSTATIC TESTING

HYDROSTATIC TESTING – KEY ENVIRONMENTAL ISSUES

Related Sections

Potential impacts on aquatic fauna from discharged

Fauna Management

HYDROSTATIC TESTING

hydrotest medium

Modification of water quality	Water Management Drainage, Erosion and Sediment Management
Third party deprivation of water resources	Water Management
Use of chemical additives (e.g. test medium corrosion inhibitors, biocides)	Fuel and Chemical Management Water Management
Test medium disposal	Water Management Waste Management
Soil contamination, erosion and sedimentation from hydrotest medium discharge	Drainage, Erosion and Sediment Management Soils Management

HYDROSTATIC TESTING – ENVIRONMENTAL OBJECTIVES

1. To minimise water use
 2. To minimise impacts on flora and fauna
 3. To maintain water quality in adjacent groundwater or surface water bodies
 4. To minimise impacts on soil
 5. To minimise disruption to landowners and third parties
-

HYDROSTATIC TESTING – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Planning and Design	▪ Hydrotesting operations shall conform to the requirements of relevant legislation and AS/NZS 2885.5². ▪ Prior to the commencement of hydrotesting activities, a hydrostatic testing plan shall be prepared, describing at least the following aspects: ▪ The procedure to be used ▪ Personnel roles and responsibilities ▪ Permits and approvals required ▪ Environmental and social objectives and their fulfilment ▪ Hydrotest medium, its source and quantities required ▪ Any hydrotest medium additives and their management, with

² AS/NZS 2885.5: 2012 *Pipelines – Gas and Liquid Petroleum – Field Pressure Testing*.

HYDROSTATIC TESTING

applicable SDS

- Hydrotest timing and scheduling
 - Hydrotest medium disposal
 - Reporting
 - Consultation with landowners and/or relevant regulatory authorities shall be conducted to determine an acceptable water sourcing and disposal methodology.
-

Hydrostatic Testing

- Holding dams, if required, shall be located, constructed and restored in accordance with the principles outlined for construction work sites - refer to Section 6.9 Construction Camps and Worksites.
 - Measures which prevent hydrotest water discharge resulting in soil erosion or sedimentation of land and water shall be adopted - refer to Section 9.7 Drainage, Erosion and Sediment Management.
 - Potential impacts on other users of the water resource shall be avoided or minimised by maintaining adequate flow rates and water levels or by coordinating water usage to minimise potential interference.
 - The use of environmentally harmful chemical additives in the hydrotest water, such as some corrosion inhibitors and biocides, shall be minimised.
 - Hydrotest water discharge or recycling for secondary uses, such as pasture irrigation or livestock watering, shall only be undertaken in accordance with applicable water quality guidelines.
 - Where practicable, the same test water shall be used for multiple test sections.
-

6.11.2 PIPELINE PURGING

PIPELINE PURGING (GAS)

At the commissioning stage of a gas pipeline, it is necessary to purge the pipeline of air to ensure safe operation and that the initial gas flow can meet the required market specifications. To achieve this, a 'slug' of inert gas such as nitrogen may be pushed through the pipeline by low pressure natural gas.

The air and nitrogen mix is purged out of the system through valve-controlled outlet pipes. This process may result in gas being vented from the pipeline as air is purged, however such gas releases are minimised as far as possible for both environmental and economic reasons.

PIPELINE PURGING (WATER, SLURRY)

To ensure the efficient operation of a water pipeline, air release valves are installed at every high point and scour valves are installed at low points. Air valves can release air from the pipeline during commissioning or allow air in to prevent pipe collapse if a leak or other release from a section of pipe is causing a vacuum. Scour valves are used to allow water to drain from a section of the pipe ahead of repair or for cleaning.

PIPELINE PURGING AND GAS VENTING

PIPELINE PURGING AND GAS VENTING – KEY ENVIRONMENTAL ISSUES

Related Section(s)

Creation of a safety hazard by venting gas	Dust & other Air Emissions Management
Potential release of greenhouse gases	Dust & other Air Emissions Control
Noise associated with gas release	Noise Control

PIPELINE PURGING AND GAS VENTING – ENVIRONMENTAL OBJECTIVES

1. To minimise the creation of safety hazards
 2. To minimise atmospheric emissions
 3. To minimise noise disturbance
 4. To minimise water pollution
 5. To minimise waste and air or water contamination by the products of pipeline purging operations
-

PIPELINE PURGING AND GAS VENTING – ENVIRONMENTAL MANAGEMENT

Activity

Management Measures

Planning - Gas	▪ Gas vents shall be located at an appropriate distance from residential areas and infrastructure, in accordance with relevant regulatory requirements ▪ Purging or venting shall be minimised by using methods that prevent or reduce the mixing of air, inert gas and product gas (e.g. use of a PIG) ▪ Purging or venting gas from the pipeline shall be conducted under meteorological conditions that facilitate rapid atmospheric dispersal of the gas ▪ Adjacent residents shall be advised of the venting operation prior to undertaking the activity
Planning – Non-water / slurry liquid pipelines	▪ See Purging principles and practice (further guidance in Appendix 4).
Planning – Water Slurry	▪ Where possible, air valves and scour valves shall be located in areas where disturbance to existing land or land use is minimised

PIPELINE PURGING AND GAS VENTING

- Effective and suitably-sized scour protection must be in place when actively releasing water from scour valves.
-

6.12 REINSTATEMENT AND REHABILITATION

Reinstatement and rehabilitation are the final major stages in pipeline construction. This section details the standard environmental management considerations for pipeline construction area rehabilitation.

Rehabilitation is the combination of reinstatement and revegetation. Reinstatement is the process of reinstalling or replacing infrastructure and re-establishing pre-construction landforms, while revegetation is the process of replacing vegetation, consistent in species composition and density with the pre-construction state. Revegetation is limited directly over the top of the pipe in order to maintain access and line of sight along the easement, although groundcovers and shrubs should be used. Progressive rehabilitation is standard following pipeline construction, generally commencing as soon as all pipeline infrastructure is in place and continuous access along the easement is no longer required.



Rehabilitated pipeline corridor co-located in a HVTL easement CNC Project Management

REINSTATEMENT AND REHABILITATION

REINSTATEMENT AND REHABILITATION – KEY ENVIRONMENTAL ISSUES

Related Sections

Erosion and sediment control

Soils Management

Drainage, Erosion and Sediment Management

REINSTATEMENT AND REHABILITATION

Reinstatement of habitat components (rocks logs and debris)	Fauna Management
Reinstatement of infrastructure (fences, gates, culverts)	Stakeholder Code of Practice
Revegetation & rehabilitation of construction areas/sites/facilities	Stakeholder Code of Practice Biosecurity Management

REINSTATEMENT AND REHABILITATION – ENVIRONMENTAL OBJECTIVES

1. To minimise soil erosion potential and maximise area stability
 2. To reinstate pre-construction landforms
 3. To restore, repair or otherwise replace fence lines, gateways and other infrastructure disturbed during construction to their pre-existing condition (unless negotiated otherwise with the relevant landowner)
 4. To minimise the potential for sedimentation or acidification of land and water
 5. To minimise modification to drainage patterns
 6. To minimise introduction of weeds, vermin or pathogens
 7. To reinstate and enhance the environment, including wildlife habitat where practical
 8. To minimise negative visual impact and enhance visual amenity
 9. To minimise adverse impacts on land use
 10. To create a pipeline line of sight and provide maintenance access to the pipeline corridor where required.
-

REINSTATEMENT AND REHABILITATION – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Planning	▪ Pre-construction environmental assessments including photographs and GPS references should be undertaken as required - for use as pre-construction baseline information or to identify analogue sites for comparison, post rehabilitation ▪ Rehabilitation plans shall be developed, considering the application of vegetation regeneration and/or revegetation techniques as appropriate ▪ Rehabilitation plans should consider creating a positive visual aesthetic as far as is possible

REINSTATEMENT AND REHABILITATION

	Site-specific rehabilitation plans should be prepared, in consultation with the landowner, referring to pre-existing conditions and outlining proposed rehabilitation methodology and monitoring regimes
Earthworks	- Compaction relief shall be undertaken, as required, by ripping or scarifying soils along the contours - As necessary, the pipeline corridor shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features - Where topsoil has been removed, it shall be respread, or clean topsoil imported where there are insufficient stockpiles. Biosecurity measures shall be applied to imported topsoil - Erosion and sediment control measures shall be installed as necessary to manage the disturbed area whilst revegetation occurs.
Reinstatement	- Third party, stock and wildlife access to newly reinstated areas should be excluded where possible, to allow for establishment of seed and plant stock sufficient for area stabilisation - Third party, stock and wildlife access to above-ground infrastructure, such as valves or scraper stations, shall be controlled by installing barriers (e.g. fencing) - Unauthorised easement access shall be discouraged by installing signs, fences, earth mounds or ditches, or by placing rock piles or previously cleared vegetation as barriers - Flagging used to identify sensitive environmental features (e.g. natural and cultural heritage), shall be removed and disposed of at the completion of construction in order to avoid drawing attention to sites - For gas pipelines, permanent pipeline location markers shall be erected along the easement, in accordance with AS/NZS 2885.3 Operation and Maintenance
Rehabilitation	- Where practicable, and in consultation with the landowner, rehabilitated areas should be fenced, in order to prevent access until site stability is established - Seed stock should be respread or sown in accordance with the rehabilitation plan to assist natural regeneration. Surface roughness is encouraged when spreading topsoil in order to trap water and seeds - Pipeline construction rehabilitation shall use native species that are typical of the surrounding vegetative community for revegetation

REINSTATEMENT AND REHABILITATION

where appropriate. Advantages of this approach include value in creating wildlife corridors, reduction of ecosystem fragmentation, creation of natural habitat and also farm management benefits (e.g. windbreaks, drought resistant shade trees and weed species suppression)

- Line of sight and access shall be maintained along the easement in accordance with AS/NZS 2885.3 Operation and Maintenance
 - Temporary sediment and erosion control measures should be removed from site once sufficient rehabilitation has been established to ensure site stability
-



**Rehabilitation on a large diameter pipeline RoW – CNC
Project Management**

7 PIPELINE OPERATION AND EASEMENT MANAGEMENT

The operation of onshore pipelines involves a range of activities generally undertaken by operations staff and specialist service companies. Common activities include surveillance of the pipeline easement, maintenance of the pipeline, pipeline easement and associated facilities (such as valves, compressor stations, pressure reduction stations and cathodic protection equipment), pigging of the pipeline for cleaning or inspection; and the use and handling of odorants.

Pipelines are widely accepted as a safe and environmentally responsible means for transporting gas and liquids. If pipeline operations are appropriately managed, few environmental issues are likely and those that do eventuate are typically localised and small-scale. Potential impacts that may require preventative action or mitigation measures include:

- soil erosion, sedimentation and subsidence
- disturbance to flora and fauna species and their habitat
- the introduction or spread of weeds and disease
- disruption to access or land use
- altered surface water flow or drainage
- contamination of soil or water
- the production, handling and disposal of wastes
- ignition and spread of fire
- degradation of air quality (dust, odour)
- reduction to amenity (visual and noise)



An operational pipeline corridor.
Ecos

This section provides guidance for the application of minimum acceptable standard environmental management measures to those aspects and activities that are particular to the operation and maintenance of existing pipelines.

In particular, this section aims to assist pipeline operators to achieve the following key environmental objectives:

1. To operate and maintain the pipeline in a safe manner.
2. To manage and maintain the pipeline easement in a manner that minimises potential impacts on the environment, land use and third parties.
3. To conduct maintenance and repair activities in a manner consistent with the minimum acceptable standard for pipeline construction contained in this Code.

7.1 EARTHWORKS

Earthworks may be required for maintenance or construction of additional facilities within the pipeline easement. Minor earthworks may be required in order to maintain access tracks and drainage controls, or to stabilise areas of erosion, and are generally of relatively short duration and minimal depth of excavation. Excavations to expose the pipeline for coating and corrosion repairs, or to protect the pipeline from land subsidence, will result in a greater level of environmental disturbance. Such works are considered to be construction and should be conducted in accordance with Section 6 Environmental Guidelines - Construction.

EARTHWORKS

EARTHWORKS – KEY ENVIRONMENTAL ISSUES	Related Sections
Soil erosion and sediment release	Soils Management Drainage, Erosion and Sediment Management
Interruption to natural surface and groundwater flows	Water Management Drainage, Erosion and Sediment Management
Disturbance to native vegetation and wildlife	Flora Management Fauna Management
Damage to agricultural production or other land uses	Biosecurity Management Stakeholder Code of Practice
Temporary disruption to residents, landowners and third parties	Stakeholder Code of Practice
Introduction of weed species	Biosecurity Management

EARTHWORKS – ENVIRONMENTAL OBJECTIVES

1. To minimise impacts on soil and water and environmental flows
2. To minimise disturbance to native flora and fauna
3. To minimise disruption to residents, landowners and third parties

EARTHWORKS – ENVIRONMENTAL MANAGEMENT

Management Measures

General	▪ Earthworks shall be undertaken in accordance with the principles and guidelines outlined in Section 9. ▪ Prior to commencing earthworks, adequate notification shall be given to the regulator, adjacent landowners and nearby sensitive receptors. ▪ During earthworks, topsoil should be stockpiled separately from

EARTHWORKS

subsoil, and respread over the disturbed area at completion of works in order to aid regeneration.

- During earthworks, erosion and sediment controls should be installed in accordance with IECA best practice sediment and erosion control and should be routinely checked to ensure they are in good condition, and remain stable and effective. Repair works should be undertaken as required.
 - Should earthworks occur in an area with known or potential acid sulphate soils, a scheme needs to be applied to ensure low pH run-off is not generated; as an example, a pH neutralising agent (such as agricultural lime) can be used to neutralise soil during stockpiling or backfilling. It is recommended that an issue-specific management plan outlining ASS management methodology is developed, approved and implemented prior to undertaking the activity.
 - Only clean fill shall be used if additional material is required³. Fill material should preferably be sourced locally and be compatible with the surrounding area. Fill material from off-site needs to be certified as weed-free by a suitably-certified service provider
-

7.2 LAND USE

Pipeline easements generally pass through freehold or leasehold land that is mainly used for other activities. In these situations, agreements have been negotiated with landowners, allowing the landowners continued use of their land whilst the pipeline operator retains a right of access to the pipeline easement to operate and maintain the pipeline and its associated easement - in accordance with the provisions of tenure and the pipeline licence.

LAND USE

LAND USE – KEY ENVIRONMENTAL ISSUES	Related Sections
Disruption of existing land uses	Stakeholder Code of Practice
Disturbance to residents, landowners and third parties	Stakeholder Code of Practice Traffic Management Noise Management Dust & other Air Emissions Management

LAND USE – ENVIRONMENTAL OBJECTIVES

³ See *Australian Standard AS2885.3* section 3.2.4.5.

LAND USE

1. To minimise disruption to existing land uses
 2. To minimise disturbance to residents, landowners and third parties
 3. To maintain appropriate consultation with all relevant landowners
-

LAND USE – ENVIRONMENTAL MANAGEMENT

Management Measures

- Consultation with relevant landowners and regulatory authorities should be undertaken. The APIA Code of Practice for Stakeholder Engagement will provide advice on this activity.
 - Where practicable, operations and maintenance activities should be conducted during appropriate periods, with the landowner consulted over the schedule and with consideration given to land use activities, including livestock and crops, in order to reduce potential adverse effects.
-

7.3 MANAGEMENT OF PIPELINE FACILITIES

Pipelines are managed above-ground through the installation of facilities. Above-ground facilities associated with pipeline operations can include compressor stations, pressure reduction stations, mainline valves, delivery facilities, scraper stations and instrumentation.

Permanent buildings may be constructed at major facilities, such as compressor stations, but

the majority of facilities are controlled remotely.

The high-pressure equipment located within above-ground facilities may create issues associated with noise, gas leaks, security, visual impacts and fire risk. Operational activities, maintenance and surveillance related to above-ground facilities should be detailed in the Safety and Operating Plan⁴, OEMP or equivalent approved plan.

Above-ground facilities associated with water and slurry pipeline operations include balance tanks, storages, pump stations and water treatment plant. Balance tanks are large permanent structures located on high ground. Larger water storages are often contained within lined reservoirs adjacent to pump stations; pump stations and water treatment equipment are generally housed within permanent buildings.



A mainline valve. W. Mathieson

⁴ See Australian Standard AS2885.3 section 3.3.

PIPELINE FACILITIES	
PIPELINE FACILITIES – KEY ENVIRONMENTAL ISSUES	Related Sections
Safety hazards resulting from increased traffic	Traffic Management
Bushfire and internal fire risk	Fire Prevention Management
Noise disturbance to sensitive receptors, other land users, stock and wildlife	Noise Management
Reduction of visual amenity	Visual Amenity Management
PIPELINE FACILITIES – ENVIRONMENTAL OBJECTIVES	
1. To eliminate unacceptable safety hazards 2. To minimise the risk of bushfire 3. To minimise the impact of noise, visibility, odour and traffic on the local community	
PIPELINE FACILITIES – ENVIRONMENTAL MANAGEMENT	
Management Measures	
Planning	▪ Where practicable, pipeline facility sites shall be located remote from populated areas and sensitive receptors. Relevant landowners are to be consulted regarding the location of above-ground facilities. Visual impact mitigations from pipeline facilities outlined in Section 9.12 Visual Amenity Management should be considered and adopted where necessary. ▪ Facility sites should be securely fenced and locked to prevent entry by unauthorised persons.
Operational Management	▪ Potential odour issues should be managed in accordance with Section 9.11 Dust and other Air Emissions Management and compliant with applicable legislation, conditions and standards. ▪ Fire prevention methods outlined in Section 9.15 Fire Prevention Management should be implemented in accordance with a site-specific risk assessment and in compliance with legislation, conditions and standards. ▪ Pipeline facilities will be maintained in a clean and tidy condition. This includes maintenance of any screening around pipeline facilities. ▪ Noise emissions from pipeline facilities should be managed in accordance with Section 9.10 Noise Management and compliant with applicable legislation, conditions and standards.

7.4 SAFETY AND EMERGENCY PLANNING

Safety and emergency response have both social and environmental implications and for this reason they are often considered during the approvals process. AS 2885 and AS/NZS ISO 31000 provide guidance on the conduct of a safety risk assessment and subsequent development of a Safety Management Plan (SMP); AS 2885 is particularly focused on high pressure gas and liquid petroleum pipelines but can still be applied to water and other high pressure pipelines, while AS/NZS 31000 is applicable to all pipelines.

SMPs should be developed for pipeline construction and operation; they should incorporate the findings of an AS 2885-based risk assessment process, and need to be in place prior to the commencement of the respective construction or operation. The SMPs should address all relevant safety issues, outlining appropriate incident prevention and response measures. A key component of the SMPs will be steps to be taken in response to emergencies, such as a spill or fire, giving consideration to both safety and environmental issues.

In addition to predictable construction and operational risks, the risk assessments for SMPs should include consideration of 'low likelihood / high consequence' risks, such as sabotage or terrorism and the risk of disruption to supply where a region relies on the production or supply of oil or gas, or the supply of basic human needs such as water.

7.5 PIPELINE SURVEILLANCE

Pipeline surveillance is an essential activity in the operation of every pipeline, and is covered in AS2885.3. Any surveillance activity requiring land access must be undertaken in consultation with the landowner, and with due attention to appropriate biosecurity procedures. Pipeline surveillance activities are likely to involve the following tasks:

- looking for any 3rd party activity on, or immediately adjacent to, the easement
- checking infrastructure condition and identifying maintenance requirements (access tracks, easement signage, fencing, gates)
- checking for evidence of erosion, washouts or land subsidence
- identifying any areas of pipeline exposure (after significant rainfall/flooding event or similar)
- assessment of vegetation cover on the easement (establishing the requirement for easement maintenance or checking rehabilitation of sites)
- monitoring for weed infestation
- monitoring the condition of watercourse crossings
- monitoring for disturbance to protected ecological or heritage sites
- monitoring for indications of leaks or spills
- monitoring for the presence of refuse or litter.

7.6 PIPELINE FAILURE AND RESPONSE

Pipelines carrying liquids such as oil, condensate or chemicals have the potential to impact on public safety and the environment in the event of pipeline failure. Pipelines are designed and operated in accordance with AS2885 to minimise the chance of such failures. Operational activities on any pipeline (gas or liquid) can lead to spills such as fuels and oils from plant and equipment, spills of chemicals in storage compounds or spills of contaminated water (such as from water bath heaters). Spill Prevention and Response Plans should be prepared as part of the SMPs for all pipelines. This section deals with general operational procedures that must be in place to minimise the risk and consequence of a liquid spill.

SPILL PREVENTION AND RESPONSE

SPILL PREVENTION AND RESPONSE – KEY ENVIRONMENTAL ISSUES	Related Sections
Safety hazards to the workforce and the public	Traffic Management
Contamination of soil and water including groundwater	Fuel and Chemical Management Water Management Drainage, Erosion and Sediment Management Soils Management
Damage to or death of flora and fauna	Flora Management Fauna Management

SPILL PREVENTION AND RESPONSE – ENVIRONMENTAL OBJECTIVES

1. To reduce the risk of a spill to as low as is reasonably practical
 2. To prevent contamination of soil and water
 3. To prevent the direct and indirect impacts on vegetation communities, fauna and fauna habitats
-

SPILL PREVENTION AND RESPONSE – ENVIRONMENTAL MANAGEMENT MEASURES

Management Measures

Planning	▪ Pipelines shall be designed and operated in accordance with AS 2885 and this Code. ▪ Pipelines shall be designed to limit the volume of material released in the case of a spill, particularly in sensitive areas. ▪ Detailed Spill Prevention and Response Plans shall be developed as part of the emergency response planning for all operational pipelines. ▪ Spill Prevention and Response Plans shall address:

SPILL PREVENTION AND RESPONSE

- monitoring and detection systems
 - notification and reporting procedures (both internal and external)
 - call-out procedures; contact lists and incident investigation procedures
 - operator response actions required to halt the spill (i.e. control of pumps, valves, etc.)
 - spill containment and materials recovery procedures
 - reinstatement and rehabilitation procedures
 - requirements for safe and legal disposal of contaminated soil, clean up material, etc
 - environmental impact assessment
 - personnel responsibilities
 - traffic management
 - equipment requirements, location, storage, maintenance and transport
 - communications and logistics
 - incident reporting and plan review / revision (recommended every two years)
 - Spill response procedures shall comply with all relevant regulatory requirements.
 - Workforce training shall be conducted in spill response and recovery procedures.
 - Spill response drills shall be regularly conducted for operational pipelines.
-

8 DECOMMISSIONING ACTIVITIES

Decommissioning of pipelines requires careful assessment of the economic, risk, social and environmental situation and close communication with regulators and other stakeholders.

This section provides guidance on the minimum acceptable environmental management standard to be adopted once the decision to decommission has been taken..

This section can be used as a reference when preparing pipeline Safety and Operating Plans, Operations Manuals or Environmental Management Plans.

Reference should be made to *AS 2885 Pipelines – Gas and liquid petroleum*, in particular AS 2885.3, for specific guidance on abandonment of pipelines.

8.1 DECOMMISSIONING PREPARATION

The decommissioning program should be supported by a suitable study which addresses any potential effect on the environment and other uses / users of the easement. The process of risk assessment should be carried out in accordance with Section 4 of this code. The methodology applied to pipeline decommissioning should be considered on a case-by-case basis.

The following aspects should be considered when considering decommissioning methodology:

- the potential reuse options
- age and length of the pipeline
- the nature of the environment in which the pipeline is located
- any other issues relevant to the particular pipeline.

Early planning for decommissioning is essential in order to determine regulatory requirements for each case. Planning will also involve setting out the strategy, philosophy, goals and objectives for the decommissioning process. It is recognised that commercial considerations, such as whether there is any future use for the pipeline or the cost of removal versus the cost of abandonment, can be a key determining factor in planning a decommissioning strategy, but planning in fact involves consideration of five assessment criteria:

- regulatory requirements
- technical feasibility
- environmental and social factors
- safety
- cost.

DECOMMISSIONING PREPARATION

DECOMMISSIONING PREPARATION – KEY ENVIRONMENTAL ISSUES

Related Section(s)

Impact on flora and fauna	Flora Management Fauna Management
Impact on soil and water quality	Water Management Drainage, Erosion and Sediment Management
Waste management and disposal	Waste Management
Impact on landowners and other stakeholders	Traffic Management Noise Management Dust and Other Air Emissions Management Stakeholder Code of Practice

PREPARATION – ENVIRONMENTAL OBJECTIVES

1. To undertake pipeline decommissioning works in a manner that is consistent with AS 2885
 2. To comply with obligations under the operational pipeline licence and any other regulatory conditions
 3. To decommission the pipeline in a manner that minimises potential impacts on the environment, land use and third parties
 4. To include detailed assessment of the environmental and social aspects of decommissioning in the decommissioning planning process
 5. To develop and implement a safety management plan for the pipeline decommissioning, that includes measures to minimise the risk to the environment, stakeholders and decommissioning personnel
 6. To include assessment of the environmental, safety and social impacts of all options prior to determining the disposal strategy for product, pipe waste and facility components
 7. To consider all feasible recycling alternatives when disposing of a facility
 8. To clarify issues of residual environmental liability as part of the decommissioning strategy development process and before licence relinquishment
-

PREPARATION – ENVIRONMENTAL MANAGEMENT

Management Measures

DECOMMISSIONING PREPARATION

Strategy Option	▪ The decommissioning strategy must be identified. ▪ Decommissioning objectives shall be set and procedures identified. ▪ A planning assessment shall be conducted. ▪ Social/community implications shall be considered when decommissioning.
Technical	▪ Planning shall include a description of the pipeline and associated equipment to be decommissioned, including lengths, diameters and type of construction. ▪ Planning will incorporate technical and engineering aspects of the decommissioning process, including opportunities for re-use and recycling and documentation of the potential impacts associated with cleaning, or removing chemicals from the pipeline. ▪ Planning shall involve assessment of the timing of the decommissioning. ▪ Planning shall involve assessment of safety considerations associated with capping, removal and disposal of above-ground infrastructure. ▪ Planning shall involve identification of critical areas where subsidence of an abandoned pipeline cannot be tolerated (e.g. crossings). ▪ Technical consideration shall be given to pipeline structural integrity and structural condition, the state of the easement, and the establishment of the sequence of dismantling.
Existing Easement Condition	▪ Assessment will be made during planning on the current condition and status of the pipeline, including the extent of burial, trenching and details of any materials used to cover the pipeline, in order to determine potential environmental impacts associated with decommissioning. ▪ Operational and monitoring data and history shall be reviewed.
Environment and Stakeholders	▪ Impacts on the environment and landowners, including exposure of the environment to pipeline-related contaminants, shall be assessed in the development of the decommissioning strategy. ▪ The risk and nature of impacts on other environmental aspects, including emissions to the atmosphere, leaching to groundwater, discharges to surface water and effects on the soil, shall be reviewed. ▪ Consumption of natural resources and energy associated with re-use or recycling shall be reviewed. ▪ Impacts on amenities, future land use options, the activities of the

DECOMMISSIONING PREPARATION

surrounding community and on the environment shall be assessed.

8.2 PRODUCT REMOVAL AND PIPE CLEANING

Onsite decommissioning commences with product removal and pipeline cleaning. Decommissioning water pipelines requires the pipe or section of pipe to be hydrostatically tested in accordance with the test requirements detailed in the WSAA Water Supply Code of Australia and other relevant state supplementary documentation. Decommissioning gas pipelines requires that the hydrocarbon product is purged from the line and the pipe cleaned using the most appropriate method over a series of stages. Likely stages include injecting inert substance such as nitrogen, flushing with water, and use of foam or brush PIGs to clean the pipeline.

PRODUCT REMOVAL AND PIPE CLEANING

PRODUCT REMOVAL AND PIPE CLEANING – KEY ENVIRONMENTAL ISSUES	Related Section(s)
Potential impact on surface and ground water quality	Water Management
Potential soil contamination	Soils Management
Potential impact on flora and fauna	Flora Management Fauna Management
Release of air pollutants	Dust and Other Air Emissions Management
Waste management and disposal	Waste Management
Temporary disruption to landowners and third parties	Stakeholder Code of Practice

PRODUCT REMOVAL AND PIPE CLEANING – ENVIRONMENTAL OBJECTIVES

1. To prevent impact on surface and ground water
2. To prevent soil contamination
3. To minimise impact on flora and fauna
4. To minimise waste and dispose of appropriately
5. To minimise disruptions to landowners and third parties

PRODUCT REMOVAL AND PIPE CLEANING – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
	▪ Site preparation and management requirements shall be implemented in accordance with developed and approved

PRODUCT REMOVAL AND PIPE CLEANING

	Decommissioning Strategy.
	▪ If the pipeline is to be abandoned, an Abandonment Plan, development in accordance with AS 2885 (s.8.10) shall be developed ▪ The equipment must be made safe by removing or making safe harmful substances.
Planning	▪ Hydrocarbon gases shall typically be disposed to fuel gas or flare systems.
Depressurising	▪ As systems become depressurised, the pipeline may then be isolated by valving and subsequent blanking.
Venting	▪ Where flammable or other harmful materials are to be vented, the point(s) for release should be located in order to preclude any likelihood of ignition, under suitable meteorological conditions and away from residential and environmentally-sensitive areas. ▪ Prolonged or significant venting activities should be undertaken in consultation with the appropriate regulatory agencies.
Draining	▪ Prior to equipment being isolated, it is essential that facilities are drained as much as possible via fitted drain points. ▪ Adequately sized drain lines should be installed at the lowest points and sized in accordance with operating engineering practices. ▪ All equipment must be cleaned and purged before connections can be cut ready for disconnection and/or removal. ▪ The extent of the cleaning activity depends upon the state of the equipment and the type of contaminants present.
Purging and Flushing	▪ Pipe-work can be flushed or purged using steam, water or inert gas. For many applications, water is used as the primary pipe cleaning method. ▪ Pipelines can be cleaned using a process called progressive pigging, where a series of cleaning PIGs is pushed through the pipeline with chemical cleaning agents and flush water to remove all hydrocarbons and other contaminants. ▪ If water is used for cleaning, water supply and disposal will be undertaken in accordance with regulations and managed in accordance with the procedures in the approved Decommissioning Strategy. ▪ Management of waste water shall be in accordance with Section 9 Environmental Guidelines: Issues and Best Practice Management. ▪ No water will be returned directly to watercourses without appropriate approvals.

PRODUCT REMOVAL AND PIPE CLEANING

- Water shall be tested for hydrocarbon and chemical residue prior to disposal.
- Where contaminant level exceeds release conditions, flush water shall be disposed of at an approved waste facility or otherwise re-treated to meet acceptable levels.
- Discharging water into the environment shall be undertaken in a manner that prevents localised effects, including erosion and sediment transport, and in consultation with any affected landowners.

Rehabilitation and Monitoring

- All pipelines which are partially or wholly left in situ should be inspected and thoroughly cleaned internally to ensure that all contaminants are removed.
 - Consideration should be given to filling the pipeline with cement slurry or other appropriate material to prevent the pipeline acting as a water conduit, or collapsing to cause surface subsidence.
 - Consideration should be given to maintenance or upgrade of the cathodic protection system in order to prevent pipeline collapse.
 - In the event that cathodic protection is maintained, the responsibility for ownership is to remain with the pipeline operator and appropriate records kept.
 - At the completion of the post-abandonment monitoring period, all signage associated with the pipeline should be removed
 - At completion of the abandonment process, location drawings, noting the pipeline status and complying with AS 100.401 shall be prepared and made available to the regulator and to affected landowners
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8.3 REMOVAL OF PIPELINE

Usually abandoning buried pipelines *in situ* is environmentally preferable to pipeline removal as a decommissioning strategy, due mainly to the disturbance associated with the excavation and removal of the pipeline.

REMOVAL OF PIPELINE

REMOVAL OF PIPELINE – KEY ENVIRONMENTAL ISSUES

Related Section(s)

Potential impact on surface and ground water quality

Water Management

Potential soil contamination

Soils Management

REMOVAL OF PIPELINE	
Potential soil erosion	Soils Management
Potential impact on flora and fauna	Flora Management Fauna Management
Potential impact on heritage	Heritage Management – Natural and Built Environments Aboriginal Cultural Heritage Management
Waste management and disposal	Waste Management
Temporary disruption to landowners and third parties	Stakeholder Code of Practice
REMOVAL OF PIPELINE – ENVIRONMENTAL OBJECTIVES	
	1. To undertake pipeline corridor remediation works in a manner that is consistent with AS 2885 2. To prevent impact on surface and ground water 3. To prevent soil contamination 4. To prevent soil erosion 5. To minimise impact on flora and fauna 6. To minimise waste and to dispose of waste appropriately 7. To minimise disruptions to landowners and third parties 8. To minimise visual impact of the easement, site locations and access tracks by undertaking appropriate rehabilitation 9. To decommission the pipeline corridor in a manner that minimises potential impacts on the environment, land use and third parties
REMOVAL OF PIPELINE – ENVIRONMENTAL MANAGEMENT	
Activity	Management Measures
Excavation	▪ The width of vegetation clearance shall be minimised to the safest practical width. ▪ Cleared vegetation shall be stockpiled for re-spreading during rehabilitation. ▪ Topsoil shall be stripped and stockpiled for re-spreading during rehabilitation. ▪ Trench subsoil and pipeline padding material shall be stockpiled separately from vegetation and topsoil.
Removal of Pipe	▪ The recovered pipe will be dismantled and segments either salvaged for reuse or disposed of as scrap, depending on its condition, relative costs, demand, etc.

REMOVAL OF PIPELINE

Reinstatement	▪ Stockpiled trench subsoil and padding material shall be returned to the excavation ▪ Additional fill will be required, to replace the volume previously occupied by the pipe: any imported fill should be certified as weed free by a certified service provider prior to importation to the site ▪ Stockpiled topsoil and cleared vegetation should be re-spread over the excavation and re-profiled to a stable form ▪ Rehabilitation aids such as berms, gabions, rock dams, etc, should be installed as required to ensure ongoing stability of the reinstated area, as described in Section 6.

8.4 REMOVAL OF ABOVE-GROUND INFRASTRUCTURE

The overall objective is to leave the easement in a condition that is as near as practical to pre-existing environmental conditions and decommission the pipeline in a manner that minimises potential impacts to the environment, land use and third parties. All above-ground pipe and supports along the pipeline should be cut-off at a minimum depth of 750mm below the natural surface, or at pipeline depth as determined by AS 2885.3, removed and blanked off below the surface. All above-ground signs and markers above the pipeline should be removed. If the cathodic protection system is being abandoned, all above-ground elements should be removed, and anode and earthing beds are to be disconnected at 600mm below the natural surface level (refer to AS 2885.3 and Section 7.3).

REMOVAL OF ABOVE-GROUND INFRASTRUCTURE

REMOVAL OF ABOVE-GROUND INFRASTRUCTURE – KEY ENVIRONMENTAL ISSUE	Related Section(s)
Potential impact on surface and ground water quality	Water Management
Potential soil contamination	Soils Management
Potential impact on flora and fauna	Flora Management Fauna Management
Waste management and disposal	Waste Management
Temporary disruption to landowners and third parties	Stakeholder Code of Practice
Visual amenity	Visual Amenity Management

REMOVAL OF ABOVE-GROUND INFRASTRUCTURE – ENVIRONMENTAL OBJECTIVES

REMOVAL OF ABOVE-GROUND INFRASTRUCTURE

1. To undertake pipeline corridor remediation works in a manner that is consistent with AS 2885
 2. To prevent impacts to surface and ground water
 3. To prevent soil contamination
 4. To prevent soil erosion
 5. To minimise impacts to flora and fauna
 6. To minimise waste and dispose appropriately
 7. To minimise disruptions to landowners and third parties
 8. To minimise the remaining visual impact of the easement, site locations and access tracks, by undertaking appropriate rehabilitation
-

REMOVAL OF ABOVE-GROUND INFRASTRUCTURE – ENVIRONMENTAL MANAGEMENT

Activity	Management Measures
Well Head Pipework	▪ Well manifolds shall be abandoned using methods that will protect groundwater resources. ▪ Wells shall be permanently plugged or abandoned, or may be re-configured for other purposes, such as for groundwater monitoring, all in accordance with the applicable regulatory requirements and in consultation with the affected landowner. ▪ Well pads shall be removed and any hydrocarbon-contaminated soil disposed of in accordance with regulatory requirements.
Other Infrastructure	▪ Re-use of buildings in good condition shall be considered. ▪ Where buildings are to be demolished, this shall be undertaken in accordance with regulatory requirements. ▪ Recovered pipe, the power plants, generators, compressor station equipment, mainline valves and other ancillary infrastructure that is part of the pipeline designed under AS 2885 will be dismantled and either salvaged for reuse or disposed of as scrap, depending on its condition, relative costs, demand, etc.

9 ENVIRONMENTAL GUIDELINES – KEY ENVIRONMENTAL ASPECTS, ISSUES AND MINIMUM STANDARD OF MANAGEMENT

Environmental Management of onshore pipeline construction, operation and decommissioning involves a range of specialist tasks, which are generally undertaken by pipeline construction companies and specialist service companies, and occur in a defined corridor.

This section outlines the key environmental aspects associated with construction, maintenance and decommissioning of onshore pipelines in Australia. For each key aspect, associated activities and issues have been defined and the minimum standard of management identified. These management standards have been developed after consideration of current practice, the applicable national codes and standards and safety, environmental, engineering and economic objectives.

These minimum standards may be directly applied to a company's operations, or as a basis for the development of project- or company-specific environmental procedures. Additional site-specific guidelines may be required to address issues unique to a particular pipeline or location. Site-specific guidelines may be captured in an environmental "line list", which identifies sites with specific environmental management requirements by position along the pipeline.

No matter what aspects of design, construction, operation or decommissioning have been contracted to other parties, ultimate environmental responsibility lies with the pipeline licensee. **It is therefore imperative that the licensee has a sufficiently resourced management system in place which ensures performance and compliance with licence obligations.**

Section 9 is divided into the following Key Aspects:

- Flora Management
- Fauna Management
- Biosecurity Management
- Heritage Management
- Aboriginal Cultural Heritage Management
- Soils Management
- Drainage, Erosion and Sedimentation Management
- Water Management
- Waste Management
- Noise Management
- Dust and Air Emissions Management
- Traffic Management
- Fuel and Chemical Management
- Fire Prevention Management

For the purposes of this section, the principle focus is on the management of Key Aspects during the Planning, Construction and Operational phases of the pipeline lifecycle. It is assumed that the Decommissioning phase of any onshore pipeline will be subject to its own planning process which should be consistent with the guidance and provisions presented in this section, Section 8 and with relevant aspects of AS 2885.3.

9.1 FLORA MANAGEMENT

An essential part of the environmental management of onshore pipeline is gaining a detailed understanding of flora species and ecological communities affected by the project.

To facilitate adequate flora management, it is recommended that the following tasks are undertaken as a minimum prior to commencement of any ground disturbance activity:

- Review of available literature and databases
- Conduct field investigations to assess presence, location and condition of flora species and communities, with an emphasis on the presence of listed species, but also noting weed or invasive species
- Undertake impact assessment to determine the likely effects of a project on terrestrial and aquatic vegetation
- Identify requirements for and develop appropriate management principles and measures, including those listed in this section.

FLORA MANAGEMENT

FLORA MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Reduced vegetation cover leading to:
 - erosion and sedimentation
 - loss of agricultural productivity
 - disruption of native fauna movement along migratory pathways
 - loss of visual amenity
 - Disturbance to existing vegetation, especially listed species
 - Excessive vegetation regrowth
 - Establishment of weed and invasive species
-

FLORA MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To minimise threat to native flora, particularly listed species, assemblages or ecosystems
 2. To prevent the introduction or spread of pest species.
 3. To prevent the introduction or spread of invasive weed species
 4. To promote and maintain stable vegetation cover
-

FLORA MANAGEMENT

5. To avoid loss of agricultural production or soil productivity
6. To minimise soil erosion and sedimentation

FLORA MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measure
Planning	Pipeline Easement Management and Access	Use existing roads, tracks and areas of disturbance as the first option. New access tracks and roads should be designed and constructed to avoid or minimise impacts on flora.
	Clearing vegetation	- Pruning or removal of protected vegetation must only occur in accordance with the requirements of the relevant state legislation. - Necessary pruning / clearing approvals must be in place before starting clearing activities. - Prior to clearing and subject to regulatory permitting and seasonality, a program of local native seed collection for use in rehabilitation of the RoW is strongly encouraged. - Prior to clearing and subject to regulatory permitting and seasonality, a program of translocation of vegetation potentially suitable for use in RoW rehabilitation should be considered. - Management of cleared vegetation shall be undertaken in a manner approved by the regulator and in accordance with landowners' requirements. - Works shall be scheduled so that the time between initial clearing and rehabilitation is minimal.
	Reinstatement and Rehabilitation	- Rehabilitation planning should be site- and/or property-specific, and undertaken in consultation with the regulator and the affected landowner. - Appropriate rehabilitation measures should be planned (e.g species selection, erosion/ sediment control devices, re-use of cleared / translocated species) to optimise potential for regrowth and stabilisation success.

FLORA MANAGEMENT

	Borrow Pits	Proposed borrow pit sites shall be assessed for potential environmental impacts relative to flora, fauna, landform and heritage.
	Construction camps and worksites	- Vegetation clearance should be minimised as far as practicable, with cleared vegetation being stockpiled separately, if required for re-spreading during reinstatement. - Trees and tall shrubs should be retained on site, where practicable, and infrastructure arranged to avoid them, in accordance with AS 4970.
Construction	Pipeline Easement Management and Access	- Utilise provisions in Section 6.1. - Vehicle parking shall be restricted to the pipeline construction corridor, easement or other specifically designated areas agreed in advance with the landowner. - As parking under trees can damage their roots through soil compaction and can impair water infiltration into the soil, it should be discouraged. - On completion of pipeline construction, temporary access tracks shall be closed and rehabilitated to a condition compatible with the surrounding land use, and as pre-agreed with the affected landowner. - Pre-existing tracks used for access during construction shall be reinstated to their pre-construction condition, or as otherwise agreed with the relevant landowner.
	Clearing	- The removal or disturbance of vegetation outside of the access tracks, the agreed / approved additional work areas and the pipeline RoW is not permitted unless additional regulatory and landowner approvals are obtained. - Avoid disturbing roots or unnecessarily compacting soil in the drip zone of vegetation to be retained. - A record should be maintained of the vegetation type and area cleared for the project (including for operations and maintenance) as part of the associated offsetting program, as appropriate. - Cleared vegetation shall be stockpiled separately in a

FLORA MANAGEMENT

		manner which: ○ facilitates re-spreading or salvaging - refer to Section 6.12 Reinstatement and Rehabilitation ○ avoids damage to adjacent live vegetation (e.g. trees shall be felled onto the easement away from standing timber). • Cleared vegetation shall be stockpiled in windrows adjacent to temporary access, for re-spreading during reinstatement, or managed in accordance with measures detailed in Section 6.13 Reinstatement and Rehabilitation. • Cleared vegetation management options include (but are not limited to): ○ re-distribution over the pipeline construction area during rehabilitation to recycle nutrients and to provide surface protection from erosion or access barriers. ○ salvage in consultation with the relevant land management agency (e.g. timber, pulp wood or firewood). ○ stockpiling for use at other rehabilitation sites if suitable. ○ retention on site as habitat.
	Reinstatement and Rehabilitation	• Rehabilitation should be monitored regularly, with any maintenance being undertaken in accordance with Section 6.13 Reinstatement and Rehabilitation. • Flagging or marking tape used to identify sensitive environmental or cultural heritage features, shall be removed and correctly disposed of at the completion of construction. • A watering regime should be determined for newly reinstated areas, to facilitate optimum germination of seed stock in the absence of rain. • In sensitive areas, supplementary planting of native vegetation that is consistent with the surrounding vegetation class/regional ecosystem should be considered as a stabilisation measure and to facilitate rehabilitation. Seed collected off the RoW

FLORA MANAGEMENT

		pre-clearing should be used in preference to imported seed. • Re-spreading stockpiled vegetation over the pipeline construction area and other disturbed areas enhances regeneration potential. • Consideration should be given on a site-specific basis to the use of mulch - which can improve soil nutrients; provide fauna habitat, improved soil structure and improved conservation of water; can, reduce erosion potential, trap water and seeds, provide weed control and reduce visual impacts. • Where seeding is adopted to facilitate prompt revegetation and soil stabilisation, the following principles shall be considered: ○ seed mixtures shall be formulated with consideration of the vegetation composition of the areas adjacent to the pipeline construction area ○ where approved, practicable and seasonal, native seed should be collected or sourced in the local area ○ sterile seed stock may be used in problem areas, to provide environmentally-acceptable, short term surface stability to stockpiles or areas that may be prone to erosion. ○ where applied, seed shall be evenly dispersed over the disturbed area ○ seeding shall take place as soon as practicable after reinstatement of the soil profile. Reapplication of seed may be required in some areas. ○ fertilisers and soil supplements may be necessary to aid germination, but shall only be applied with approval from regulators and in consultation with landowners, as their application could encourage faster-growing weed species.

FLORA MANAGEMENT

	Watercourse Crossings	- At ecologically-sensitive watercourse crossings, mechanical slashers shall be considered for use in clearing activities, to retain as much ground cover and root stock as possible. - Cleared vegetation shall be stockpiled away from watercourses and, wherever practicable, shall not be stored or felled so as to land in watercourses. - Soil excavated from the watercourse bed shall be kept separate from other materials, and used solely for reinstatement of stream beds after construction.
	Borrow Pits	- Where present, topsoil and vegetation shall be removed from the excavation site and stockpiled separately in an adjacent area (in accordance with Section 6.9 Borrow Pits) for use in rehabilitation. - Borrow pit rehabilitation shall include: - managing cleared vegetation in accordance with measures outlined in Section 6.13 Reinstatement and Rehabilitation. Re-spreading cleared vegetation over the site is the preferred option, particularly covering the pit slopes. - implementing appropriate regeneration/revegetation measures in accordance with Section 6.13 Reinstatement and Rehabilitation, taking into consideration site-specific characteristics which may affect regrowth and stabilisation success. Seeding and the use of geotextile materials may be appropriate - reinstatement of access tracks in accordance with the guidelines in Section 6.1 Access to Site.
Operation	Pipeline Easement Management and Access	Regrowth vegetation on the pipeline easement shall be maintained to ensure root systems do not create a safety risk to the pipeline⁵. The width of vegetation removal for easement maintenance purposes (i.e. the distance cleared on either side of the pipeline centreline) should be the minimum extent reasonably necessary to ensure the access to

⁵ Also refer to *Australian Standard AS2885.3*

FLORA MANAGEMENT

		the RoW and safe operation of the pipeline. • If erosion is occurring due to inadequate vegetation cover on the easement, consideration should be given to promoting additional growth or installing erosion control structures. Such work should be planned in consultation with the landowner. • When undertaking vegetation maintenance, maximum heights for vegetation along the easement should be determined by considering requirements for line-of-sight and access. Vegetation type, land use sensitivity and topography should also be taken into consideration. Minimum ground clearance for most equipment used for maintenance is usually between 150 and 300mm.
	Watercourse Crossings	• A buffer of riparian vegetation should be maintained for watercourses. If regrowth trees within this buffer require removal, it should be done using hand-held equipment.
	Reinstatement and Rehabilitation	• Where appropriate, trees may be permitted to regrow on the pipeline construction area outside the pre-determined buffer zone of the pipeline. Each pipeline operator should determine its own requirements and it is common for various segments of the same pipeline to have different buffer zone widths. • The following guideline for zone widths should be considered: Clearance Zone – strip of land 3m wide located directly above centreline of pipe Zone A - strip of land no closer than 1.5m from centreline of pipe – perennials and annuals only. Zone B - strip of land no closer than 3m from centreline of pipe and suitable for small woody shrubs Zone C - strip of land no closer than 5m from centreline of pipe and suitable for woody shrubs and small trees. • Where necessary and practicable, rehabilitated areas may need to be fenced in order to prevent access

FLORA MANAGEMENT

		until site stability is established. • In consultation with the landowner, third parties, stock and wildlife access to newly-reinstated areas should be excluded where possible, until there is sufficient establishment of seed and plant stock. • As a general consideration, areas that have been recently rehabilitated should be avoided by ground, vehicular or machinery movement for as long as possible.
Related Sections Fauna Management Drainage, Erosion and Sedimentation Management Biosecurity Management Environmental Offsets		

9.2 FAUNA MANAGEMENT

Australia is home to a unique and diverse range of terrestrial and aquatic fauna species. Pipeline construction has the potential to significantly impact on individuals, species and communities.

An essential part of the environmental assessment process is gaining a detailed understanding of fauna species and communities affected by a pipeline project, as proponents will be required to work within the regulatory frameworks listed in Section 2 to protect fauna values.

The following tasks may be undertaken to provide adequate fauna management:

- Review of available literature and databases to determine the likely presence/absence of species – particularly listed fauna species
- Field investigations to confirm presence / absence of species in the project area
- Impact assessment to determine the likely effects of the project on terrestrial and aquatic fauna
- Development and implementation of appropriate management and impact mitigation measures, including those listed in this section.

Successful planning and implementation of appropriate fauna impact management controls are essential to limit environmental impacts during the construction and operational phases of a pipeline.

FAUNA MANAGEMENT

FAUNA MANAGEMENT– KEY ENVIRONMENTAL ISSUES

- Removal of key habitat such as mature trees, hollow-bearing trees and fallen trees which are used for nesting, shelter and foraging
 - Fragmentation of habitat
 - Disturbance to fauna movement corridors
 - Introduction of invasive species that can destroy natural fauna habitat or displace natural food plants
 - Impacts of noise and increased human activity on natural behaviour
 - Potential for fauna to become trapped in the open trench
 - Increased bushfire threat during construction
-

FAUNA MANAGEMENT

FAUNA MANAGEMENT– ENVIRONMENTAL OBJECTIVES

1. To minimise impacts on native fauna, particularly listed species, or their habitat
 2. To prevent the spread or transfer of pest or weed species.
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FAUNA MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:		
See Appendix 4.		
Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Use of existing roads, tracks and areas of disturbance wherever feasible. New access tracks and roads should be designed and constructed to avoid or minimise impacts on fauna or their habitat. • Wherever possible, construction planning shall consider opportunities to time activities in a way that minimises impact on sensitive fauna lifecycle periods (e.g. breeding, nesting, migration).
	Clearing	• Careful planning of RoW location and clearing can minimise some wildlife habitat fragmentation effects – for example, by maintaining tree canopy connectivity where practicable, particularly at watercourses and roadside remnants. • Plan for use of fauna spotters during clear and

FAUNA MANAGEMENT

		grade operations, to relocate fauna disturbed or trapped by clearing operations
	Hydrostatic Testing	- Measures which minimise potential impacts on aquatic fauna shall be adopted, such as avoiding significant aquatic habitat areas, maintaining adequate flow rates and water levels or the use of alternative water resources. - Proponents should not plan to dispose of hydrotest media to waterways, unless the media can be suitably treated and the regulator indicates such disposal can be acceptable. - Planning is also required to ensure that the hydrotest process does not transfer pest species of fish or other aquatic fauna from one catchment to another.
	Borrow Pits	Proposed borrow pit sites shall be assessed for potential environmental impacts to fauna and their habitat.
	Watercourse Crossings	- Where practicable, trenched watercourse crossings shall be scheduled during dry or low flow periods and shall avoid periods of fauna sensitivity (e.g. fish migration periods). - Consideration should also be given to potential effects from upstream works on downstream estuarine / tidal waters.
	Reinstatement and Rehabilitation	Site-specific or property-specific rehabilitation plans may be necessary, depending upon site conditions or legal requirements (e.g. problematic soils, significant habitat or species and regulatory permit conditions, easement negotiations). These plans should include discussion of the proposed inspection regime and anticipated ongoing maintenance measures, particularly as these apply to fauna impact management.
Construction	Clearing	Fauna spotter/catchers should be on site during clearing to advise on clearing techniques that will minimise fauna impact and to undertake fauna handling, if required.

FAUNA MANAGEMENT

		- Records of all fauna interactions should be created, listing the species concerned, the nature of the interaction and its GPS coordinates. - Cleared vegetation shall be stockpiled separately in a manner which does not impede stock or wildlife. - Prior to clearing, habitat trees/hollows and habitat for other conservation significant species should be identified and flagged, with a view to re-using such trees/hollows/habitat as part of RoW reinstatement. - Consideration shall be given to the control of feral animal movements along newly cleared corridors that facilitate movement or provide new access to sensitive environments.
	Pipe Stringing and Welding	- Individual pipes and joined pipe sections (pipe strings) shall not impede vehicle, stock or wildlife passage. Gaps which coincide with gaps in the topsoil and vegetation stockpiles, with crossing points for designated access tracks/roads and fence lines shall be left in the strings, with their location, and the location of any additional gaps needed for site or emergency access, shall be located in consultation with relevant landowners. - Welded pipe sections should have temporary end caps installed when the site is not attended, to prevent ingress of fauna.
	Trenching	- Measures shall be adopted to prevent fauna entrapment within the pipeline trench, such as: - minimising the period of time the trench is open, particularly in fauna habitat areas - constructing trench plugs with slopes less than 45° to provide exit ramps for fauna - installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas) - use of branches, ropes, hessian sacks, ramped gangplanks or similar to create 'ladders' to enable fauna to exit the trench

FAUNA MANAGEMENT

		○ conduct of regular surveys of open trenches, and engagement of appropriately-certified personnel to remove trapped fauna as required.
	Blasting	● In addition to standard regulatory requirements, blasting in ecologically-sensitive areas shall incorporate appropriate precautions to protect ecological resources. For example, ○ where possible, blasting should be scheduled to avoid sensitive lifecycle periods of fauna species (e.g. breeding, nesting, migration). ○ smaller and/or staggered charges shall be used where practicable. ● Rock that is not required for other purposes may be retrieved and used for wildlife habitat creation where possible.
	Pipe laying and Backfilling	■ A suitably accredited fauna spotter/catcher should survey the trench prior to the commencement of pipe laying and backfill activities and relocate any trapped fauna as required.
	Reinstatement and Rehabilitation	■ Native groundcover consistent with adjacent vegetation shall be encouraged to regenerate over the entire pipeline construction area, particularly in sensitive areas, to minimise negative habitat barrier effects. ■ Where appropriate, habitat structural elements, such as timber and rocks, shall be replaced on the pipeline construction area. ■ Re-spreading stockpiled vegetation, either whole or mulched, can provide valuable fauna habitat. ■ On private land, the reinstatement plan should be agreed with each landowner and tailored to the specific challenges and opportunities of that property.
Operation	Pipeline Easement Management and Access	■ The corporate body of knowledge about a particular pipeline should include awareness of the types of fauna found on or adjacent to the pipeline easement and the possibility that other fauna, especially listed fauna, might also be present from time to time.

FAUNA MANAGEMENT

		▪ Fauna habitat should be considered when planning for easement management, especially for general mowing, slashing or line of sight maintenance activities, with any valuable habitat to be managed in accordance with licence conditions or the approved maintenance plan / arrangements. ▪ A fauna survey should be undertaken when proposing to undertake maintenance excavations in sensitive areas or in areas containing potential habitat values. ▪ Consideration shall be given to the control of feral animal movements along pipeline easement corridors that provide access to sensitive environments.
	Reinstatement and Rehabilitation	▪ Where appropriate, native groundcover and shrubs shall be encouraged to regenerate over the entire pipeline construction area, in order to minimise negative habitat barrier effects. ▪ If vegetation has remained in a stockpiled state at the side of the RoW for a lengthy duration, suitably qualified fauna spotter/catchers should catch and relocate fauna from it, prior to re-spreading.
Related Sections Flora Management Biosecurity Management		

9.3 BIOSECURITY MANAGEMENT

Biosecurity is defined as the protection of environment, economy and public health from negative impacts associated with pest, diseases and weeds. Several biosecurity issues are prevalent throughout Australia and control and eradication is expensive and timely (or in some cases can be practically impossible). Known major biosecurity issues include footrot, Bovine or Ovine Johne's Disease, Q-Fever, Phylloxera, dieback/Phytophthora, Mundulla Yellows, Red Imported Fire Ant, Myrtle Rust and Equine Influenza⁶ and there are numerous lesser biosecurity issues that can be important at a local level – such as importing weed seed, moulds or rusts into a high value agricultural cropping area or areas of remnant native vegetation.

Each State and Territory has specific legislation which assigns responsibility for the prevention and control of the spread of pests, diseases and weeds to those individuals and organisations whose activities could result in biosecurity impacts.

Pipeline construction and operation have the potential to facilitate the spread of pest, diseases and weeds through the movement of vehicles, equipment and personnel, and the transportation of contaminated materials, plant or equipment. This section presents guidelines for the prevention and control of the spread of pest, diseases and weeds during the construction and operational life of a pipeline.

9.3.1 WEED MANAGEMENT

Noxious or declared weeds can be a significant problem in Australia in terms of agriculture and the conservation of native flora and fauna. Management of declared and noxious weed species in each State and Territory is controlled under specific legislation which assigns responsibility for the prevention and control of the spread of pests, diseases and weeds to those individuals and organisations whose activities could result in biosecurity impacts. Numerous noxious or declared weed species are known to exist in Australia, all of which are classified according to their potential threat to agriculture and/or the environment.

A declared or noxious weed is defined as a plant that has, or has the potential to have, a detrimental effect on economic, social or conservation values. Environmental weeds are generally considered to be plants that invade areas of native vegetation, usually adversely affecting the regeneration and survival of native flora and fauna, while agricultural weeds have the potential to result in financial impacts to the landowner.

Apart from the clear potential impact to stakeholders from poor biosecurity by the proponent during construction, both environmental and agricultural proclaimed noxious weeds can cause issues during operations, for pipeline licence holders, even if their own easement is correctly managed for weeds, by accessing the easement from infestations located off easement in the surrounding area.

There are many weeds that are not declared or noxious, and an understanding of these species, many of which are pioneers in disturbed ground, can be beneficial as they can provide stability to disturbed ground, rapidly stabilise watercourse banks, and can aid with erosion and sediment control if appropriately managed.

Deliberate use of weeds for environmental purposes should only be undertaken in consultation with the affected landowner and regulatory authorities. Following construction, the cleared pipeline easement can be subjected to invasion of weed species due to:

- disturbance of topsoil/ surfacing of pre-existing seed stock
- greater pioneering capability for weeds than for native vegetation
- removal of vegetation competition
- creation of favourable conditions such as increased water and light
- redistribution of propagative material
- introduction of weeds from outside the easement.

Appropriately-trained personnel are required to identify potential weed problems and to develop suitable control procedures. A specific control program may be required for some particularly invasive or undesirable weed species. The control program will be required to meet the requirements of relevant local or state authorities and should be developed and implemented in consultation with the relevant landowners. Note that, in some areas with a high level of weed invasion, it may be impractical to maintain a weed-free pipeline easement, and in such areas, pipeline surveillance should monitor the density and abundance of weeds and schedule weed control as required.

Construction activities may provide conditions for weeds to invade, as certain opportunistic weed species thrive in disturbed soils. This is compounded by the longevity of seed viability of many weed species, which can remain dormant in soil for many years until the soil is disturbed. The construction of a linear pipeline development presents the potential risk of spreading weeds significant distances along the easement as construction progresses if unmanaged, as does any subsequent maintenance or on-ground surveillance activity during the operation of the pipeline. This section presents guidelines for the prevention and control of the spread of noxious weeds during each phase of a pipeline life cycle.

WEED MANAGEMENT

WEED MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Spread of noxious weed species
 - Potential for unsustainable rehabilitation
 - Competition from weed species and loss of agricultural land use and native flora
 - Reduced primary industry productivity and produce quality
 - Reduction in diversity of native species
 - Impacts to sensitive environments adjacent to weed infected areas
 - Loss of visual amenity
-

WEED MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To minimise the introduction and/or spread of weeds
 2. To promptly identify weed species and habitats likely for each species to occur in, and adopt specific weed control procedures
 3. To eliminate infestations of noxious weed species
 4. To effectively control weed species
 5. To avoid impacts to primary industries
 6. To avoid impacts to flora and fauna
-

WEED MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

WEED MANAGEMENT

See Appendix 4.

Phase	Activity	Management Measures
Planning	Weed Control	• An appropriately detailed weed control program should be incorporated into the CEMP and/or OEMP. • The weed control program should include adoption of a weed hygiene procedure for known areas of weed infestation. • The weed control program should be developed in consultation with local authorities. Where relevant, the program should utilise existing weed datasets and landowner input into the presence and location of weeds. • An inventory of noxious or declared weed species occurring along the easement shall be compiled and appropriate weed control procedures shall be developed, • Weed management goals and desired outcomes should be established, based on regulatory pest plant control guidelines, regional weed control programs, an assessment of weed risk and consultation with landowners. • Consultation should be conducted with relevant landowners and regulatory authorities regarding any special management measures required for an area or property - such as weed management provisions, quarantine provisions, certified area provisions (e.g. organic,). • Arrangements should be developed to ensure project and contractor staff are inducted into weed control issues and solutions, and are advised of relevant project commitments and their responsibilities in fulfilling these.
	Pipeline Easement Management and Access	• Existing roads, tracks and areas of disturbance should be used wherever practicable. New access tracks and roads should be designed and constructed to avoid or minimise impacts on areas of serious weed infestations. Access to the pipeline easement shall be managed to minimise potential

WEED MANAGEMENT

		weed impacts.
	Reinstatement and Rehabilitation	Rehabilitation procedures shall include provision for weed management where required – refer to Section 6.12 Rehabilitation and Reinstatement
	Watercourse Crossings	Construction machinery shall be weed free prior to entering a flowing watercourse, or starting construction of a watercourse crossing.
Construction	Construction Operations	- All machinery, equipment and vehicles brought to site should be free of any soil, seed or plant material. All soil and organic matter should be removed, including under the vehicle and in the cabin or load trays. - All machinery, equipment and vehicles brought to site should be inspected upon entry, and either admitted or refused entry on the basis of presence / absence of soil seed or plant material. Records of inspection shall be maintained. - Major construction operations should include vehicle washdown bays at the site entry point(s), for use by machinery entering or leaving the site - All machinery, equipment and vehicles should be free of any soil, seed or plant material prior to being floated from one project work area to another. Records of movement between sites shall be maintained. - Evidence of compliance with hygiene requirements should be documented, e.g. on a Vehicle Wash down Register. - Appropriate weed control measures applied prior to and during construction include: - consideration of engagement of a licensed and suitably qualified or experienced weed control sub-contractor - ensuring weeds have been effectively controlled in work areas prior to commencing construction - ensuring construction crews involved in clear and grade and reinstatement are trained in the recognition and dispersal

WEED MANAGEMENT

		methods of weeds ○ applying weed hygiene measures, such as spraying with non-residual herbicide, use of wash down or blow down bays, in areas of significant noxious weed infestation (note that weed wash down wastewater or sediment may require treatment by physical or chemical means to ensure weeds do not occur at discharge locations) ○ adoption of weed hygiene for all vehicles, equipment and portable infrastructure. ○ restricting access of vehicles and personnel to areas of known noxious weed infestation. Vehicles exiting such areas may need to be re-cleaned. ○ ensuring imported construction materials are sourced from clean locations and meet applicable Australian Standards . ● Transportation of topsoil along the pipeline corridor should be avoided where practicable. ● Where demountable buildings are used on the pipeline easement or work site, the floors will be cleaned regularly, by brushing/washing, to good hygiene practices.
	Pipeline Easement Management and Access	● Appropriate weed biosecurity measures shall be applied as necessary. ● Frequent access to the pipeline easement may increase the risk of weed introduction and establishment. In areas where vehicular movement is so frequent that processes such as wash down are deemed impractical, other suitable controls should be considered (such as drive-through herbicide bays, limiting washdown to first visit or to plant arriving from specific known weed areas, etc). ● The presence of noxious weeds should be reported to affected landowners and local authorities, and the control of significant species should be conducted in conjunction with affected landowners and local authorities.

WEED MANAGEMENT

	Fuel and Chemical Management	• Weed control activities involving the use of chemicals shall be undertaken in consultation with the relevant landowners and regulatory authorities, giving due consideration to sensitive land uses (e.g. chemical free, organic and biodynamic farming, run off potential, wind drift and flora and fauna sensitivities).
Operation	Pipeline Easement Management and Access	• Patrol officers should be trained in the identification of all weed species likely to be encountered, particularly declared noxious and environmental weed species, and in techniques for their eradication. • Inspection of the pipeline easement should include an assessment of weed impacts. If significant infestations are found, aspects noted should include: ○ weed species that are present (listed noxious weeds should be noted as such) ○ estimated coverage area ○ possible reasons for infestation ○ suggested management measure(s). • All maintenance inspections should include notes on weeds encountered and actions taken / recommended
	General activities	• In identified weed infestation areas, all vehicles and machinery entering or exiting the pipeline easement or other work sites shall comply with weed biosecurity requirements. All soil and organic matter should be removed, including under the vehicle and in the cabin or load trays. • Evidence of compliance with weed biosecurity requirements should be documented, e.g. on a Vehicle Wash down Register. • Maintenance crews should be made aware of weed control requirements and their compliance with biosecurity requirements monitored as appropriate. • Where appropriate, the ground surface of facilities will be gravelled to reduce the potential for weed infestation.

WEED MANAGEMENT

Related Sections

Flora Management

Biosecurity Management

9.3.2 PEST AND PATHOGEN MANAGEMENT

PEST AND PATHOGEN MANAGEMENT

PEST AND PATHOGEN MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Reduction in agricultural productivity
- Adverse effects on the health of livestock or other fauna
- Damage to or loss of native vegetation
- Loss of biodiversity
- Poor regeneration
- Reduced visual amenity

PEST AND PATHOGEN MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To prevent the spread of pests, diseases and pathogens as far as is reasonably practical.
2. To prevent the introduction of pests, diseases and pathogens into new areas.
3. To avoid impacts on primary industry, affected landowners and the environment.

PEST AND PATHOGEN MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Information on pest and disease should be obtained from the relevant regulatory agencies and local landowners, and the relevant hygiene requirements and access restrictions conveyed to personnel. • An appropriately detailed pest and disease control program should be incorporated into the pipeline CEMP and OEMP. This should outline known locations, site specific management measures that should be applied when working in (or in proximity to) infected areas and additional provisions on

PEST AND PATHOGEN MANAGEMENT

		precautionary pest and disease management and control measures that will be applied throughout the remainder of the easement. • Consultation with relevant landowners and regulatory authorities regarding any special management measures required for a specific area or property - such as pest and disease management provisions, quarantine provisions, certified area provisions (e.g. organic properties). • New access tracks and roads should be designed and constructed to avoid or minimise contact with areas of known infestations or high risk potential (such as major flying fox camps, landfills, etc). Quarantined areas or areas of high risk on the pipeline corridor requiring special hygiene management should be identified, or alternatively, in potentially affected areas, the entire pipeline corridor should be considered at risk and managed accordingly. • Pest and/or disease infected areas on the pipeline corridor requiring special hygiene management should be identified and avoided if possible. • Location of demountable buildings and other work areas shall avoid areas of known infestation where possible. • Consider, as required, the engagement of a suitably qualified or experienced pest and disease professional (integrated pest management) sub-contractor. • All activities within areas of potential disease or pathogen high risk should be monitored in accordance with a management program designed to detect pest or disease occurrence and respond appropriately.
Construction and Operation	All ground disturbance activities	• Personnel should be trained adequately in vehicle and machinery hygiene management. • Machinery and vehicles should be cleaned prior to exiting high risk areas. The method of cleaning is dependent upon the type of pest or pathogen, government agency hygiene requirements, remoteness of the area and cleaning agent (usually water) availability. Types of cleaning include wash

PEST AND PATHOGEN MANAGEMENT

		down with high-pressure water containing disinfectant or application of other cleaning solutions and should remove all soil and vegetative material from the interior and exterior of machinery and vehicles, and from equipment and boots. - Hygiene points should be located close to infected/infested areas along the pipeline corridor to reduce the risk of spreading infected/infested material. - In areas of confirmed infection/infestation, stringent wash down must be completed before leaving the area, removing all soil and vegetative material from cabins, trays, and undercarriages. This may include removal by physical, mechanical or chemical means. Records of treatment methods and the date/time of application should be maintained. - Facilities should be provided for site workers to decontaminate their footwear prior to moving out of infected/infested areas. - Evidence of compliance with hygiene requirements should be documented, such as on a Machinery/ Vehicle Wash down Register.
	Hydrostatic Testing	To eliminate the potential spread of weed, pest, and disease, water used for hydrostatic testing shall be free of any known pathogens, weed seeds etc.
	Pipeline Easement Management and Access	- Transportation of topsoil or subsoil along the pipeline easement should be limited to the extent of the landform / soil type, and generally restricted to local movements only, with particular care to be taken when working in or near high risk areas. - Appropriate and applicable pathogen hygiene measures shall be applied in problem areas to prevent spreading. - Vehicles and machinery should be prevented from carrying any soil or vegetative matter out of the area. - All activities within areas of potential disease or pathogen high risk should be monitored in accordance with an approved biosecurity management program.
Related Sections		

PEST AND PATHOGEN MANAGEMENT

Flora Management
Fauna Management
Biosecurity Management
Traffic Management
Waste Management

9.4 HERITAGE MANAGEMENT– NATURAL AND BUILT ENVIRONMENTS

Significant heritage features of natural or anthropological origin are protected by a range of Commonwealth, State and local laws. For the purpose of this Code natural and built heritage includes:

- natural features or places which are considered to possess significant value, such as fossils, unique landforms, significant flora and fauna; and
- features or places possessing significant European historical values such as buildings, infrastructure and commemorative locations.

During the impact assessment stage, ecological and cultural and historical heritage surveys are necessary along the proposed pipeline corridor to identify areas of potential heritage impact. Where significant heritage features are identified, a range of management options which aim to avoid and minimise impacts may be implemented during the pipeline planning and construction phases. These may include pipeline route re-alignment around a feature, excavation and salvage of heritage artefacts, or site-specific measures which permit the pipeline to be placed in close proximity to heritage sites while avoiding direct disturbance. In achieving the latter, heritage sites may require fencing and/or flagging of the features to be avoided. It should also be noted that cultural heritage training for construction personnel is a useful tool to increase knowledge, awareness and respect for historic artefacts and sites.

Flagging will be used to identify sensitive ‘no go’ areas and features of heritage significance, both natural and built environments. Features marked in this manner shall not be disturbed unless authorised by relevant regulatory authorities and, in the case of indigenous community heritage sites, authorised representatives of the relevant community. Flagging or marker tape used to identify sites shall be in a standardised colour and consistently applied throughout the project. Instruction on flagging or marker tape importance and colouring shall be included in project Inductions. Flagging shall be removed at the completion of construction to avoid drawing attention to sites.

During construction, there is potential for construction activities, such as earthmoving to uncover previously unrecorded heritage sites. In the event that this occurs, procedures in compliance with any applicable regulatory requirements and agreed to by all relevant stakeholders shall be followed.

Heritage sites are of cultural value to the community and are protected by law. Such sites may comprise areas or items of archaeological, anthropological, ethnological, environmental or scientific significance. Most impacts occur during construction, but while it is unlikely that damage to heritage sites will result from pipeline operations, undisturbed sites on the easement or within proximity to the easement must be afforded continued protection.

Appropriate approvals must be obtained prior to any activity that will disturb or destroy a heritage site or item. The operations workforce should be made aware of the location and value of known sites in order to ensure that they are avoided, and of the procedures to be applied if any new sites or objects are encountered (for example, if floods uncover previously unrecorded items).

HERITAGE MANAGEMENT

HERITAGE MANAGEMENT– KEY ISSUES

- Locating items of heritage value
 - Damage to heritage objects
 - Determining the heritage significance of items encountered
-

HERITAGE MANAGEMENT –OBJECTIVES

1. To protect and preserve heritage value
 2. To mitigate and manage the impacts of pipeline projects on heritage items and areas – by creating awareness of heritage items in the project workforce and by effective engagement with relevant stakeholders
-

HERITAGE MANAGEMENT MEASURES

Related Standards and Guidelines:		
See Appendix 4.		
Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Heritage sites should be identified prior to pipeline construction with appropriate input from the heritage stakeholders. • Identified sites should be assessed to gain a measure of their significance, location and management measures for each site, and this information entered onto a database which shall be available to patrol officers and environmental advisers and auditors during operations. • Identified heritage sites that are on the preliminary alignment should be avoided by re-alignment of the

HERITAGE MANAGEMENT

		pipeline corridor where possible. New access tracks and any other associated facilities should also avoid identified sites. • A program shall be developed and implemented to facilitate effective consultation with heritage and interested community groups, regulatory authorities and other relevant stakeholders where impacts on heritage items or areas are anticipated.
	Clearing	• In the case of protected or retained vegetation within the pipeline construction area, where there is significant natural, heritage or visual amenity values to protect, the vegetation shall be marked with flagging or marker tape to indicate that it should be avoided. Marker paint shall not be used.
	Borrow Pits	• Proposed borrow pit sites shall be assessed for potential impacts relative to flora, fauna, landform and heritage. • Borrow pits shall avoid known sites of natural, scientific, or heritage significance.
Construction/ Operation	Pipeline Easement Management and Access	• A database of heritage sites on or in close proximity to the pipeline corridor should be maintained during construction and operation. • Sites that are within or immediately adjacent to the easement should be given adequate physical protection. Such measures include: ○ installing flagging or barriers ○ installing appropriate signs ○ inclusion in project inductions. • Physical protection measures shall be adequately maintained. • Patrol officers should be adequately trained in heritage and cultural issues and in their ongoing management. • Patrol officers will record any disturbance to heritage sites. Actions to address site disturbance shall be taken in consultation with regulatory authorities and the relevant stakeholders, as necessary. • Where appropriate, patrol officers shall monitor any

HERITAGE MANAGEMENT

		work activities on the easement. All operations activities must comply with the permit and reporting requirements under relevant State and Commonwealth heritage legislation
Related Sections Grading Clearing Aboriginal Cultural Heritage Management		

9.5 ABORIGINAL CULTURAL HERITAGE MANAGEMENT

Aboriginal and Torres Strait Islander heritage is an important part of Australia's history and heritage, with evidence of the occupation of Australia by Aboriginal and Torres Strait Islander people dating back more than 60,000 years.

Aboriginal cultural heritage consists of places and items that are of significance to Aboriginal people's traditions, observances, lore, customs, beliefs and history. It provides evidence of the lives and existence of Aboriginal people from before European settlement through to the present day.

Heritage items include both physical and non-physical elements. Physical items include things created by traditional societies, such as stone tools, grinding grooves, culturally-modified trees, art sites and ceremonial or burial grounds. Aboriginal cultural heritage also relates to the connection and sense of belonging that people have with the landscape and with each other. Non-physical heritage includes peoples' memories, story-lines, ceremonies, language and 'ways of doing things' that continue to enrich local knowledge about the cultural landscape and facilitate local Aboriginal people's connection with the land.



Culturally-modified tree -
CNC Project Management



Ground edge axe - CNC Project
Management

Australia's state and territory governments have broad responsibilities for recognising and protecting Australia's Indigenous heritage, including archaeological sites. This body of legislation acts to ensure cultural heritage is conserved - by ensuring acts that might affect it are controlled and can only be undertaken under permit or through application of some other approved impact management mechanism.

The majority of states and territories maintain registers of indigenous heritage sites. The relevant contents of registers should be reviewed during the planning phase of all projects with the potential to interfere with places and objects of heritage value, however proponents should be aware that the registers may not be comprehensive, or may contain information that is not published. For these reasons it is advised that contact is made directly with the relevant state or territory government agency.

Consultation

Aboriginal community consultation is an integral part of the assessment of Aboriginal cultural heritage significance, as aboriginal stakeholders should be considered the primary source of information about their cultural heritage and how it is best identified, protected and conserved. Consultation should be carried out in line with the relevant state or territory best practice guideline. The aims of the consultation process are as follows:

- To identify Aboriginal community groups and individuals with an interest in being involved in the ongoing consultation process
- To provide representatives of the Aboriginal community with the opportunity to participate in the field assessment process and to inspect and comment on the Aboriginal sites and values of the study area
- To encourage all Aboriginal stakeholders to participate in the cultural heritage assessment process through provision of knowledge that will ensure that sites are avoided, protected and any potential damage mitigated
- To identify the Aboriginal cultural heritage values of the study area
- To provide an opportunity for the registered stakeholders to comment on the outcomes and recommendations of heritage assessment and reporting
- To integrate Aboriginal heritage values and recommendations into project construction and operational procedures (CEMP and OEMP).

Pipeline proponents should be aware that their initiation of consultation over cultural heritage, especially if the Aboriginal group approached has no prior experience in such consultation, may give rise to complex reactions within the Aboriginal stakeholder group, as the inquiry acts as a catalyst for important internal discussions on locations, kinship, information availability, custodial responsibility and so forth, to take place. For this reason, proponents should initiate cultural heritage discussion with an open minded and sympathetic approach, should be prepared to resource complex internal consultation processes and should resist placing strict time constraints on the required outcomes.

ABORIGINAL CULTURAL HERITAGE

ABORIGINAL CULTURAL HERITAGE – KEY ISSUES

- Locating items of aboriginal heritage
- Damage to aboriginal objects
- Effective consultation with aboriginal stakeholder groups
- Determining the aboriginal heritage significance of items

ABORIGINAL CULTURAL HERITAGE –OBJECTIVES

1. To protect and preserve aboriginal cultural heritage
2. To mitigate and manage the impacts of pipeline projects on heritage items and areas
3. To create awareness of aboriginal cultural heritage
4. To engage with aboriginal stakeholders

ABORIGINAL CULTURAL HERITAGE MANAGEMENT MEASURES

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Early consultation with relevant state or territory department and aboriginal stakeholders. • The relevant state / territory database of registered cultural heritage sites should be consulted prior to pipeline construction by suitably qualified persons with appropriate input from indigenous communities. • Any activity that is likely to have a significant impact to an area of cultural heritage sensitivity requires survey by a qualified archaeologist accompanied by members of the appropriate Aboriginal representatives. • Following survey, a Cultural Heritage Management Plan (CHMP) or equivalent shall be produced. The CHMP will identify all proposed areas of impact and contain recommendations for impact avoidance and minimisation on sites that have been identified within the survey area. The CHMP also

ABORIGINAL CULTURAL HERITAGE

		contains provision for cultural heritage monitoring during ground disturbance activities and procedures to be applied should additional cultural heritage items be uncovered during construction.
	Clearing	- Where a registered site exists on or immediately adjacent to the pipeline corridor, flagging or marker tape should be used to protect the site. - Clearing personnel should be inducted into the locations of known cultural heritage, of applicable marking and delineation procedures and of reporting requirements in the event that known cultural heritage sites are impacted during clearing operations.
	Borrow Pits	- Proposed borrow pit sites shall be included as part of the CHMP assessment. - Borrow pits should avoid known or identified sites of natural, scientific, or heritage significance.
Construction / Operation	Pipeline Easement Management and Access	- A register of cultural heritage sites and their location should be maintained during construction and operation. - All management measures in relation to registered sites should be undertaken in accordance with the recommendations contained within the CHMP. - Sites that are within or adjacent to the easement should be given adequate physical protection in accordance with the CHMP. Such measures include: - installing barriers such as flagging or fencing - installing appropriate signs - designating land zones within and adjacent to RoW. - All cultural heritage monitoring requirements should be outlined in the CHMP or will be subject to agreements with relevant cultural heritage groups.

ABORIGINAL CULTURAL HERITAGE

		• Regular pre-start toolbox meetings should contain an appropriate level of cultural heritage guidance during ground disturbance activities in areas of sensitivity where appropriate. • Physical protection measures shall be adequately maintained. • On the discovery of physical remains or other suspected cultural heritage material, work should stop and procedures within the CHMP should be followed. • Project maintenance patrol officers must be adequately trained in heritage and cultural issues and their management and must be familiar with the cultural heritage register, its contents and the conservation requirements for registered cultural heritage. • All operations activities must comply with the permit and reporting requirements under the relevant State and Commonwealth legislation. • Patrol officers will record any disturbance to heritage sites. Actions to address site disturbance shall be taken in consultation with regulatory authorities and local community group. • Where appropriate, patrol officers shall monitor any work activities on the easement.
	Construction Camps and Worksites	• For cultural heritage purposes, construction camps and worksites invite the same CHMP requirements as activities along the construction RoW.
Related Sections Clearing Grading Heritage Management – Natural and Built Environments		

9.6 SOIL MANAGEMENT

Soil management is one of the most critical aspects of good environmental management on pipelines. Effective management of different soil horizons and soil types can facilitate control on sediment and erosion during ground disturbance activities and can significantly contribute to positive rehabilitation outcomes.

During pipeline construction, a wide variety of soils may be encountered, and some of their characteristics can be problematic during construction and rehabilitation of the pipeline - and can have ongoing effects on landform stability and pipeline integrity. This section outlines some of the standard principles of effective soil management that should be applied across all pipeline activities. It also expands on effective management measures for some specific soil types that require more defined management when encountered, including the following soil types:

- Highly erosive soils
- Acid sulfate soils
- High shrink/swell soils
- Salty soils
- Soils in dry/desert environments
- Wetland soils
- Soils with pH extremes
- Shallow/rocky soils

9.6.1 GENERAL SOIL MANAGEMENT

GENERAL SOIL MANAGEMENT

GENERAL SOIL MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Soil erosion
- Sediment release to land and water
- Damage to native vegetation and wildlife
- Damage to agricultural production and other land uses
- Subsidence of pipeline trench.

GENERAL SOIL MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To minimise the potential for soil erosion
2. To minimise sediment release to land and water
3. To avoid unacceptable damage to native vegetation or wildlife habitats
4. To prevent damage to agricultural production or other legitimate land uses
5. To minimise the risk of buried pipe exposure
6. To adequately control subsidence of the pipeline trench

GENERAL SOIL MANAGEMENT

GENERAL SOIL MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

GENERAL SOIL MANAGEMENT

See Appendix 4.		
Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Prepare Soil Management Plan (SMP) using available soil mapping. SMP should identify the soil types anticipated along the pipeline corridor, their associated potential impacts and management measures recommended for adoption during construction and reinstatement. • Potential impacts associated with soil and ground stability should be monitored as part of a structured inspection and monitoring program. • Where there is a potential for land degradation, access along the easement during wet weather should only be undertaken in consultation with the relevant landowner. Similarly, where access along private roads may lead to road degradation but is required for maintenance purposes, it should only be undertaken in consultation with the relevant landowner. • Vehicle access should be restricted to stable ground as far as possible. Additional care should be taken near watercourses and drainage lines. • Prior to construction, means of disposal of any excess soil should be identified.
	Clearing	• Clearing activities shall be scheduled to minimise the time between initial clearing and rehabilitation.
	Grading	• Prior to grading, the appropriate soils management procedures (i.e. width and depth of topsoil stripping, location and management of stockpiles) should be determined by a qualified soil scientist or experienced project personnel.
	Reinstatement and Rehabilitation	• Any imported material required for rehabilitation works should be obtained with landowner approval. If the regulator permits soil to be brought in for rehabilitation works, it should preferably be sourced locally and in all situations should be certified as being free of weeds and other contaminants by qualified personnel.
	Construction	• New sites shall be located at existing clearings or

GENERAL SOIL MANAGEMENT

	Camps and Worksites	disturbed areas where practicable, and on well-drained land with all-weather access. • New sites shall be designed to minimise the area of disturbance. • Topsoil cleared from any site shall be retained, kept in a viable state and used for rehabilitation of completed works.
Construction	Pipeline Easement Management and Access	• During earthworks, topsoil should be stockpiled locally, separately from subsoil, and respread over the disturbed area at completion of works in order to aid rehabilitation. • Excavated subsoil not required for trench backfill, may be stockpiled in locations approved by landowners and regulatory authorities. • Where required and approved by the regulator and the landowner, any topsoil imported to the site shall be of an appropriate quality and weed free. • Topsoil will be required to cover subsoil used for easement repairs. • Stability of the pipeline easement and, in particular, the condition of watercourse bed, banks and riparian vegetation should be determined regularly, but particularly following a significant rainfall event.
	Grading	• As part of the initial preparations of site access, topsoil shall be removed, and either stockpiled in windrows adjacent to temporary access for re-spreading during reinstatement, or stockpiled for use at other locations if the access is to remain permanently. • Soil and surface stability shall be maintained at all times, e.g. cut and fill excavation shall be shaped to maintain slope stability and will employ temporary erosion control berms. Overall, drains and sediment barriers shall be installed as necessary and maintained until final construction reinstatement is completed.
	Trenching	• Subsoil shall not be mixed stockpiled topsoil or vegetation.
	Pipelaying and	• Rock removed from the pipeline corridor shall be

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	Backfilling	stockpiled in an adjacent area, and either re-used as rip-rap or removed for off-site disposal as appropriate. • Backfill soils shall be compacted to a level consistent with surrounding soils, with the aim of preventing trench subsidence. During final re-profiling of the pipeline construction area, a low crown of soil mounded over the trench may be necessary to compensate for settling and potential subsidence. Overland water flow must be diverted away from the newly completed backfill crown, or alternatively, a cambered RoW may be an appropriate means of protecting the backfill crown from runoff erosion. • Where obvious demarcations between soil horizons exist, they shall be replaced in order of excavation
	Reinstatement and Rehabilitation	• The pipeline construction area shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features as far as possible. Site-specific stabilisation measures may be necessary to prevent slumping or erosion. • Upon completion of pipeline construction, temporary access tracks shall be closed and rehabilitated to a condition compatible with the surrounding land use and as pre-agreed with the affected landowner. • Rehabilitation procedures shall include: ○ removing all waterway crossing structures and stabilising stream banks and beds, as required, with suitable materials (e.g. rock rip-rap, geotextiles, hydromulch) ○ removal of excess rock or fill material ○ re-profiling of the site in a manner which ensures soil stability and which is as near as practicable to pre-existing contours ○ soil compaction relief in trafficked areas as necessary (i.e. ripping along the contours) ○ re-contouring the road to match the profile of the adjacent landscape and stabilising

GENERAL SOIL MANAGEMENT

		drainage and road cut and fill ○ ripping along the contours to relieve compaction and promote regeneration. Figure eight or zigzag rip lines may be appropriate in flat to low gradients to prevent rilling along the road ○ re-spreading stockpiled topsoil over the rehabilitation area ○ re-spreading stockpiled vegetation, either whole or mulched, over the pipeline construction area and other disturbed areas. Re-spreading techniques should be considered on a case-by-case basis
	Borrow Pits	● Site rehabilitation shall include: ○ soil compaction relief in trafficked areas as necessary (i.e. ripping along the contours). Ripping should aim to permit the site to drain freely unless it has been otherwise specified for use as a dam ○ re-profiling of the site to achieve soil stability and congruity with the surrounding landscape. A minimum 2horizontal:1vertical batter on side slopes is considered suitable to assist stabilisation ○ re-spreading stockpiled topsoil, where present, over the rehabilitation area ○ erosion control and site stabilisation measures such as, erosion berms and contour ripping on the borrow pit side slopes to create terracing
Operation	Reinstatement and Rehabilitation	● The reinstated pipeline trench should be routinely checked for subsidence and exposure of pipe, particularly at watercourse crossings and drainage depressions.
Related Sections Flora Management Water Management Drainage, Erosion and Sediment Management		

9.6.2 EROSION SOILS (SLAKING AND DISPERSION)

Soil characteristics:

- Occurrence may be due to high sodium, high magnesium or low calcium : magnesium ratio
- Hazard arising from exposure to water (with or without soil disturbance)
- Easily detected by field tests (Emerson test)
- Lab tests required to determine specifics of individual occurrences and identify management measures
- Dispersion related to soil structure
- Salt in the soil or water reduces the dispersive effects on soil particles

EROSION SOILS

EROSION SOILS – KEY ENVIRONMENTAL ISSUES

- Soil erosion
- Sediment release to land and water, reducing soil and water quality
- Damage to agricultural production and other land uses
- Damage to native vegetation and wildlife
- Damage to infrastructure
- Subsidence of pipeline trench

EROSION SOILS – ENVIRONMENTAL OBJECTIVES

1. To minimise the potential for soil erosion
2. To avoid unacceptable damage to land, water, native vegetation or wildlife habitats
3. To adequately prevent or control sediment release to land and water
4. To minimise the risk of pipe exposure
5. To minimise damage or subsidence to the pipeline trench
6. To minimise damage to infrastructure
7. To prevent loss of agricultural production or impingement on other legitimate land uses

EROSION SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measure

EROSIVE SOILS

Planning	Pipeline Easement Management and Access	• Soil mapping to be conducted sufficient to identify areas where problem soil exist and allow avoidance where possible. • Prepare SMP using available soil mapping. SMP should identify the soil types anticipated along the pipeline corridor and outline management measures recommended for adoption during construction and reinstatement. • Avoid steep slopes where possible (i.e. >10%).
	Clearing	• Design clearing programs that minimise clearing, employ a staged approach to clearing, adopt erosion and sediment control structures during clearing.
	Grading	• Minimise the exposure of erosive soil layers. • Implement a staged approach to grading and adopt erosion and sediment control structures during grading.
	Trenching	• Minimise the exposure of erosive soil layers. • Stabilise any exposed erosive soil layers as soon as possible.
	Pipe laying and Backfilling	• Minimise the time that the trench is open at any one location. • Apply compaction to decrease permeability compared to natural soil (i.e. return soil to trench with similar or greater bulk density to that of surrounding soil). • Apply ameliorants only to the top of the reinstated material, not throughout.
	Reinstatement and Rehabilitation	• Apply ameliorants to the top of the reinstated material. • Prevent concentration of water flows. • Employ erosion and sediment control structures (refer to guidance in website of International Erosion Control Association

EROSIVE SOILS

		http://www.austieca.com.au . • Revegetate as soon as possible.
	Borrow Pits	• Erosive material to be avoided.
	Construction Camps and Worksites	• Construct and manage to ensure erosive soils are either avoided, or are left unstabilised for as short a time as practicable. • Note that erosive soils are less suitable than other soils as sites for effluent irrigation or trench de-watering.
Construction	Pipeline Easement Management and Access	• Apply management measures. • Limit vehicle traffic to essential vehicles only. • Install erosion and sediment control structures. • Consider application of specific seasonal or intense weather controls eg; to be applied prior to the onset of the wet season, or for the anticipated onset of cyclonic rainfall events.
	Clearing	• Install erosion and sediment control structures.
	Grading	• Install erosion and sediment control structures.
	Trenching	• Install erosion and sediment control structures.
	Pipe laying and Backfilling	• Minimise exposure of erosive soil material. • Ensure adequate compaction in trench to prevent an increase in permeability from natural soil. • Divert overland runoff flows away from backfill.
	Reinstatement and Rehabilitation	• Use ameliorants on surface soil layers. • Revegetate as soon as possible.
	Borrow Pits	• Use only where erosive material to be adequately compacted and below the soil surface.

EROSIVE SOILS

Operation	Reinstatement and Rehabilitation	A patrol officer to inspect easement for signs of erosion either at intervals specified in the SMP, or at regular intervals (minimum 6 monthly), and particularly after heavy rain events.

9.6.3 ACID SULFATE SOIL (POTENTIAL AND ACTUAL)

Soil characteristics:

- Potential Acid Sulfate Soils (PASS) are benign, anaerobic subsoils in their natural state
- PASS are predominantly coastal, mostly occurring below 5m AHD
- Exposure (Oxidisation) leads to production of H₂SO₄ (sulfuric acid) in the soil ('Actual Acid Sulfate Soil - AASS')
- AASS release acid and dissolved metals
- Field testing (pH test of runoff, ponds or puddles) may be used as guide, with Lab testing required to identify PASS and AASS

ACID SULFATE SOILS**ACID SULFATE SOILS (ASS) – KEY ENVIRONMENTAL ISSUES**

- Damage to native land and aquatic vegetation and wildlife
- Damage to agricultural production and other land uses
- Significant adverse effects on soil and water quality
- Corrosion of concrete and steel infrastructure
- Reduced working life of construction materials
- Danger to project staff (acid burns, damage to PPE)

ACID SULFATE SOILS – ENVIRONMENTAL OBJECTIVES

- To minimise PASS disturbance or AASS creation in all operational areas
- To prevent contamination of surface water, watercourses and groundwater with leachate or runoff from oxidised ASS
- To identify and manage ASS so as to minimise potential adverse impacts associated with disturbance or oxidation
- To minimise impacts to soil, water, native flora and fauna (including aquatic habitats)

ASS – ENVIRONMENTAL MANAGEMENT

ACID SULFATE SOILS

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measure
Planning	Pipeline Easement Management and Access	• Soil mapping should be referenced or undertaken as part of the planning process to identify PASS and known AASS areas. • ASS disturbance shall be avoided where possible. • The project Soil Management Plan shall include information on how to avoid, limit and manage oxidation of ASS, and any relevant regulatory information, if PASS or AASS are anticipated on the project site. • In sensitive environmental areas, specific environmental management procedures shall be adopted to minimise environmental impacts. • Compute likely volumes required and plan ahead to ensure there is adequate neutralisation material (type and volume) available on site at all times. • Where required, ensure that a treatment pad has been designed and constructed ahead of likely requirement. • Where encounters with PASS are considered a possibility, a suitably qualified environmental officer will be onsite during construction, and if necessary, during operations and decommissioning. • Pre-arrange an acceptable licensed receiver facility in the event that large amounts of PASS or AASS require safe disposal (note that in some areas, AASS may only be disposed of to a licensed hazardous waste facility).
	Clearing	• Ground disturbance and vegetation clearing shall be planned to minimise

ACID SULFATE SOILS

		disturbance or oxidation of PASS.
	Grading	Ground disturbance shall be planned to minimise disturbance or oxidation of PASS, or to increase runoff from AASS.
	Trenching	- The time planned between trenching and backfilling shall be minimised to prevent oxidisation of exposed soils. - Backfill to commence immediately following pipelay. - Investigate methods of reducing the drainage of surrounding ASS (eg: drain soils to a central treatment pond; consider installation of galvanised sheet piling or the like, to minimise the volume of soil potentially oxidised during construction). - Adequate planning to ensure that ASS remains in stockpiles for the minimum amount of time. - Plan to manage any ASS stockpiles to ensure minimal oxidation (i.e. cover with a membrane, irrigate to keep wet/saturated). - Base pH buffering treatment rates on laboratory analyses. - Plan treatment areas where ASS material can be treated adequately. - Plan validation testing of treated ASS to be used as fill material. - In AASS areas, all runoff, including trench water, should be tested and treated as required to achieve a pre-determined acceptable pH prior to disposal to natural waterways.
	Pipe laying and Backfilling	- Base pH buffering treatment rates on laboratory analyses. - Calculate a nominal pH buffering rate (using laboratory information gathered during soil mapping) for application to the trench area prior to backfilling to account

ACID SULFATE SOILS

		for oxidation of soil on sides and bottom of trench during operations. • In PASS areas, plan to backfill ASS in locations below the water table wherever possible. • Ensure there is adequate space available to store soil from PASS and non-PASS horizons separately, to allow PASS to be backfilled under non-PASS soils.
	Reinstatement and Rehabilitation	• PASS is generally found under naturally neutralised surface layers, so soil reinstatement should be carried out in the order in which it was removed, to ensure no ASS is placed on or near the surface, or on top of naturally neutralised layers. • Control overland runoff flows in areas of PASS or AASS, to minimise off-site transport of low pH runoff. Collect runoff from suspect areas and modify pH as required prior to release. • ASS is to be reinstalled below the water table wherever possible. • AASS material can be used for rehabilitation provided its pH matches that of the surrounding area.
	Borrow Pits	• No ASS to be used as fill material.
	Construction Camps and Worksites	• It is recommended that construction camps or worksites avoid ASS areas, unless the PASS is deep enough that it can be avoided and not require extra management considerations.
Construction	Pipeline Easement Management and Access	• Follow routes that avoid ASS (both PASS and AASS) areas to minimise disturbance of ASS. • In PASS areas, construction contractor staff will need to include expertise in AASS matters, and will need to be capable of following PASS treatment prescriptions in the SMP.

ACID SULFATE SOILS

		- Follow the prepared ASS management prescriptions in the SMP, including surface water pH monitoring and response, and the installation of piezometer wells for groundwater monitoring. - Environmental management procedures in the CEMP and OEMP (or the SMP) will include measures (staffing, training, procedures) to minimise PASS and AASS environmental impacts during all stages of construction.
	Clearing	Ground disturbance and vegetation clearing shall be planned so as to minimise disturbance or oxidisation of PASS.
	Grading	- Ground disturbance and vegetation clearing shall be kept to a minimum to reduce disturbance or oxidisation of PASS. - Any PASS disturbed during the grading process will be treated at the appropriate rate determined from the laboratory results obtained during the soil mapping.
	Trenching	- Minimise time trench is open. - Ensure adequate neutralising material is readily available (eg, AgLime), and apply to soil and trench water as indicated by analysis.
	Pipe laying and Backfilling	- Apply neutralising material at a nominal rate (using laboratory information gathered during soil mapping) to the trench area prior to backfilling to account for oxidation of soil on sides of trench during construction. - Ensure soil reinstatement is carried out in the order from which they were removed, so ASS is placed at the base, and preferably below the water table. - Treat any AASS to the degree indicated by analysis as that necessary to neutralise its acid producing potential prior to re-

ACID SULFATE SOILS

		placement.
	Reinstatement and Rehabilitation	- PASS is generally found under naturally neutralised surface layers, so soil reinstatement should be carried out in the order in which it was removed, to ensure no ASS is placed on or near the surface. - Control overland runoff flows in areas of PASS or AASS, to minimise off-site transport of low pH runoff. Collect runoff from suspect areas and treat as required prior to release. - ASS is to be reinstalled below the water table wherever possible. - AASS material can be used for rehabilitation provided its pH matches that of the surrounding area).
	Borrow Pits	No ASS to be used as fill material.
Operation	Reinstatement and Rehabilitation	- During pipeline operations, the disturbance of ASS should be avoided or minimised. Barriers or other control measures should be implemented to ensure such soils are not released to surrounding land and water and that disturbed PASS does not drain to natural waterways. - Patrol officers will be trained in AASS matters, and will follow the pH monitoring plan included in the soil management plan for areas identified as containing ASS.

9.6.4 HIGH SHRINK/SWELL SOILS

Soil Characteristics:

- These soils have high clay content and mineralogy
- Soils shrink and swell dependent on moisture content
- Vegetation communities are a useful surface indicator
- Gilgai micro-relief (small ponding of water) common on these soils
- Infrastructure on and in the ground can be at risk

HIGH SHRINK/SWELL SOILS**HIGH SHRINK/SWELL SOILS – KEY ENVIRONMENTAL ISSUES**

- Damage to infrastructure
- Increased cost of infrastructure
- Access when wet

HIGH SHRINK/SWELL SOILS – ENVIRONMENTAL OBJECTIVES

1. To prevent adverse impacts on soil quality
2. To minimise damage to infrastructure

HIGH SHRINK/SWELL SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:		
See Appendix 4.		
Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Design route to avoid soils with high shrink/swell values where possible. • Prepare soil management plan using available soil mapping. Soil management plan should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes. • Develop contingency plans – especially for overland access – to be applied during wet weather. • Ensure shrink/swell characteristics are recognised in engineering specifications for infrastructure.
	Clearing	• Limit soil disturbance.
	Grading	• Limit soil disturbance.
	Trenching	• Plan effectively so that trenching is undertaken during dry conditions.
	Pipe laying and Backfilling	• Plan to reinstate the soil layers in the order they were removed. • Ensure adequate/extra non shrink/swell padding material is available.
	Reinstatement	• Maintain even moisture conditions where possible.

HIGH SHRINK/SWELL SOILS

	and Rehabilitation	
	Borrow Pits	Not recommended in this soil type.
	Construction Camps and Worksites	Ensure shrink/swell characteristics are recognised in engineering specifications for construction camps / worksites.
Construction	Pipeline Easement Management and Access	Not recommended during wet weather.
	Pipelaying and Backfilling	Ensure adequate/extra non shrink/swell padding material is placed around pipework.
	Reinstatement and Rehabilitation	Ameliorants may assist with breaking up coarse soil structure.
	Construction Camps and Worksites	Ensure shrink/swell characteristics are recognised in engineering specifications for construction camps / worksites.
Operation	Reinstatement and Rehabilitation	A monitoring plan to be followed to ensure that infrastructure damage is identified in a timely manner (i.e. during season changes, after extensive rain periods and especially during subsequent dry times).

9.6.5 SALTY SOILS

Soil characteristics:

- Any soil type can become affected
- Can be detected by EC meter in the field, with extent to be confirmed by lab tests
- Unique vegetation species (for established areas) or unhealthy vegetation (for new areas)
- May occur on the surface or deeper in the soil
- Commonly associated with elevated water tables
- Can be due to both natural and created situations
- Soil salinity can be reduced by lowering the water table and/or leaching of salts

SALTY SOILS

SALTY SOILS – KEY ENVIRONMENTAL ISSUES

SALTY SOILS

- Reduced success of rehabilitation
 - Damage to infrastructure and reduction in effectiveness of cathodic protection measures
 - Ecological damage from brackish runoff to natural waterways
-

SALTY SOILS – ENVIRONMENTAL OBJECTIVES

1. Limit flow-on effects caused by reduced vegetation growth
 2. To improve the success of rehabilitation
 3. To minimise damage to infrastructure
-

SALTY SOILS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:		
See Appendix 4.		
Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Prepare SMP using available soil mapping. SMP should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes.
	Pipe laying and Backfilling	• If topsoil is non-saline, identify topsoil reserves and keep separate from remaining saline subsoil material.
	Reinstatement and Rehabilitation	• Prepare a rehabilitation plan (eg. ameliorants and drainage.)
	Borrow Pits	• Not recommended.
Construction	Pipeline Easement Management and Access	• Minimise disturbance where possible.
	Pipelaying and Backfilling	• Identify any non-saline soil material and stockpile for replacement at or near the soil surface; saline material to be the most deeply buried.
	Reinstatement and Rehabilitation	• Improve drainage characteristics to allow for leaching of the salt from the soil • If salty soil is a natural characteristic of the area, use salt-tolerant species for rehabilitation.

SALTY SOILS

		Where salt is being leached from the soil and transported to the surface around the disturbed area due to rising of the water table, deep rooted, salt-tolerant tree species can be used to lower the water table in areas immediately adjacent to the RoW.
Operation	Reinstatement and Rehabilitation	A monitoring plan should be followed to ensure that rehabilitation in suspected salty soil areas is successful

9.6.6 SOILS IN DRY/DESERT ENVIRONMENTS

Terrain Characteristics

- Varied soil types encountered
- Many areas devoid of vegetation
- GIS for identification (isohyets and vegetation communities)
- Soil and vegetation management important to ensure maximum utilisation of unpredictable moisture
- Establishment improved with supplementary irrigation
- Soil seed reserves often limited, therefore topsoil management critical

SOILS IN DRY/DESERT ENVIRONMENTS

SOILS IN DRY/DESERT ENVIRONMENTS – KEY ENVIRONMENTAL ISSUES

- Reduced success of rehabilitation

SOILS IN DRY/DESERT ENVIRONMENTS – ENVIRONMENTAL OBJECTIVES

- Limit the disturbance of fragile environments
- Improve the success of rehabilitation

SOILS IN DRY/DESERT ENVIRONMENTS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement	Minimise disturbance area due to the

SOILS IN DRY/DESERT ENVIRONMENTS

	Management and Access	difficulty of rehabilitation (where vegetation exists).
	Reinstatement and Rehabilitation	• Good knowledge of local drought-resistant species required. • Adequate watering regime required to re-establish vegetation.
Construction	Pipeline Easement Management and Access	• Maintain vegetative cover where possible.
	Reinstatement and Rehabilitation	• Establish a suitable watering regime to re-establish vegetation.
Operation	Reinstatement and Rehabilitation	• Seek local advice on local pioneer species. • A monitoring plan should be followed to ensure that rehabilitation is successful.

9.6.7 WETLAND SOILS

Soil Characteristics:

- Hydrosols (Isbell 2002), soil textures range from sands to clays
- Grey/gley soils , often mottled throughout, supports unique vegetation communities
- GIS (wetland mapping) and/or field descriptions should be utilised for identification
- Can contain PASS

WETLAND SOILS**WETLAND SOILS – KEY ENVIRONMENTAL ISSUES**

- Damage to wetland ecosystems
- Subsidence of pipeline trench
- Damage to infrastructure

WETLAND SOILS – ENVIRONMENTAL OBJECTIVES

1. Limit the disturbance of wetland environments
2. Reduce damage to infrastructure

WETLAND SOILS – ENVIRONMENTAL MANAGEMENT**Related Standards and Guidelines:**

See Appendix 4.

WETLAND SOILS

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Avoid through re-alignment where possible. • In sensitive environmental areas, specific environmental management procedures shall be developed by suitably qualified and experienced soil scientists or advisors to minimise environmental impacts.
	Clearing	• Minimise extent of clearing.
	Trenching	• Investigate construction methods that stop the trench acting as a drain for the surrounding wetland (eg. sheet piling). • Investigate application of trenchless techniques.
	Reinstatement and Rehabilitation	• Use local provenance species to reinstate.
	Borrow Pits	• Should be avoided.
	Construction Camps and Worksites	• Should be avoided.
Construction	Pipeline Easement Management and Access	• Follow environmental management procedures.
	Pipelaying and Backfilling	• Backfilling shall be conducted so as not to provide a conduit for interstitial soil water to drain from the wetland. • Surface level should be re-established to the original height, and compaction level should replicate soil density of surrounding areas – to avoid trench acting as a sump.
	Reinstatement and Rehabilitation	• Ensure drainage of site is reinstated as far as possible. • Local provenance species to be returned to site where possible.
Operation	Reinstatement and Rehabilitation	• A monitoring plan should be followed to ensure that rehabilitation is successful.

9.6.8 SOILS WITH PH EXTREMES (HIGH AND LOW)

Soil Characteristics:

- Incorporates a large range of soil types
- Extreme pH is most likely to be encountered with subsoil rather than with topsoil
- Identification can be initially determined from soil maps (if available), then broadly confirmed with field tests, with lab analysis needed to quantify ameliorants if required
- Can alter the availability/toxicity level of nutrients
- Limits establishment and persistence of vegetation, can corrode infrastructure and can reduce the efficiency of cathodic protection measures
- Soil management important to ensure topsoil and subsoil stored separately and reinstated in order
- Ameliorants readily available to adjust pH (elemental sulfur and lime/dolomite)

SOILS WITH PH EXTREMES (HIGH AND LOW)**SOILS WITH PH EXTREMES (HIGH AND LOW) – KEY ENVIRONMENTAL ISSUES**

- Reduced success of rehabilitation
- Damage to infrastructure

SOILS WITH PH EXTREMES (HIGH AND LOW) – ENVIRONMENTAL OBJECTIVES

1. To limit flow-on effects from reduced vegetation growth
2. To improve the success of rehabilitation
3. To minimise damage to infrastructure

SOILS WITH PH EXTREMES (HIGH AND LOW) – ENVIRONMENTAL MANAGEMENT**Related Standards and Guidelines:**

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Prepare SMP using available soil mapping. SMP should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes. • Using soil mapping to determine potential for encountering pH extreme soils, and to calculate the amounts and types of ameliorants required.

SOILS WITH PH EXTREMES (HIGH AND LOW)

	Reinstatement and Rehabilitation	- Identify the symptoms of extreme pH effects on rehabilitated RoW. - Monitoring equipment available.
	Borrow Pits	Limited use.
	Construction Camps and Worksites	Limited use without amelioration.
Construction	Trenching	Separate excavated topsoil from subsoil material.
	Pipelaying and Backfilling	- Return excavated soil in same order as it was removed. - Add ameliorants to top of reinstalled subsoil (i.e. similar to rooting depth of vegetation).
	Reinstatement and Rehabilitation	Monitor for pH conditions and visible symptoms on reinstated vegetation, and ameliorate as required.
	Borrow Pits	Use only below soil surface, consider amelioration.
	Construction Camps and Worksites	Amelioration and monitoring required.
Operation	Reinstatement and Rehabilitation	Monitor for pH conditions and visible symptoms on reinstated vegetation, and ameliorate as required.

9.6.9 SHALLOW ROCKY SOILS

Soil Characteristics:

- Minimal soil present
- Can be identified by referencing contour information and soil mapping
- Conservation of available soil material is vital
- Importation of soil may be required for backfill and for rehabilitation
- Reinstatement of rock material as a mulch will help reduce erosion

SHALLOW ROCKY SOILS

SHALLOW ROCKY SOILS – KEY ENVIRONMENTAL ISSUES

- Minimal soil for disturbed area rehabilitation

SHALLOW ROCKY SOILS – ENVIRONMENTAL OBJECTIVES

SHALLOW ROCKY SOILS

1. Limit flow-on effects from reduced vegetation growth
2. Improve the success of rehabilitation

SHALLOW ROCKY SOILS – ENVIRONMENTAL MANAGEMENT**Related Standards and Guidelines:**

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	- Plan alignment to reduce length in rocky soils where possible. - Prepare SMP using available soil mapping. SMP should outline the soil types anticipated along the pipeline corridor and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes.
	Grading	Consideration must be given to equipment selection.
	Trenching	Consideration must be given to equipment selection.
	Pipelaying and Backfilling	- Separating rock material from soil may be required, with rock stockpiled for later reuse as mulch. - Crushing of rock may be required for padding material. - Provision for the importation of padding material may be required.
	Reinstatement and Rehabilitation	- Provision for the importation of topsoil may be required. - Re-spread rock may be useful mulch. - Local provenance species should be used in rehabilitation.
	Borrow Pits	Borrow pits may be suitable for use as a source of aggregate material for bedding.
Construction	Pipeline Easement Management and	- Retain as much soil material present as possible. - Where possible, separate soil from rock and stockpile rock for later re-spreading as mulch.

SHALLOW ROCKY SOILS

	Access	May need to utilise alternate methods to trenching (rocksaw, blasting, etc).
	Pipelaying and Backfilling	Padding material may need to be imported / crushed.
	Reinstatement and Rehabilitation	- Soil may need to be imported to establish vegetation for rehabilitation (must be certified weed and seed free). - Local provenance species should be used in rehabilitation. - A suitable watering regime of reinstated areas should be prepared to gain good rehabilitation outcomes.
	Borrow Pits	Borrow pits may be suitable for use as a source of aggregate material for bedding. Ensure provisions for borrow pits are in accordance with this Code.
Operation	Reinstatement and Rehabilitation	A monitoring plan shall be followed to ensure that rehabilitation of any areas disturbed during operations is successful.

9.7 DRAINAGE, EROSION AND SEDIMENT MANAGEMENT

Much of the Australian landscape is fragile, with ancient soils that are susceptible to wind or water erosion. Construction activities involving earthworks increase erosion risks by removing protective / stabilising features such as vegetation cover.

Drainage, erosion and sediment control are discussed as they relate to a particular construction activity, throughout this document, with additional guidelines considered in this section.



Erosion controls (berms and sediment fences) at a watercourse crossing. W. Mathieson

DRAINAGE, EROSION AND SEDIMENT MANAGEMENT

DRAINAGE, EROSION AND SEDIMENT MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Loss of topsoil and subsoils

DRAINAGE, EROSION AND SEDIMENT MANAGEMENT

- Siltation and sedimentation of land and water
- Reduced potential for rehabilitation success
- Long term stability of disturbed areas
- The requirement for costly rectification measures

DRAINAGE, EROSION AND SEDIMENT MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To minimise potential for soil loss and degradation, both on and off construction areas
2. To prevent adverse impacts on water quality

DRAINAGE EROSION AND SEDIMENT MANAGEMENT – ENVIRONMENTAL MANAGEMENT**Related Standards and Guidelines:**

See Appendix 4.

Phase	Activity	Management Measures
Planning	General Planning	• Installation of drainage, erosion and sediment control measures shall be in accordance with IECA Erosion and Sediment Control Guidelines. The pipeline should be risk assessed against the following provisions to determine the level of sediment and erosion control management that is required during construction: ○ natural and constructed drainage patterns ○ corridor soil types and erosion potential ○ corridor slopes ○ rainfall frequency and intensity ○ catchment size and, therefore, required capacity and coordination of control structures ○ existing vegetation cover ○ proximity to sensitive environments, particularly sedimentation leading to impact on water quality ○ land use impacts (e.g. cultivation and grazing). • A drainage, erosion and sediment control plan should be developed, applying best practice guidelines where appropriate, as part of the CEMP and OEMP document. • The CEMP and OEMP will usually require approval by

DRAINAGE, EROSION AND SEDIMENT MANAGEMENT

		the regulatory authorities as a pre-start condition of approval, and should document sediment and erosion control measures for specific locations and soil types along the pipeline corridor and at other project-related sites of disturbance. • Where practicable, pipeline route selection shall avoid highly erosion-prone soils and minimise exposure to areas of higher erosion risk generally, such as waterways. • Appropriate measures shall be developed to address wet weather considerations, including access and minimising soil erosion and sedimentation to waterways. • Consideration should be given to scheduling works outside known wet periods and allowing for wet periods in construction schedules.
	Pipeline Easement Management and Access	• Ground disturbance activities, including the creation of access tracks, shall not result in an uncontrolled sediment release to land or water. Planning consideration shall be given to adopting appropriate management actions including: ○ provision for storage of topsoil and spoil away from areas of surface water flow ○ diverting overland flows from disturbed areas ○ provision of space for larger sediment control structures (e.g. sediment basins) ○ minimising the number of watercourse crossings during route selection.
	Grading	• To minimise the risk of erosion and potential for site runoff, the period of time between grading and reinstatement shall be minimised.
	Horizontal Directional Drilling	• To avoid contaminated water or sediment leaving the site, sediment and erosion controls sized to contain site run-off shall be installed at drill pad sites, together with diversion structures that re-route uncontaminated overland flows from the adjacent area around the site.
	Pipelaying and	• Assess and manage the risk of subsurface water flow

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	Backfilling	and subsequent erosion of the backfilled trench. • Appropriate measures shall be employed to prevent obstruction of sub-surface water flows in side slopes (e.g. natural seepage zones) across the trench, such as the installation of trench breakers or permeable zones within the backfill adjacent to the seepage, or other forms of subsoil drainage. • Minimise length of time trench is open or pipe exposed. Backfill to commence as soon as is practical following pipelay.
	Borrow Pits	• Site layout plans identifying topsoil, vegetation and spoil storage areas, access tracks, excavation boundaries and borrow pit drainage controls shall be prepared prior to commencement of borrow pit operations.
	Open-cut Watercourse Crossings	• In the absence of official flow data, advice should be sought from the relevant landowner about the flow characteristics of potential waterway crossing locations. • Watercourse crossing sites will be located and designed in a manner which minimises scour potential e.g. the crossing location shall be at low velocity, straight sections, with the pipeline orientated as near to perpendicular to water flow as practicable. • Site layout plans detailing proposed drainage and sediment control measures shall be developed for significant waterway crossings. Crossings shall be designed to ensure that on-site drainage and sediment controls are capable of accommodating locally significant rainfall events.
	Construction Camps and Worksites	• Site layout plans shall be prepared during the planning phase identifying topsoil stockpile, vegetation stockpile and spoil storage areas, access tracks, excavation boundaries, and drainage and sediment control structures for all site offices, construction camps and temporary worksites.
	Reinstatement and Rehabilitation	• Rehabilitation of the pipeline construction area shall incorporate drainage, sediment and erosion control measures to manage surface water flows during site

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		re-establishment. - Where the pipeline is likely to cause or be affected by soil erosion, stabilisation works including diversion structures may be required. These may involve geotextiles, rock stabilisation, concrete lining, localised drainage modification or other site-specific measures as appropriate. - The period of time between backfilling and rehabilitation of the pipeline construction area shall be minimised to reduce the potential for erosion. - Site-specific or property-specific rehabilitation plans may be necessary for areas that require focussed reinstatement effort, (e.g. problematic soils, significant habitat or species). Rehabilitation plans should include: - Description of planned works, including an installation schedule - Site layout plan of rehabilitation works - The proposed inspection program and schedule - Anticipated ongoing maintenance measures.
Construction	Erosion Controls	- The first consideration when managing potential erosion is to adequately manage drainage, then to focus on erosion and sedimentation controls. - Installation of drainage and erosion control structures should be undertaken in accordance with the provisions of the drainage, erosion and sediment control management plan (e.g. table drains, erosion berms, silt fences). - Erosion control berms shall be designed and constructed in a manner which ensures discharge runoff water does not lead to erosion or sedimentation by incorporating the following design characteristics: - The focus should be on structures and measures that direct runoff away from exposed works, that avoid concentrating runoff, and that slow the pace of its flow - erosion control berm gradients shall closely follow land contours, to ensure low velocity

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		discharge away from the exposed soils ○ run-off water from erosion control berms shall be directed to the downslope side of the pipeline to prevent discharge water from crossing the pipeline construction area again ○ where necessary, the installation of erosion control berms shall coincide with the location of Trench Blocks to enable more effective water diversion • Erosion control berms and drains shall be constructed so as to permit traffic to move over them safely without destroying them. • Access track drains shall discharge run-off water in a manner which does not lead to sedimentation or erosion, i.e. low gradient run-off, broad dish shaped outlets to appropriately stable areas (e.g. vegetated or rip-rap stabilised). • Erosion control structures shall be routinely inspected and maintained to ensure they remain effective (i.e. removal of silt build up, reinforcing or re-establishing failed structures), particularly before and after major rainfall events. • Appropriate measures shall be applied during all phases of construction to control drainage, erosion and sediment on the pipeline construction area (including above-ground infrastructure sites), work and camp sites as required. • Ground disturbance and vegetation clearing shall be minimised as far as practicable, to minimise areas of soil instability. • The period for which the soil is left exposed to erosion shall be minimised.
	Sediment Controls	• Sediment control structures may include: ○ sediment or silt barriers generally constructed from geotextile silt fence or filter fabric secured in place with star pickets or sand bags, concrete saddle weights or culverts ○ sediment basins or ponds which are

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		constructed downslope and are designed to catch and retain run-off water allowing sediment to settle out. • Installation of sediment control structures should be undertaken in accordance with the provisions of the drainage, erosion and sediment control management plan, which will usually have been approved by the regulatory authorities as part of the CEMP or OEMP. • Sediment control structures shall be regularly inspected and maintained to ensure they remain effective (i.e. removal of silt build up, replacement/re-installation of failed components such as straw bales and fencing), particularly after high intensity rainfall or run-off events.
	Discharge Water Erosion and Sediment Control	Wastewater discharge from construction activities (e.g. hydrotesting, trench de-watering or well-point de-watering) shall be managed in accordance with the following principles: • Where necessary, discharge water quality shall be monitored against relevant water quality standards prior to release and appropriate disposal options determined in consultation with relevant regulatory authorities and, if appropriate, the relevant landowner. • Soil erosion and sedimentation of land and water caused by the discharge of site pump-out water shall be prevented by: ○ applying inlet filters or screens on water uptake hoses ○ supporting the inlet hose above the sediment layer in the water ○ avoiding discharge directly to waterways where discharge water sediment loads significantly exceed that of the receiving waters ○ allowing for sufficient settlement to occur before discharging water ○ consideration of adding a flocculent and a filter or settlement basin to separate out the sediment prior to release

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		○ discharging water in a manner which does not result in flooding of land both on and off the pipeline construction area or run-off beyond the intended receiving area into waterways ○ discharging diverted watercourse water (i.e. flume and 'dam and pump' crossings) directly back into the watercourse over rip-rap protection downstream of the crossing ○ discharging trench and hydrotest water through sediment filters (e.g. hose outlet filters, geotextiles or straw bales) to remove solids ○ discharging water to holding or settling ponds to avoid erosion and permit sediment to settle out of the water column ○ discharging trench and hydrotest water to stable land through flow diffusers (e.g. spray bars) and energy dissipaters (e.g. rock rip-rap or geotextile filters/fabrics).
	Grading	● Graded topsoil shall be stockpiled separately from other materials (e.g. vegetation), where it can be readily recovered for re-spreading and where loss through wind or water erosion or other means will be minimised. ● Soil and surface stability shall be maintained at all times, e.g. cut and fill excavation shall be shaped to maintain slope stability and temporary erosion control berms, drains and sediment barriers shall be installed in accordance with the management plan and all structures and surfaces shall be maintained in as stable a state as is practicable until final construction reinstatement is completed.
	Trenching	● Consider the use of trench shoring as opposed to benching to reduce spoil generation in deeper trenches. ● Where well point de-watering is necessary to stabilise saturated soils (e.g. high water table areas such as floodplains), appropriate water quality management and erosion control measures shall be adopted for

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		discharge water. Erosion protection may include water discharge flow dissipaters, such as rock rip-rap, geotextiles or straw bales. • Appropriate management measures for drainage, sediment and erosion control shall be adopted when trenching in problem soil areas, e.g. salty or PASS soils. • Spoil stockpiles shall be located, formed, stabilised and protected so as to minimise loss of material through water or wind erosion. • Spoil stockpiles shall not impede natural or constructed surface drainage channels or access tracks unless appropriate diversion management measures are in place. • Erosion within the trench shall be prevented utilising trench plugs at appropriate intervals.
	Rehabilitation and Reinstatement	• Rehabilitation will be undertaken in accordance with the site rehabilitation management plan. • Drainage, sediment and erosion control measures will be installed to assist in diversion, stabilisation and management of anticipated surface water flows during site re-establishment. • The project disturbed areas shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features. • A low crown of soil mounded over the trench may be necessary to compensate for potential subsidence of trench soil (except in cultivation areas). Breaks in the crown at intersecting drainage lines will prevent the impediment or channelling of surface drainage and shall coincide with drainage and erosion control features. Post-construction monitoring of the reinstated pipeline alignment will pay particular attention to maintenance of these mound breaks. • During rehabilitation, cleared vegetation may be re-spread over the pipeline construction area or in filter strips, as an alternative or addition to erosion control berms. • Erosion and sediment control measures – such as diversion berms, geotextile matting, silt fences, straw

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		bales, and sediment basins - shall be installed as required, particularly on moderate to steep grades, as per best practice guidelines. Regular monitoring for trench subsidence shall be undertaken during the pipeline construction maintenance period and operations phases.
	Borrow Pits	Drainage, erosion and sediment controls will be implemented in accordance with the borrow pit layout plan and monitored regularly to ensure that control measures are operating effectively.
	Construction Camps and Worksites	Drainage, erosion and sediment control measures shall be installed in accordance with the approved plan in the CEMP and OEMP (or the approved site management plan if construction camps and work areas are not covered on the CEMP or OEMP) to prevent site run-off leading to erosion and sedimentation.
	Watercourse Crossings	- Utilise relevant erosion and sediment control guidelines and ensure appropriate monitoring to determine their ongoing adequacy. - Crossings shall be completed promptly in order to minimise exposure to weather events. - Diversion dams shall be constructed of appropriate materials which will minimise watercourse sedimentation, such as steel plates, sand bags or inflatable dams. Unprotected earthen dams shall be avoided. - Risk of erosion and sedimentation resulting from trenching adjacent to watercourses shall be mitigated by: - delaying grading of banks and slopes leading to watercourses until construction of the crossing is imminent, thus minimising erosion and sedimentation risk - ceasing trenching on approaches to wet watercourses and leaving hard trench plugs in place for the maximum period possible pending pipelaying - stockpiling excavated bank material at an appropriate distance from the watercourse or behind adequate stockpile berms

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		○ installing sediment and erosion control measures in accordance with the site layout plan (e.g. silt fences, sediment basins and erosion berms) on watercourse approaches and banks
Operation	Pipeline Easement Management	• During operational maintenance activities, erosion and sediment controls should be installed in accordance with best practice guidelines and should be routinely checked, especially following significant rainfall events, to ensure they are in good condition, are stable and are effective. Repair works should be undertaken as required. • Where erosion is occurring due to inadequate vegetation cover on the easement, the site should be reinstated and consideration should be given to revegetating the area or installing an erosion control device. Such work should be conducted in consultation with the landowner. • If significant erosion is encountered, erosion and sediment control structures should be installed and monitored. • Vehicle access should be restricted to stable ground where practicable. Additional care should be taken near watercourses and drainage lines. • The reinstated pipeline trench should be routinely checked for subsidence and exposure of pipe, particularly at watercourse crossings and drainage depressions after rainfall events. • Importation of material required for rehabilitation works should only be undertaken after consultation, and approval if required, with the regulator and the landowner; imported material should preferably be sourced locally and should be free of weeds, seeds and other contaminants. • Potential impacts associated with soil and ground stability should be monitored as part of a structured inspection and monitoring program.
	Watercourse Crossings	• Erosion and sediment controls should be installed and managed in accordance with best practice guidelines (see Appendix 4 for further guidance).

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		- Erosion control measures such as silt fences, berms and drains shall be appropriately maintained. Monitoring should note the condition of such measures and the need for remedial action. - Where required, designated crossing points should be used and the bed and banks maintained in a stable condition. - Should erosion and sedimentation occur, appropriate corrective actions should be undertaken (consideration to be given to permanent rather than temporary repair). This may include restoring bank profiles, reseeding slopes, replacing sandbags or gabions, installing additional silt fences or geotextile fabric or generally hardening the site with engineered structures.
Related Sections Flora Management Water Management Soils Management		



Erosion controls at a trench de-watering site. Ecos

9.8 WATER MANAGEMENT

Water is an important feature of the Australian environment. Pipeline operations should aim to minimise potential impacts on water quality and/or quantity. Such impacts may be associated with sediment loads to streams, the potential for spills of product or chemicals and the maintenance of appropriate surface and groundwater flow regimes.

WATER MANAGEMENT

WATER MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Reduction in water quality as a result of increased sediment load
- Contamination of surface or groundwater by product or chemicals
- Altered drainage patterns and water flow regimes
- Secondary impacts on flora and fauna as a result of altered water quality or quantity.

WATER MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To control and minimise the volume of sediment entering waterways from erosion, from the pipeline corridor, from associated project works or facilities or from operational activities
2. To prevent contamination of surface water, watercourses and groundwater
3. To manage surface water flows and to minimise potential adverse impacts associated with altered flow regimes
4. To minimise indirect impacts to flora and fauna, and direct impacts to riparian, aquatic and water-dependant flora and fauna

WATER MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Construction water sourcing options and any related approval requirements should be considered in planning documentation, including anticipated volumes and intended sources. • The requirement for holding dams should be determined at the project planning phase, including their indicative locations. • Requirements for and potential locations of holding dams should be discussed with the relevant landowner – to facilitate their post-construction re-

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		use, if permitted and appropriate, as farm infrastructure • Holding dams, if required, shall be located, constructed, managed and rehabilitated in accordance with the principles outlined for construction camps and work sites.
	Clearing	• Cleared vegetation shall be stockpiled away from watercourses and shall not be stored in or felled so as to land in watercourses. • At ecologically-sensitive watercourse crossings, mechanical slashers and extensive trimming shall be considered for use in site preparation, as an alternative to vegetation clearing.
	Grading	• Grading and stockpiling of soil shall not, as far as practicable, impede surface drainage or water flows. • Grading of watercourse beds and banks shall be minimised, leaving an undisturbed organic mat within the riparian zone, or delayed until construction of the crossing is imminent, thus minimising risk associated with sediment release into watercourses - refer to Section 6.10 Watercourse Crossings for detail. • When working through sensitive areas, consideration should be given to locating soil stockpiles in an adjacent, less sensitive area, so that the construction ROW width can be minimised. • Grading machinery and equipment have high weed transfer potential. It is essential to manage weed hygiene effectively, to conduct regular, thorough biosecurity inspections and to maintain biosecurity records.
	Trenching	• Where trench de-watering is required, approval may be required from the relevant landowner/ regulator • measures to protect receiving water quality may include the following: ○ Testing water prior to disposal to determine if it meets the relevant regulatory standards and / or ANZECC criteria ○ Containing and / or treating water onsite or removing water off-site for

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		treatment/disposal if it does not meet criteria for disposal on-site ○ Dewatering to stabilised ground via low dispersion methods to prevent erosion ○ Preventing discharges entering surface water bodies unless permitted by relevant authority ○ Use of sediment traps where required ○ Bunding of dewatering pumps to prevent fuel spill contamination.
	Hydrostatic Testing	• Prior to the commencement of hydrotesting activities, a hydrostatic testing program / procedure shall be prepared. • Where discharge water quality criteria apply and testing is required, testing should be undertaken using a suitably rigorous technique, such as by an accredited testing laboratory, and in accordance with relevant Australian Standards. • Water that does not meet discharge quality criteria shall not be released without the approval of the regulator, and should be given additional treatment sufficient for it to meet the discharge quality criteria.
	Borrow Pits	• Borrow Pits to be located away from recharge zones (hydraulic conditions) to prevent damage to groundwater sources.
	Construction Camps and Worksites	• Where practicable, camps and worksites (excluding Horizontal Directional Drilling sites and other water crossing construction sites) shall be located so as to not drain directly to major water courses, creeks or other surface water bodies.
	Watercourse Crossings	• For major crossings, hydrological and hydraulic modelling should be conducted to determine watercourse characteristics and determine the most appropriate methodology for construction. • Where flow data are not available, proponents should consult affected landowners over the flow characteristics of the water body. • Site-specific or type-specific watercourse crossing techniques shall be determined by the pipeline

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		proponent in consultation with relevant regulatory authorities following consideration of environmental sensitivities (natural and social). Schedulers shall remain vigilant regarding the likely onset of significant rainfall or flood events, receiving daily weather reports and subscribing to long range forecasts and flood warning services where relevant.
Construction	General	- Erosion and sediment controls should be implemented as per site-specific management plans, to protect water quality. - The removal and subsequent discharge of water from the pipeline corridor shall not result in erosion or pollutants (such as sediment, saline, contaminated or pH-modified water) being released to land or water outside of acceptable parameters. Water quality shall be monitored and appropriate discharge options adopted to ensure discharge water quality remains acceptable.
	Fuel and Chemical Management	Fuels, lubricants and chemicals, including drilling fluids, shall be stored and, where practicable, handled within containment facilities such as bunded areas or over leak proof trays, designed to prevent the release of spilled substances to the environment.
	Hydrostatic Testing	- Where practicable, test water shall be re-used for multiple test sections. - In the absence of specific approval conditions relating to its discharge, hydrotest water shall only be discharged or recycled for secondary uses, such as pasture irrigation or livestock watering, where its quality is within relevant statutory water quality guidelines - The use of environmentally-harmful chemical additives in the hydrotest water, such as corrosion inhibitors and biocides, shall be avoided where practicable. Appropriate treatment measures may be required when such chemicals are used, prior to discharge of the test water to the environment.
	Watercourse Crossings	See Section 6.10 for provision of construction management provisions to protect water quality at

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		watercourse crossings.
Operation	Pipeline Easement Management and Access	- During operational maintenance activities, erosion and sediment controls should be installed in accordance with best practice guidelines and should be routinely checked, especially following significant rainfall events, to ensure they are in good condition, are stable and are effective. Repair works should be undertaken as required. - Should erosion and sedimentation occur, appropriate corrective action should be undertaken (consideration to be given to permanent rather than temporary repair). This may include restoring bank profiles, reseeding slopes, replacing sandbags or gabions or installing additional silt fences or geotextile fabric. - Stability of the pipeline easement and, in particular, the condition of watercourse bed, banks and riparian vegetation should be inspected in accordance with an agreed inspection program. - Changes to the pattern of water flow should be monitored. Prior to installing any new surface control structures (such as berms or diversion drains) the implications for existing land use and downstream environments should be considered.
	Fuel and Chemical management	- The refuelling or maintenance of equipment, machinery and vehicles, should be conducted as far away as is reasonably practical from any surface water body, to reduce the risk of water pollution resulting from accidental fuel or oil release. - All chemicals used during operations shall be transported, stored, handled and disposed of in accordance with the requirements of the relevant dangerous goods and environmental legislation, industry standards and applicable Safety Data Sheets (SDS - previously known as Material Safety Data Sheets or MSDS). - Hazardous wastes shall not be stored or handled in areas that drain directly to any waterway or surface water.
Related Sections Flora Management Fauna Management		

WATER MANAGEMENT

Fuel and Chemical Management
 Soils Management
 Drainage, Erosion and Sediment Management

9.9 WASTE MANAGEMENT

During the construction and operation of a pipeline, domestic and industrial wastes such as waste oils, packaging, drums, timber skids, sewage, used lube oils and general refuse may be generated. Sewage and putrescible waste may also be generated from work sites, site offices and camps. All waste management practices and disposal methods must comply with the relevant State legislation and local planning requirements.

Opportunities for recycling shall be investigated throughout all phases of the pipeline lifecycle. There shall be a strong emphasis placed on housekeeping and cleanliness at all sites in order to promote safety and minimise environmental impact.

Historically, asbestos has been used as a constituent of pipeline coating. The removal of asbestos, in particular friable asbestos products, poses health risks to humans if the fibres are inhaled. Any material that contains more than 1 per cent asbestos by volume should be regarded as asbestos material. If repair or disposal of this pipeline coating type is required, appropriate safety measures and waste management protocols for asbestos handling and disposal shall be applied.

WASTE MANAGEMENT

WASTE MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Contamination of soil and water
- Health risks to the community and the workforce
- Adverse effects on native vegetation and wildlife
- Reduction of visual amenity
- Optimised opportunities for waste reuse or recycling
- Waste minimisation and appropriate disposal
- Impact on post construction land use

WASTE MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To avoid contamination of soil and water
 2. To minimise potential risks to workers and the public
 3. To minimise adverse effects on native vegetation, livestock and wildlife
 4. To minimise visual impacts
 5. To maximise the efficiency of resource use
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WASTE MANAGEMENT

6. To minimise health risks associated with waste management
7. To minimise environmental impacts related to waste management
8. To promote the principles of reduce, reuse and recycle

WASTE MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:		
See Appendix 4.		
Phase	Activity	Management Measures
Planning	Waste Management Plan	• Prior to the commencement of construction, waste management plans shall be developed, detailing the required waste management procedures and commitments to reuse and recycling for all waste-generating activities. • Waste management plans shall meet all necessary regulatory requirements and should be based on the following principles, listed in order of priority: ○ Reduce wastes at the point of use ○ Reuse materials where possible ○ Recycle wastes where practicable ○ Dispose of wastes appropriately and responsibly. ○ Consider alternative methodologies of avoiding and reducing generation of on-site waste. • Consideration should be given to Life Cycle Assessment of pipeline and facility items during the procurement phase, with preference assigned (subject to other considerations such as cost and availability) to goods with the least impact, when assessed from a whole-of-life perspective. • Consideration should be given during the planning phase to adopt a purchasing policy that encourages suppliers to reduce and/or collect packaging and supply recycled products where appropriate.
	Pipeline Easement Management and Access	• Waste streams should be identified during the planning phase and provision should be made to allow for appropriate on-site waste separation and management.

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	Blasting	Blasting refuse, such as containers, cartridges, caps and wire, shall be retrieved for disposal at an approved waste depot (note that requirements differ between jurisdictions).
	Hydrostatic Testing	Planning should include the review of beneficial re-use opportunities for hydrotest water.
Construction/ Operation	General	- Waste material shall not be left on-site or buried in the pipeline easement, unless such a disposal mechanism is approved by the regulator and supported by the relevant landowner. - Waste generated on site, including packaging waste, should be secured to prevent it blowing off-site. - Waste should be removed from site regularly and progressively to maintain good housekeeping practices. - Waste receptacles should be appropriate to the nature and volume of waste being produced on site and should be emptied regularly to prevent overloading or the overflow of waste materials.
	Solid Inert Wastes	Solid inert wastes associated with pipeline construction may include building rubble, concrete, bricks, timber, plastic, glass, metals, bitumen/ road base and tyres. Appropriate solid waste management shall be applied during construction and may include: - Stockpiling reusable and recyclable wastes, such as timber skids, pallets, drums, scrap metals, pipe transport spacers and tyres, for salvage. - Collecting and transporting general refuse to local, council-approved disposal sites. - Development of on-site collection and/or disposal areas, in accordance with regulatory requirements and in consultation with affected landowners. - Supplying designated collection bins at work sites for aluminium cans, glass and paper recycling (where recycling facilities are available). - Collecting and transporting general refuse to landfill sites approved by the local authorities.
	Liquid Inert	Drilling fluids shall consist of approved products or

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	Wastes (for use in trenchless construction)	synthetic lubricants, and shall be contained within the fluid circulation system (i.e. mud tanks, fluid pump system, drill point bell holes and drilling orifice) during drilling. Drilling fluids shall be recycled for use where practicable, or disposed of in accordance with regulatory requirements.
	Recyclable wastes	• Providing suitable collection points for reusable and recyclable wastes such as timber skids, pallets, drums, scrap metals and pipe transport spacers for salvage. • Recyclable waste products including timber, steel, plastics, etc should be reused and recycled where possible. • Where possible, appropriate and permitted, hydrotest water and pigging water discharge should be recycled for secondary uses, such as pasture irrigation or livestock watering.
	Construction camps and worksites	• Putrescible wastes are organic wastes able to be decomposed by bacterial action and may include discarded food, domestic garbage, commercial wastes and garden clippings. Appropriate putrescible waste management shall be applied during construction and may include: • Collection and transportation to a landfill approved by the relevant regulatory authority (usually local government). • On-site disposal at camp or work sites - I only in remote areas where storage and transportation to a registered landfill depot may lead to the creation of unacceptable health risks. • The pipeline construction area and associated camp, work and storage sites shall be maintained in an hygienic state free from the presence of exposed putrescible wastes. • Appropriate measures shall be taken to ensure litter accumulation is avoided, such as the provision of litter bins on-site and through regular site maintenance. Adequate resourcing should be provided to ensure waste receptacles are in

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		sufficient supply, and that their maintenance (emptying and cleaning) can be conducted as required. • Housekeeping should form a central part to project environmental inductions and toolbox meetings. • Site reinstatement shall include regular progressive removal of temporary infrastructure and wastes from site. • Soil suspected of being contaminated should be analysed, and if confirmed as contaminated, should be disposed of in a manner and to a location approved by the regulatory authorities and, if relevant, the affected landowner. • Sewage and sullage disposal shall be via approved septic systems, mobile chemical treatment systems or, alternatively, via municipal sewage treatment plants. • Recycled wastewater may be utilised for plant irrigation where water quality is within acceptable parameters for release.
	Fuel and Chemical Waste Management	Hazardous wastes are those which pose an immediate potential risk to human health and/or the environment. Such wastes, which are relevant to pipeline construction, may include: radiography or cleaning chemicals, waste oils, medical wastes or sewage. Management measures include: • Purchasing supplies in bulk containers, where practicable, to minimise packaging. • Managing hazardous wastes in accordance with all relevant regulatory requirements. Many hazardous wastes may also be declared as prescribed wastes under State or Territory legislation for which specific management requirements may be imposed (e.g. waste inventories, tracking systems and permitting). • All waste chemicals and other toxic materials shall be stored and collected for safe transport off-site for reuse, recycling, treatment or disposal at locations approved by relevant regulatory authorities. • Hydrocarbon wastes, including lube oils and oily sludge's, shall be collected for safe transport off-site

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		for reuse, recycling, treatment or disposal at approved locations. • Hazardous waste storage areas must be suitably designed to adequately contain any spills & leaks (e.g. bunded in accordance with statutory requirements). • The potential for soil contamination (e.g. loading bay drain/PIG trap contents, oil/fuel spills) must be managed according to the location, concentration of contaminants, the potential to leach and the extent of the potentially- affected area. Appropriate disposal options shall be determined in consultation with the relevant environment protection authorities and, if relevant, affected landowners. • Management of hazardous liquid wastes such as radiography or cleaning chemicals and waste oils shall comply with relevant regulatory requirements. Management measures include: ○ safe storage prior to collection and transport off-site for reuse, recycling, treatment or disposal at locations approved by relevant regulatory authorities ○ storage areas must be suitably designed to contain any spills and prevent contamination of soil or water (e.g. bunded or otherwise contained in accordance with statutory requirements). • Suppliers shall be asked to accept returned used or exhausted hazardous materials that they originally supplied, or should be required to accept the used or exhausted materials they are proposing to replace with new.
	Asbestos	• Asbestos should be processed and handled in accordance with regulatory requirements. Generally, management measures include: ○ a licensed contractor should be used to collect and dispose of asbestos ○ asbestos must be handled so as to minimise release of fibres or dust to the air. Where

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		possible, the asbestos should be wet when handled, in order to prevent dust being released ○ Appropriate PPE should be worn (gloves, face mask) at all times when in the presence of asbestos, with disposable full-body suits to be worn if exposure is constant ○ collected material should be placed in polythene bags (0.2mm thick) or double-wrapped in sheets of polythene. Packages should carry an asbestos warning label ○ owners of vehicles transporting asbestos may be required to hold a waste transport permit. This requirement should be checked with the regulatory authorities. ○ vehicles must be carefully cleaned following asbestos transport ○ asbestos shall only be disposed of at an appropriately licensed site. ● Soil with an asbestos content equal to or greater than 1 per cent by volume should be regarded as a hazardous waste. Protection and management measures as outlined above should be applied.
Related Sections Fuel and Chemical Management Dust and other Air Emissions Management Soils Management Biosecurity Management		

9.10 NOISE MANAGEMENT

Construction activities will generally cause temporary increases in local noise levels, however the progression of the construction crew along the linear construction corridor results in construction noise impacts being transient at any one location.

During operation and maintenance activities on the pipeline, noise emissions may be generated by:

- vehicles and machinery travelling along the pipeline easement and access tracks
- activities such as earthworks and vegetation management
- maintenance at above-ground sites

- gas vented from pressurised equipment
- equipment noise at above-ground sites.

Noise emissions, in particular those with tonality, modulation or impulsiveness, may adversely impact local residents. All plant and facilities should be designed and operated to comply with relevant State noise regulations and *Australian Standard AS 1055 – Acoustics*.

This section outlines management measures to avoid or attenuate construction noise where there is a potential for it to result in impacts to sensitive receptors.

NOISE EMISSIONS

NOISE EMISSIONS – KEY ENVIRONMENTAL ISSUES

- Disturbance to local residents and other land users
 - Disturbance to livestock and wildlife
-

NOISE EMISSIONS – ENVIRONMENTAL OBJECTIVES

1. To minimise construction and operational noise impacts on adjacent residents and other land users
 2. To minimise construction and operational noise impacts on wildlife and livestock
-

NOISE EMISSIONS MANAGEMENT

NOISE EMISSIONS MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	Residents/Noise complaints	• Preparation of a noise assessment of the proposed activities shall be undertaken for inclusion in planning documentation. • Where practicable, excessively noisy activities shall be scheduled for periods that are less likely to result in a noise nuisance. • Areas where the pipeline corridor will be in close proximity to sensitive receptors (residences, wildlife habitat) shall be identified during the planning phase and provisions shall be considered to minimise noise emissions during construction. • A noise complaints management procedure shall

NOISE EMISSIONS MANAGEMENT

		be developed during the planning phase, and implemented as part of the CEMP and OEMP (note that some regulatory jurisdictions have mandated complaints handling procedures. - Landowners and local residents shall receive adequate notice of all noisy activities associated with the project, prior to their commencement. - Where vibration is likely to be an issue, dilapidation surveys shall be undertaken to record pre-construction condition of buildings in proximity to work areas that might be affected.
	Pipeline Easement Management and Access	Access to the pipeline easement shall be conducted in a manner that adequately considers potential noise or vibration impacts. In some areas, access, particularly for heavy vehicles and equipment, may need to be restricted to specific times as determined in consultation with local authorities or landowners.
	Pipe Stringing	Appropriate measures shall be taken as required to minimise pipe transport-related noise.
	Blasting	Blasting program design shall conform to the appropriate noise, comfort and vibration criteria applicable in the relevant jurisdiction. Note that most jurisdictions require advance warning of blasting activities to be given to affected stakeholders.
	Pipeline Purging	- Adjacent residents shall be advised of pending venting operations prior to their occurrence. - Gas vents shall be located at an appropriate distance from residential areas and infrastructure, in accordance with relevant regulatory requirements.
	Borrow Pits	Borrow pit location should be away from sensitive receptors and extraction activities should be scheduled for standard working hours.
	Equipment	Equipment should be selected in consideration of its noise emissions. Where practicable, equipment should be selected that is likely to result in the lowest noise impact whilst still

NOISE EMISSIONS MANAGEMENT

		completing the required task. Equipment shall be fitted with appropriate noise abatement devices (e.g. mufflers, silencers and screens) and shall be maintained in good working order.
Construction	Construction Operations	- Construction activities shall comply with all relevant regulatory requirements and guidelines pertaining to noise control. - Monitoring of construction noise should be conducted at locations of sensitive receptors, to validate noise propagation predictions and to validate requests from the sensitive receptors, if any, for additional noise reductions measures - Where construction is adjacent to residences, noisy construction activities shall be undertaken within standard construction hours, except where unavoidable for practical reasons or agreement is obtained from affected residents. Affected residents shall be advised in advance of loud construction activities⁷. - As part of noise management procedures in the CEMP and OEMP, noise complaints should be registered and investigated as soon as possible following its receipt. Remedial action should be undertaken as indicated by the complaint investigation, and the complainant should be advised of the proponent's response to their complaint.
Operation	Management of Pipeline Facilities	- Noise-generating equipment, such as generators, shall be located at appropriate distances from residences, and/or within noise enclosures if necessary. - Noise attenuation screens shall be provided where appropriate. - Noise from pipeline facilities shall be within acceptable regulatory limits and be subject to a monitoring program to ensure that noise

⁷ State or Local government requirements, such as the Qld EPA, may also apply

NOISE EMISSIONS MANAGEMENT

		emissions are within acceptable limits. • A complaints management system will be applied to operations just as for construction. Any noise complaint received should be registered and investigated as soon as possible following its receipt. Remedial action should be undertaken as indicated by the complaint investigation, and the complainant should be advised of the proponent's response to their complaint.
Related Sections Dust and other Air Emissions Management		

9.11 DUST AND OTHER AIR EMISSIONS MANAGEMENT

Due to the nature of pipeline construction activities involving earthworks, dust emissions, plant and equipment exhaust emissions and hazardous materials' vapour emissions may result. Dusty conditions result from the exposure of soils, therefore many control measures relevant to erosion and sediment control are also relevant to dust control (refer to Section 9.7 Drainage, Erosion and Sediment Control). This section details air emission and dust prevention and suppression measures which aim to minimise air emission levels and ensure they do not exceed acceptable limits.

Air emissions from planned gas pipeline operations are generally small in quantity. Emissions that may have an adverse effect on air quality include:

- the intentional release of natural gas during pipeline purging to allow certain maintenance activities
- the products of combustion (particularly nitrous oxides) associated with flaring
- the accidental release of odorant or of odorised gas
- vehicle and machinery exhaust emissions
- emissions from generators supporting on-site works, site camps or offices
- dust blown off un-vegetated lengths of the pipeline alignment.
- dust emissions from vehicle and equipment movement

DUST AND OTHER AIR EMISSIONS

– KEY ENVIRONMENTAL ISSUES

- Odour emissions
- Temporary reduction of amenity associated with dust
- Soil erosion and sedimentation of land and water
- Depletion of water resources
- Impacts on sensitive flora and fauna
- Inconvenience to sensitive receptors such as residents and construction workforce
- Generation of greenhouse gases and other reportable emissions

DUST AND OTHER AIR EMISSIONS – ENVIRONMENTAL OBJECTIVES

1. To minimise impacts on the community and the construction workforce
2. To minimise impacts on land, water and air quality
3. To minimise impacts on flora and fauna
4. To reduce water use
5. To reduce emissions across the project, particularly those that are reportable
6. To minimise the creation of emissions-related safety hazards

DUST AND OTHER AIR EMISSIONS – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:		
See Appendix 4.		
Phase	Activity	Management Measures
Planning	General considerations	• Dust suppression strategy shall plan for prevention and avoidance of dust generation in the first instance, before consideration of dust suppression measures • Existing climate and conditions should be evaluated to determine the most appropriate dust suppression methodology, having regard to limited water resource availability in dry climates or drought conditions. • Planning should include investigation of ground engineering products as part of the dust

DUST AND OTHER AIR EMISSIONS

		suppression strategy. • Water supplies for dust suppression should be identified during the planning phase. • Provision should be made to monitor emissions through the construction period, to enable effective management. This should include accounting for all on-site emissions. • Consideration should be given to adopt a purchasing policy that encourages procurement of reduced- emission vehicles, machinery, equipment and plant items.
	Pipeline Purging	• The planned release of gas from pipelines, including flaring of purged gas, shall be minimised for economic and greenhouse gas emissions reasons, and in compliance with any applicable approval conditions. • Where practicable, planned gas releases, including flaring of purged gas, shall be conducted under favourable meteorological conditions that will facilitate rapid atmospheric dispersion of the gas. • Gas vents shall be located an appropriate distance from residential areas and infrastructure, in accordance with relevant regulatory and Australian Standards requirements. • Adjacent residents and local authorities shall be advised of any pending venting operation prior to commencement of the activity.
Construction	Construction Operations	• Vehicles shall travel at appropriate speeds to minimise generation of dust - generally a maximum speed of 20kph over unsealed site roads and tracks, at work and camp sites, and at the pipeline construction area, is appropriate. • To minimise the generation of dust, traffic movements on the RoW shall be minimised to essential movements only in dry conditions • Known sources of air emissions shall be identified, and treated by an appropriate

DUST AND OTHER AIR EMISSIONS

		mitigation measure, such as location away from sensitive receptors, strict use of suppression measures, covers or seals, location downwind of receptors, etc. • Road surfaces shall be constructed of materials that minimise dust creation, particularly if frequently trafficked and adjacent to residences. • Multiple plant or equipment close to sensitive receptors may need to be monitored for exhaust emissions as well as noise production. • Plant and equipment to be maintained to minimise emissions. Any plant releasing heavy emissions should be removed and serviced immediately. • Minimise ground disturbance through retaining existing groundcover vegetation where possible. • Water should be applied to exposed soils, as required, to prevent dust generation. Water supplies shall be of an appropriate quality and should not lead to soil contamination (e.g. through use of saline groundwater or contaminated waste water). • In heavily-trafficked areas, or where water resources are scarce, reduced speed limits or the use of dust stabilisers may be employed. In problem areas it may be appropriate to remove additional soil layers down to the harder subsoils. • In areas of stony soils, trench spoil can be sieved into soil and stone fractions, with the soil used for backfill, and the stone fraction applied to road surfaces as a dust suppressant • Appropriate signage should be installed where dust conditions are high and in proximity to adjacent public roads. • Dust generated from soil stockpiles shall be minimised. Effective mechanisms include ensuring exposure time is minimised, applying water, covering stockpiles with protective materials such as hessian or tarpaulins, or by

DUST AND OTHER AIR EMISSIONS

		applying polymers or sowing sterile grass as a longer term stabiliser on stockpiles or exposed slope batters. • If normal methods of dust stabilisation fail to suppress dust created by particular activities to acceptable levels, those particular activities may need to be temporarily halted until either dust generating conditions subside or an alternative, less dusty form of the activity is identified, or additional methods of dust stabilisation are identified and effectively applied.
	Blasting	• Monitoring of noise, vibration and dust resulting from controlled blasts should be conducted in areas where sensitive receptors are impacted.
	Reinstatement and Rehabilitation	• Progressive reinstatement shall be undertaken to reduce the distance of open RoW and associated potential for dust generation.
Operation	Pipeline Easement Management and Access	• If dust problems still occur at particular sections of the easement, the following measures should be adopted as appropriate: ○ revegetate using existing species and prevent access until vegetation is established ○ ensure speed limits are appropriate and being observed ○ minimise vehicle movements or harden road surfaces ○ use geotextiles, hessian or mulched vegetation on localised areas ○ if available, spray water on the problem areas. • In areas of heavy "bulldust", the easement may be stripped and the more stable subsurface watered to provide a firm base (although this may not always be possible for very deep bulldust)⁸.

⁸ Soybean oil soapstock, a by-product of the soybean oil production process, is an environmentally friendly, biodegradable material used in some overseas dust suppression situations, exhibiting much longer effective life than water. When used

DUST AND OTHER AIR EMISSIONS

	Management of Pipeline Facilities	• Pipeline licensees should maintain an accurate record of operational emissions. • Where technically and economically feasible, natural gas should be flared rather than vented. • Any venting should be conducted in compliance with the requirements of AS 2885.3 • Where required, odourisation of gas (i.e. mercaptan dosing) should be undertaken in a manner that minimises the risk of accidental release of odourant. Odouring equipment should be appropriately maintained and waste materials should be disposed of in a manner which minimises opportunities for uncontrolled odour releases.
	Pipeline Spill Prevention and Response	• Periodic leakage surveys shall be conducted to detect fugitive gas releases from the pipeline, and any reports of gas odours in the vicinity of the project works shall be investigated as a priority. • In the case of a spill of odourant, it should be controlled and cleaned up in accordance with its Safety Data Sheet, and the approved OEMP spill response procedure.
Related Sections Waste Management Noise Management		

9.12 VISUAL AMENITY MANAGEMENT

Visual amenity is a measure of the visual quality of a landscape, area or site experienced by the residents, workers or visitors. It is the cumulative impacts on the visual components of a locality that visual amenity is judged upon. Visual amenity is an intrinsic component of the planning and assessment elements of all pipeline projects.

Proponent assessment of visual amenity should consider the following factors:

- Temporary activities and infrastructure associated with construction

at suggested levels, this material does not migrate into the groundwater nor harm agricultural crops. At the time of writing the authors were not aware of its use in Australian situations, and proposals for use may attract regulator and / or community scrutiny

- Long term activities and infrastructure associated with operations
- Short term activities associated with operational maintenance of the pipeline
- Short term activities and infrastructure associated with decommissioning

VISUAL AMENITY

VISUAL AMENITY – KEY ENVIRONMENTAL ISSUES

- Presence of workforce and ground disturbance activities
 - Project visual impacts and modification on existing viewscape
 - Re-instatement and rehabilitation of existing environment
-

VISUAL AMENITY – ENVIRONMENTAL OBJECTIVES

1. To minimise impact on sensitive receptors
 2. To minimise visual changes to the viewscape
 3. To ensure rehabilitation and re-instatement following construction minimises permanent visible change as far as is practicable
-

VISUAL AMENITY MANAGEMENT – ENVIRONMENTAL MANAGEMENT
Related Standards and Guidelines:

See appendix 4.

Phase	Activity	Management Measures
Planning	Pipeline Easement Management and Access	• Utilisation of existing roads, tracks and areas of disturbance where practicable. New access tracks and roads should be designed and constructed to avoid or minimise visual impacts in sensitive areas. Mitigation may include screening to minimise line of sight.
	Clearing	• Relevant stakeholders and landowners shall be consulted during the planning phase to identify aspects of visual amenity that are valuable to them. These shall be avoided by the construction works as far as is practical. • Consideration should be given to retention of significant vegetation patches or individual trees within the approved corridor, where there are significant visual amenity values to protect.

VISUAL AMENITY

		In the case of protected or retained vegetation within the pipeline construction corridor, where there are significant natural, heritage or visual amenity values to protect, the vegetation shall be flagged for avoidance.
	Reinstatement and Rehabilitation	- Pre-construction survey may include establishment of the visual landscape prior to construction. This survey can include photographs and GPS references for benchmarking post rehabilitation. - Appropriate methods of reinstatement shall be planned to reflect the surrounding environment. Rehabilitation plans should consider creating a positive visual outcome where possible.
	Borrow Pits	Borrow pits shall be located in a manner which minimises aesthetic impacts, e.g. shielded by vegetation or landforms, or situated away from public areas.
	Construction Camps and Worksites	Where practicable, sites shall be located in a manner which minimises visual impact and where casual viewing likelihood, such as from a passing road, is reduced.
Construction	Pipeline Easement and Access	Site-specific screening plantings may be necessary at critical viewing locations where unacceptable visual impacts are evident, e.g. some road crossings or above-ground pipeline facilities such as scraper stations.
Operation	Management of Pipeline Facilities	- Pipeline facilities shall be kept in a clean and tidy condition. Where visual treatments, such as painting or screening by vegetation or other means, were applied during construction, such treatments shall be maintained in an effective condition. - In residential areas, or areas used for tourism or for social or leisure pursuits, changes to visual presentation of the project should be considered from time-to-time and new measures adopted where necessary. Examples of such changes could include refreshment of natural screens, repainting, recolouring, etc.

VISUAL AMENITY
Related Sections

Flora Management

Traffic Management

Waste Management

9.13 TRAFFIC MANAGEMENT

Traffic assessment and management is an important component of pipeline planning and construction as pipeline projects have the potential to significantly alter local traffic regimes. Potential negative impacts on local traffic regimes can occur during:

- Transportation of pipe sections along the road network to storage areas or the RoW
- Mobilisation and demobilisation of construction machinery, equipment and camps
- Construction activity at or near road crossings
- Movement of the construction workforce between construction sites and accommodation facilities.

Local amenity and air quality can be adversely affected by project vehicle and plant movements, particularly during the construction phase. A traffic management plan can include site-specific mitigation measures aimed at reducing the overall impact of increased traffic volumes and variations in normal traffic conditions.

TRAFFIC MANAGEMENT

TRAFFIC MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Safety hazard resulting from increased traffic
- Traffic impact on flora, fauna and cultural heritage
- Soil erosion and degradation on the RoW and on access tracks
- Reduction in air quality and visual amenity
- Increased noise and vibration from increased traffic

TRAFFIC MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To minimise sensitive receiver amenity and air quality impacts from traffic
 2. To minimise disturbance from traffic to flora, fauna and cultural heritage
 3. To minimise soil erosion and degradation
 4. To minimise unnecessary traffic movements
 5. To work with road authorities, councils and communities to develop appropriate traffic management strategies
-

TRAFFIC MANAGEMENT

TRAFFIC MANAGEMENT – ENVIRONMENTAL MANAGEMENT

Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management Measures
Planning	General considerations	• A traffic management plan should be produced outlining assessment of the most effective methodology for construction logistics (transport of equipment, plant, materials including pipe, work force etc.). This should be undertaken in consideration of the transportation network surrounding the proposed pipeline corridor and outline any restrictions (e.g. structures with height or weight restrictions, unsuitable roads, etc.). • Pipe transport routes, including utilisation of existing roads and tracks, shall be determined in consultation with relevant stakeholders, e.g. regulators, landowners and communities, with a view to minimising hazards, road damage and adverse impacts. • Access/egress points to the RoW should be well planned with turning areas, temporary stockpiles and other areas of additional workspace being identified during the planning phase. • Preference should be given to using existing roads, tracks and areas of disturbance where available. • Application of relevant legislative and design requirements where appropriate. Pipeline access shall be designed and maintained to accommodate the intended construction traffic volume. • Any vegetation removal associated with new access or widening of existing access must be assessed during the planning process and will be included in the calculations required to scope any necessary project offsets.
Construction	Pipeline Easement Management and Access	• Appropriate measures shall be employed to prevent surface damage to public roads, e.g. limiting dirt track access during wet weather and protecting bitumen surfaces where tracked

TRAFFIC MANAGEMENT

		machinery is required to cross roads. - Where vehicles are required to cross existing utilities (e.g. pipelines, fibre optic cables) permits may be required and protective measures such as berming or bridging may be necessary, particularly on above-ground utilities, in consultation with the utility owner. - Appropriate measures shall be applied to ensure vehicles remain on designated access roads and tracks, and within defined pipeline construction areas and associated work/camp sites, e.g. worker inductions and tool box talks, signs, boundary markers and fences, strictly enforced non-compliance measures. - Vehicles shall travel at safe speeds that minimise dust generation and access track deterioration. - As a general rule, gates shall be left as they are found or as signposted. If closed gates are required to be opened for extended periods (e.g. convoy passage) they shall not be left unattended unless otherwise agreed with the landowner. - Vehicle parking shall be restricted to the pipeline construction corridor and other pre-designated areas. - Parking under trees shall be discouraged to prevent root zone soil compaction, to prevent root damage and to prevent impairment of water infiltration into the soil.
	Clearing	Cleared vegetation shall be stockpiled separately in a manner which does not impede vehicles.
	Grading	- Vehicles shall not drive on stockpiled topsoil. It is important to preserve the soil structure as far as is possible to gain good rehabilitation outcomes. - Stockpiled soil shall not impede the movement of vehicles across the pipeline construction area. Stockpile breaks shall coincide with designated access roads or tracks, fence lines and gaps in stockpiled vegetation.
	Pipe Stringing	Pipe shall be strung allowing gaps for the passage

TRAFFIC MANAGEMENT

	and Welding	of vehicles between the line of pipe. Gaps shall coincide where possible with access roads or tracks, stock and wildlife trails, boundary fences and gaps in stockpiled vegetation. Welded pipe sections (pipe strings) shall not impede vehicle passage. Gaps shall be left which coincide with the gaps in the topsoil and vegetation stockpiles, designated access tracks/roads and fence lines, and shall be located in consultation with relevant landowners.
	Watercourse Crossings	- Access tracks and roads shall, where practicable, avoid crossing waterways. Where necessary, water course crossings shall be: - via existing crossings - on a formed track through the stream bed within the pipeline construction area corridor at dry waterway crossings (e.g. ephemeral streams). However, access shall be limited, where practicable, to vehicles and equipment essential to construction at the site, or - via culvert causeways, bridges or other such crossing structures.
	Construction camps and worksites	- Site camps and worksites shall be constructed in accordance with the site layout plan. - Sufficient parking and turning space shall be provided around construction camps and worksites away from areas of native vegetation.
	Reinstatement and Rehabilitation	Compaction relief shall be undertaken as required by ripping or scarifying soils along the contours, particularly on heavily-trafficked areas such as the pipeline construction work site, temporary access roads and turning circles, and in trafficked areas of camps and work sites. Figure eight or zigzag rip lines may be appropriate in flat to low gradients to prevent rilling.
Operation	General Provisions	- Any on-easement access will be in accordance with the provisions of the OEMP. - Vehicle parking shall be restricted to designated

TRAFFIC MANAGEMENT

		areas. • Parking under trees shall be discouraged to prevent root zone soil compaction, to prevent root damage and to prevent impairment of water infiltration into the soil.
Related Sections Noise Management Dust & other Air Emissions Management Weed Management Biosecurity Management		

9.14 FUEL AND CHEMICAL MANAGEMENT

The use and storage of oils, fuel and chemicals on-site can pose a threat to the environment and personnel if not managed properly. Management procedures must be put in place prior to the introduction and use of any chemical on the pipeline easement or associated facilities.

Control of these substances, from both environmental and safety aspects, relies primarily on the selection of chemicals that pose less risk to the safety of employees or the environment. Emphasis is then placed on the safe and secure transport, storage and application of chemicals to prevent harm to the environment, and on effective response capacity should spills occur.

FUEL AND CHEMICAL MANAGEMENT**FUEL AND CHEMICAL MANAGEMENT – KEY ENVIRONMENTAL ISSUES**

- Contamination of soil and water, including ground water
- Safety and health hazards to the workforce and the public
- Air and odour emissions

FUEL AND CHEMICAL MANAGEMENT – ENVIRONMENTAL OBJECTIVES

1. To prevent contamination of soil and water
2. To avoid unacceptable safety or health hazards to the workforce and the public
3. To minimise atmospheric emissions

FUEL AND CHEMICAL MANAGEMENT – ENVIRONMENTAL MANAGEMENT**Related Standards and Guidelines:**

FUEL AND CHEMICAL MANAGEMENT

See Appendix 4.		
Phase	Activity	Management Measures
Planning	General provisions	▪ Detailed spill response procedures, for land and water, shall be formulated during the project planning phase; these are to be supplemented, using applicable Safety Data Sheets (SDS), if / when additional fuels or chemicals are proposed to be introduced to the site during construction or operations. ▪ Central and field refuelling locations shall be planned so as to minimise the environmental impacts of spills. ▪ Targeted workforce training shall be conducted in fuel and chemical handling, spill response and materials recovery procedures for land and water. ▪ Appropriate fuel and chemical handling procedures shall be adopted, aiming to avoid spills onto land or into water (e.g. use of spill mats), and to reduce handling hazards to project personnel. ▪ Induction will include training as required on appropriate fuel and chemical handling procedures developed for the project. ▪ Provision should be made to allow for deployment of appropriate spill response equipment, including containment and recovery equipment, to be readily available on-site close to active work fronts, maintenance areas and site offices.
Construction	Pipeline Easement Management and Access	• The storage and handling of fuels and chemicals shall comply with all relevant legislation and <i>Australian Standard AS1940 – The storage and handling of flammable and combustible liquids</i>. • SDS should be obtained when purchasing chemicals and should be available on-site for all chemicals stored and handled. Persons handling chemicals shall wear PPE as designated in the applicable SDS, and shall be provided with appropriate training. • The minimum practicable volume of chemicals should be stored on-site. • Chemicals use should be minimised where

FUEL AND CHEMICAL MANAGEMENT

		practicable.
	Pipe Stringing and Welding	Associated consumables such as cleaning solvents, primer and dangerous goods shall be suitably stored in accordance with the applicable SDS.
	Hydrostatic Testing	The use of environmentally-harmful chemical additives in the hydrotest water, such as corrosion inhibitors and biocides, shall be avoided where practicable. Spent hydrotest water may need to be held for testing and treatment before release to land.
	Construction camps and worksites	- Fuels, lubricants and chemicals shall be stored in accordance with their SDS and, where practicable, handled within containment facilities (e.g. bunded areas, leak proof trays) designed to prevent their release to the environment. - SDS should be obtained when purchasing chemicals and should be available on-site for all chemicals stored and handled. Persons handling chemicals shall wear appropriate PPE, as defined in the applicable SDS and shall be provided with appropriate handling and usage training. - The minimum practicable volume of chemicals should be stored on-site. - Chemical use should be minimised where practicable. - Adequate PPE must be on-site to allow for the handling of fuel and chemicals stored on site.
	Spill Prevention and Response	- Spill response kits will be adequately provisioned and maintained, and positioned sufficiently close to active construction activities to enable effective deployment in the event of a fuel or chemical spill. - If a fuel or chemical spill occurs outside a bunded area, spill response procedure must be followed to control, isolate and remediate the spill. - An inventory of spill response kits, their contents and location should be prepared and maintained throughout construction. - Toolbox meetings should include regular attention to spill response processes, to ensure that work crews are

FUEL AND CHEMICAL MANAGEMENT

		refreshed and understand spill response procedures and subsequent reporting requirements. ▪ Spill response drills should be conducted when and where appropriate (for example, when a new chemical or fuel is introduced to the site, when there are numbers of new personnel, etc)
Operation	Management of Pipeline Facilities	▪ The storage and handling of fuels and chemicals shall comply with all relevant legislation and <i>Australian Standard AS1940 – The storage and handling of flammable and combustible liquids</i>. ▪ Fuels, lubricants and chemicals shall be stored in accordance with their SDS and, where practicable, handled within containment facilities (e.g. bunded areas, leak proof trays) designed to prevent releases to the environment. ▪ Where practicable, fuels and chemicals shall not be stored or handled in the vicinity of natural or built waterways or water storage areas (e.g. streams, canals, dams, lakes). ▪ Areas for storage of liquids such as oil or pipeline liquids should be bunded and drains from bunds kept clear of foreign material.
	Spill prevention and response	▪ Spill response kits will be adequately provisioned and positioned at permanent facilities and during repair or maintenance works, to enable their effective deployment should a fuel or chemical spill occur. ▪ If a fuel or chemical spill occurs outside a bunded area, spill response procedure must be followed to control, isolate and remediate the spill. ▪ An inventory of spill response kits, their contents and location should be prepared and maintained. ▪ Toolbox meetings should include regular attention to spill response processes, to ensure that work crews are refreshed and understand spill response procedures and subsequent reporting requirements. ▪ Spill response drills should be conducted when and where appropriate (for example, when a new chemical or fuel is introduced to the site, when there are numbers of new personnel, etc).

FUEL AND CHEMICAL MANAGEMENT
Related Sections

Water Management

Waste Management

Pipeline Failure and Response

9.15 FIRE RISK MANAGEMENT

Pipeline construction activities have the potential to temporarily increase the risk of bushfires. Although bushfire risk in relation to pipeline construction is considered low, there are two primary issues for consideration: Firstly, the potential for construction activities to generate a bushfire, and secondly, the potential for bushfires to impact on the pipeline or associated infrastructure, assets or activities.

Considering pipeline operations and maintenance activities, generally, the risk of fire ignition and spread is considered low.

Potential bushfire ignition sources associated with pipeline construction are predominantly cutting, welding and grinding activities, as well as the operation of equipment (e.g. petrol driven pumps) or vehicles in high fire hazard areas or on days of extreme fire risk. In areas of rocky soil, grading, slashing or bulldozing operations can also cause sparks and an increased fire risk.

This section provides guidelines for conducting pipeline construction, operational or maintenance activities in a manner which minimises fire risks.

It should be noted that the residual risk after application of risk minimisation strategies can still be high if proposed for days of Extreme Fire Danger (referred to as Catastrophic in some jurisdictions) and any planned activities within the pipeline corridor on such days, or days designated for a Total Fire Ban, should be separately risk-assessed prior to their commencement.

FIRE RISK MANAGEMENT

FIRE RISK MANAGEMENT – KEY ENVIRONMENTAL ISSUES

- Injury to the public or project personnel
- Damage to, or loss of, flora, fauna or habitat
- Loss of, or damage to, primary industry production
- Loss of, or damage to, homes or property
- Damage to, or loss of, third party infrastructure

FIRE RISK MANAGEMENT – ENVIRONMENTAL OBJECTIVES

FIRE RISK MANAGEMENT

1. To minimise the risk of fire ignition
 2. To prevent the spread of fire in the event of ignition
 3. To protect the public and project personnel
 4. To minimise damage to, or loss of, private or public property or third-party infrastructure
 5. To minimise damage to, or loss of, flora, fauna or habitats
 6. To provide adequate response in the event of ignition
-

FIRE RISK MANAGEMENT – ENVIRONMENTAL MANAGEMENT
Related Standards and Guidelines:

See Appendix 4.

Phase	Activity	Management measures
Planning	Fire Prevention and Preparedness	• Measures to prevent and respond to fire incidents should be developed in the project planning phase in accordance with: ○ AS 2885 ○ fire prevention planning guidelines ○ advice from local fire response service providers ○ emergency preparedness and response planning. • Project planning should include provisions to address the risk posed by project personnel smoking, including the identification of no-smoking places and times, and the designation of smoking areas, as required. • Prior to the commencement of construction, consideration must be given to fire prevention and response based on a risk assessment of proposed activities. A fire prevention management strategy shall be incorporated into the CEMP, and shall include bushfire prevention resourcing, emergency preparedness provisions, emergency contacts, equipment, fire watcher(s), response procedure and training (including drills), and shall be linked to the Project's safety and emergency response procedures. • Responsibility for maintaining the fire prevention

FIRE RISK MANAGEMENT

		management strategy shall be allocated. • Regular and timely consultation shall be undertaken with all relevant regulatory authorities and fire / bushfire services, and planning will ensure compliance with relevant fire restrictions, notification requirements, permitting procedures and requirements. • Fire risk management measures to be applied during the planning phase may include: ○ aligning the pipeline to avoid high fire danger areas ○ scheduling construction to avoid high fire danger periods. ○ allowing for postponement of construction in fire prone areas during extreme fire rating periods. ○ allowing for flammable material to be regularly cleared from around potential fire ignition sources. ○ planning for the use of tarpaulins or fire resistant mats at welding or grinding stations on days of high fire danger. ○ documenting procedures to ensure flammable materials are cleared from the immediate vicinity of field equipment which may pose a potential fire hazard e.g. petrol driven pumps, generators. ○ maintenance and operation of all machinery and equipment so as to comply with relevant fire safety standards thus minimising fire risk. ○ documenting a requirement that machinery and vehicles not in use shall be parked with the ignition off in areas free of flammable material and vegetation (e.g. not parked over shrubs, tall grass or cleared vegetation residue) ○ inclusion of undertray grass removal in vehicle management procedures. • Fire response preparation measures shall include:

FIRE RISK MANAGEMENT

		○ purchase, deployment and maintenance of appropriate fire fighting equipment at all work and camp sites in accordance with applicable fire safety regulations and associated risk analyses. ○ equipping construction machinery and vehicles with fire fighting equipment (e.g. fire extinguishers, water knapsacks, rakehoes) in accordance with the applicable fire safety regulations. ○ having fire control equipment, such as earthmoving machinery and water trucks or mobile tanks, available for fire control at the construction site during work operations in high fire risk areas or at times of extreme fire danger rating. ● Construction workforce bushfire education and training shall be undertaken as appropriate, detailing fire prevention and safety, instructions, personnel responsibilities and basic fire suppression techniques.
	Pipe Stringing and Welding	● Precautions shall be taken to minimise fire risk in accordance with the requirements of relevant fire protection legislation and regulations. ● Consultation with relevant local fire and emergency service authorities should also be undertaken to discuss high risk activities during months of heightened fire risk. ● Hot works permits and permits to undertake works may be required from project management or from local fire / bushfire or other authorities prior to commencement of welding, cutting or grinding activities, particularly on days of extreme fire danger rating or Total Fire Ban.
Construction	Clearing	● Stockpiling vegetation at the side of the pipeline RoW should be risk-assessed in terms of fire risk, and appropriate management measures applied as required.
	Pipe Stringing and Welding	● Pipe shall be strung, allowing gaps for emergency response access across the line of pipe. Gaps shall

FIRE RISK MANAGEMENT

		coincide where possible with access roads or tracks, stock and wildlife trails, boundary fences and gaps in stockpiled vegetation.
	Construction camps and worksites	Adequate and properly maintained fire fighting equipment shall be provided at camps and worksites. Fire breaks around offices and camps should also be installed and maintained, as required.
Operation	General Operation	- Pipeline operations and maintenance shall be conducted in accordance with the requirements of regulatory and local fire authorities. In particular, operations shall comply with relevant fire restrictions, notification requirements and permitting procedures. - Any non-essential maintenance works should be avoided on days of extreme fire rating or Total Fire Ban. - All equipment shall comply with relevant fire safety standards. - Machinery and vehicles not in use shall be parked in areas of low fire risk (e.g. not parked over shrubs, tall grass or cleared vegetation debris) with the ignition switched off. - Vehicles shall be regularly cleaned and checked to ensure that combustible materials such as grass and debris do not build up in critical areas where ignition could occur. - Smoking shall be banned in all project vehicles - Where flammable or combustible chemicals are required to be stored on-site, appropriate fire-fighting equipment shall be available; incompatible chemicals should not be stored together, and where practicable, flammable liquids should be stored in fire-resistant cabinets.
	Management of Pipeline Facilities	- Fire fighting equipment shall be maintained on-site in areas of higher fire risk (e.g. at facilities close to residences, cropping lands or areas of sensitive native vegetation). - Where appropriate, the ground surface of facilities will be hardened (eg, gravelled or concreted) to reduce fire risks and prevent weed infestation.

FIRE RISK MANAGEMENT

Related Sections

Stringing, Coating and Joining

GLOSSARY OF TERMS AND ABBREVIATIONS

Abandonment	See 'Decommissioning'
Acid sulfate soil	Soils which form when sulfate-rich soils or sediment are exposed to oxygen. Drainage or other disturbance which causes oxidisation results in the release of acidic leachates from the soil
AGA	Australian Gas Association
Anthropological	Pertaining to human societies
ANZECC	Australian and New Zealand Environment and Conservation Council
APPEA	Australian Petroleum Production and Exploration Association
ARPEL	Regional Association of Oil, Gas and Biofuels Sector Companies of Latin America and the Caribbean
Aspect	Element of an organisation's activities, products or services that can interact with the environment
AS 2885	Australian Standard AS 2885 Pipelines – Gas and liquid petroleum
Bell hole	An enlarged area of trench
Borrow pit	Surface excavation for the extraction of materials such as sand or clay
Bulldust	Highly dispersive soil which becomes powdery (talc-like) when disturbed, with potential to cause large movement of sediment and soil particles due to wind and water erosion
Bund	An earth, rock or concrete wall constructed to prevent the inflow or outflow of liquids
Cathodic protection system	Application of an electrical current to the pipeline exterior to prevent the electrochemical corrosion
CEMP	Construction Environmental Management Plan
Clean Water Diversion	A form of obstruction that directs rainwater or runoff that is yet to enter the site away from disturbed areas, keeping it 'clean' from any on-site contamination, usually from sediment
Clear-and-grade	The preparation of the right of way for vehicular movement, trenching and other construction activities, involving clearing vegetation and other obstacles from the right of way, grading topsoil to the edge of the right of way, and creating a safe working surface (and slope) for construction
Decommissioning	(also Abandonment) The process by which a pipeline is made inoperative at the end of its useful life. This involves dismantling and decontaminating the pipeline safely to the satisfaction of the regulator

Dieback	A soil borne plant pathogen (<i>Phytophthora cinnamomi</i>), commonly referred to as cinnamon or dieback fungus. The disease affects the roots of native Australian plants, in particular forest tree species, leading to their eventual decline. The fungus thrives in newly-created situations of perpetual wetness
DTI	Department of Trade and Industry (United Kingdom) (now Department for Business Innovation and Skills)
Easement	A right held by the proponent to make use of the land (in this case, for the installation and operation of a pipeline)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC	<i>Environment Protection and Biodiversity Conservation Act, 1999</i>
Erosion control berms	Compacted earthen banks strategically placed to divert erosive and/or silt-contaminated water away from vulnerable areas such as the pipeline corridor or water resources
ESD	Ecologically Sustainable Development. Defined by the Australian National Strategy for ESD (1992) as “ <i>development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends</i> ”
Flow line	A pipeline used to relay raw gas, condensate or oil from a well to a processing plant
Gabions	Small rocks enclosed within wire mesh, used to stabilise slopes
Geofabric or geotextile	Permeable or semi-permeable fabric for placing on ground surfaces to minimise erosion
Grading	Levelling of the right of way using graders, backhoes or bulldozers
Hazard	The potential of something to cause injury or harm
Horizontal Directional Drilling	A ‘trenchless technology’ by which a pipeline tunnel is drilled at a shallow angle under a crossing (e.g. a waterway, wetland, road or railway) through which the pipe is then threaded
Hydrocarbon	A class of organic chemical compounds consisting primarily of the elements hydrogen and carbon. Petroleum hydrocarbons are complex mixtures of hydrocarbons ranging from light gas to heavy oil compounds. Some common petroleum hydrocarbons include methane, ethane, propane, butane, naphtha, condensate, crude oil and asphaltenes
Hydrostatic testing (or hydrotesting)	A pipeline testing process used to test welds and pipeline integrity in high pressure hydrocarbon pipelines. The process involves filling the newly constructed pipeline with pressurised water or other

	medium, enabling the detection of leaks.
Impact	Result of an organisation's aspect actually causing an environmental harm
Landowner	A general term used to refer to the legal owner or manager of a parcel of land. It may be a private landowner, Government or private utility, or a Government Agency responsible for management of a particular parcel of Crown land (e.g. National Parks or Forestry areas).
Line list	A document for construction contractors which itemises the management procedures to be undertaken and which contains site-specific or property-specific information for field reference
Line management	Each individual employee and contractor operating within an agreed management structure or 'chain of command'
Mainline valves	Valves located in a pipeline at intervals along its length
MCMPR	Ministerial Council on Mineral and Petroleum Resources
Padding	Fine-grained material placed in the trench to protect the pipeline coating from damage
PIG	Pipeline Inspection Gauge. A tool which is inserted into a pipeline and propelled along by hydrotest water or by gas, to clean and inspect the pipe internally
Problematic Soils	A soil whose properties increase the risk of environmental harm and where additional management measures may be required. Such soils include dispersive soils, acid sulfate soils, contaminated soils, soils affected by dryland salinity, sand or serpentine soils
Purging	Removing all air from the pipeline, using gas
Radiography	Non-destructive examination of pipeline welds using X-ray to detect defects
Rehabilitation	Rehabilitation is the process of restoring a site or area's environmental attributes by returning an area to its pre-disturbance state. The process may include initial stabilisation, followed by regeneration, revegetation or restoration, depending upon the defined scope of works. Commonly the main objective of rehabilitation is either reinstatement of, or improvement on, the pre-existing condition
Reinstatement	Reinstatement is the process of re-establishing a pre-existing physical condition, and usually involves bulk earth works and structural replacement of pre-existing attributes of a site, such as soil surface topography, drainage, culverts, fences and gates, etc
Restoration	Restoration is the replacement of structural habitat complexity, ecosystem processes, services and function from a <i>de novo</i> or

	degraded site to that of a pre-determined or analogue state
Riparian	Relating to the bank or shore of a natural watercourse, such as a river or stream
Ripping	Raking or shallow ploughing to relieve compaction and to aerate soils
Rip-rap	Natural material such as rock or timber used to protect susceptible areas, such as reinstated creek beds and banks, or soils at water discharge receiving areas, from erosion caused by water flows
Risk	The probability that harm or injury may occur to persons or the environment
RoW/ROW	Right of Way. The works area required to construct the pipeline. All pipeline construction work is restricted to the RoW
Scraper stations	An above-ground facility used to launch and receive PIGs into and from the pipeline system.
SDS	Safety Data Sheet, also referred to as Material Safety Data Sheet (MSDS), and containing information on the substance's physical, chemical and environmental characteristics
Side-boom tractors	Construction equipment, consisting of a tractor with a boom crane, designed for lowering a pipe string into a trench
Skids	Timber blocks used to keep pipe lengths off the ground
Stringing	Laying the pipe adjacent to the pipeline trench
Third party	Those parties not directly associated with the pipeline - such as landowners, government, other commercial interests (e.g. power utilities, mining companies) and the general public.
Trench blocks (trench breakers)	Impermeable barriers placed in the trench during pipelaying to prevent erosion along the pipeline in the backfilled trench. They are generally installed adjacent to watercourses and in sloping terrain, and are designed to allow water to seep up and out of the backfilled trench, where it is diverted away from the pipeline construction area by erosion control berms
Trench plug	Short section of trench left unexcavated to allow passage of stock or wildlife across the trench
Trench spoil	Soil from the pipeline trench
Trench water	Water (usually shallow groundwater, rainwater or runoff) in the pipeline trench
Waters/Watercourses	Sources of water including drainage channels, streams, creeks, rivers, dams and other water bodies. Waters can also include trench and hydrotest discharge waters.

FURTHER READING

American Water Works Association (AWWA) Standard for Water Quality Standard

ARPEL (Regional Association of Oil & Natural Gas Companies in Latin America & the Caribbean) (1992) *Decommissioning and Surface Land Reclamation at Petroleum Production and Refining Facilities. Environmental Guideline No.6.*

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Standards Australia (1997) *AS 2885.1 Pipelines – Gas and Liquid Petroleum – Design and Construction (AS 2885.1:1997)*

Standards Australia (2002) *AS 2885.2 Pipelines – Gas and Liquid Petroleum – Welding (AS 2885.2:2002)*

Standards Australia (2001) *AS 2885.3 Pipelines – Gas and Liquid Petroleum – Operation and Maintenance (AS 2885.3:2001)*

Standards Australia (2003) *AS 2885.4 Pipelines – Gas and Liquid Petroleum – Offshore (AS 2885.4:2003)*

Standards Australia (2002) *AS 2885.5 Pipelines – Gas and Liquid Petroleum – Field Pressure Testing (AS 2885.5:2002)*

Standards Australia (2001) *AS 1579 – Arc Welded Steel pipes and fittings for water and waste water*

Standards Australia (2001) *AS 1281 Cement mortar lining of steel pipes and fittings*

Standards Australia (2000) *AS 2129 Flanges for Valves and pipe fittings*

Standards Australia (2004) *AS 4087- Metal Flanges and AS/NZS 2280 Ductile Iron Pipe and Fittings.*

Standards Australia (2004) *AS/NZS 31000 Risk Management. (AS/NZS 31000:2009)*

Standards Australia (2004) *AS/NZS ISO 14001: Environmental Management Systems – Requirements with guidance for use (AS/NZS ISO 14001:2004).*

Standards Australia (2004) *AS/NZS ISO 14004 Environmental Management Systems – General guidelines on principles, systems and supporting techniques (AS/NZS ISO 14004:2004).*

Standards Australia (2003) *AS/NZS ISO 19011 Guidelines for Quality and/or Environmental Management Systems Auditing (AS/NZS ISO 19011:2003)*.

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APPENDICES

APPENDIX 1: ABOUT APIA

The Australian Pipeline Industry Association Ltd (APIA) is the peak national body representing the interests of Australia's transmission pipeline sector. It has a diverse membership base with approximately 400 members including contractors, owners, operators, advisers, engineering companies and suppliers of pipeline products and services. APIA's current membership is predominantly involved in the high-pressure transmission of gas, however, the Association welcomes membership of companies and individuals involved in the transmission via pipelines of other products including potable and recycled water, LNG and CO₂, petroleum and petrochemical liquids, minerals and sand slurry, sewage and wastewater removal, powerline and cable conduits.

APIA has been based in Canberra since January 1998 and has developed a strong presence and profile. The Association has a full-time team comprising a Chief Executive, Business Manager, Policy Adviser, Membership Officer and Functions/Administration Officer plus part-time Research and Technical Policy Managers and an Accounts Administrator.

The APIA web page at www.apia.net.au is a vital tool for members, providing access to specialist industry information. APIA manages and promotes an Annual Convention and Exhibition as well as a comprehensive program of seminars, luncheons and dinners. APIA also provides information and promotes the interests of the pipeline industry through public presentations, newspaper feature articles, editorial comment in *The Pipeliner* and other publications and media releases as well as a regular Chief Executive Brief to members.

An important role for APIA has been its industry research programs and the Association has strong working relationships with leading institutions. As part of this research focus, APIA has been a leading proponent in the development of the industry technical standard, AS2885.

APIA's Mission

To represent and provide services to our members to deliver a strong and dynamic pipeline industry.

APIA's Key Objectives

- Be an advocate for the industry
- Maintain a viable Association with an active membership
- Assist the industry to maintain its leadership in the management of the environment, health and safety
- Maintain research & development and knowledge transfer programs that assist in the efficient and safe construction, operation and maintenance of pipelines

A streamlined Standing Committee structure enables APIA to progress its core priorities.

APPENDIX 2: APIA ENVIRONMENT POLICY

APIA recognises the pipeline industry's responsibility to the community regarding environmental protection, and will promote the adoption of all practicable measures to ensure that pipeline planning and design, construction, operation and decommissioning is conducted in an efficient and environmentally responsible manner.

In support of this commitment APIA will promote through example, as appropriate, and encourage APIA member companies to:

- Embrace a proactive approach to environmental management in the knowledge that environmental impacts can be prevented or minimised
- Comply with relevant legislation, regulations, standards and guidelines for the protection of the environment and, in their absence, adopt the best practicable means available to prevent or minimise adverse impacts
- Actively work with government agencies and statutory bodies in drafting legislation, policies, standards and procedures for environmental protection
- Develop and maintain management systems for self-regulation which identify, document, control and monitor environmental risks and monitor compliance with environmental requirements with the intention of continual improvement
- Incorporate environmental management into the planning, acquisition, design, construction, operation, decommissioning and divestiture of all pipeline related businesses and facilities
- Implement appropriate strategies that aim to minimise greenhouse gas emissions
- Implement appropriate waste management strategies based on the principles of reduce, reuse, recycle and appropriate disposal as the final option
- Ensure that all employees and contractors are aware of their environmental responsibilities and have opportunities to be trained in the necessary skills
- Communicate openly with stakeholders regarding environmental matters related to the industry's activities.



Cheryl Cartwright
APIA Chief Executive
May 2013

APPENDIX 3: LEGISLATION

The following is a list of environmental legislation relevant to the construction, operation and decommissioning of pipelines in Australia. This list of Acts is provided only as a guide, with each often having associated Regulations and Policies that should also be reviewed. Due to changing legislation, varying requirements and the often complex nature of pipeline approvals, APIA advises its members to seek advice on the legislation applicable to their specific project circumstances from appropriate technical consultants and from the relevant Commonwealth, State or Territory regulatory authorities.

COMMONWEALTH

<i>Aboriginal & Torres Strait Islander Heritage Protection Act 1984</i>	<i>National Greenhouse & Energy Reporting Act 2007</i>
<i>Australian Heritage Council Act 2003</i>	<i>Native Title Act 1993</i>
<i>Environment Protection & Biodiversity Conservation Act 1999</i>	<i>Offshore Petroleum and Greenhouse Storage Act 2006</i>
<i>Industrial Chemicals (Notification and Assessment) Act 1989</i>	<i>Ozone Protection and Synthetic Greenhouse Gas Management Act 1989</i>

AUSTRALIAN CAPITAL TERRITORY

<i>Environment Protection Act 1997</i>	<i>Native Title Act 1994</i>
<i>Fisheries Act 2000</i>	<i>Nature Conservation Act 1980</i>
<i>Heritage Act 2004</i>	<i>Pest Plants and Animals Act 2005</i>
<i>Lands Acquisition Act 1994</i>	<i>Planning and Development Act 2007</i>

NEW SOUTH WALES

<i>Aboriginal Land Rights Act 1983</i>	<i>Ozone Protection Act 1989</i>
<i>Catchment Management Authorities Act 2003</i>	<i>Pesticides Act 1999</i>
<i>Contaminated Land Management Act 1997</i>	<i>Petroleum (Offshore) Act 1982</i>
<i>Crown Lands Act 1989</i>	<i>Petroleum (Onshore) Act 1991</i>
<i>Environmental Planning and Assessment Act 1979</i>	<i>Pipelines Act 1967</i>
<i>Environmentally Hazardous Chemicals Act 1985</i>	<i>Plant Diseases Act 1924</i>
<i>Explosives Act 2003</i>	<i>Protection of the Environment Operations Act 1997</i>
<i>Fisheries Management Act 1994</i>	<i>Road Transport Act 2013</i>
<i>Forestry Act 2012</i>	<i>Roads Act 1993</i>
	<i>Rural Fires Act 1997</i>

<i>Forestry and National Park Estate Act 1998</i>	<i>Rural Lands Protection Act 1998</i>
<i>Heritage Act 1977</i>	<i>Soil Conservation Act 1938</i>
<i>Land Acquisition (Just Terms Compensation) Act 1991</i>	<i>Threatened Species Conservation Act 1995</i>
<i>Local Government Act 1993</i>	<i>Waste Avoidance and Resource Recovery Act 2001</i>
<i>National Parks and Wildlife Act 1974</i>	<i>Water Act 1912</i>
<i>Native Title (New South Wales) Act 1994</i>	<i>Wilderness Act 1987</i>
<i>Native Vegetation Act 2003</i>	<i>Work Health and Safety Act 2011</i>
<i>Noxious Weeds Act 1993</i>	

NORTHERN TERRITORY

<i>Aboriginal Land Act</i>	<i>Offshore Water (Application of Territory Laws) Act</i>
<i>Agricultural and Veterinary Chemicals (Northern Territory) Act</i>	<i>Pastoral Land Act</i>
<i>Bushfires Act</i>	<i>Petroleum Act</i>
<i>Crown Lands Act</i>	<i>Petroleum (Submerged Lands) Act</i>
<i>Dangerous Goods Act</i>	<i>Planning Act</i>
<i>Energy Pipelines Act</i>	<i>Soil Conservation and Land Utilisation Act</i>
<i>Environmental Assessment Act</i>	<i>Territory Parks and Wildlife Conservation Act</i>
<i>Fisheries Act</i>	<i>Traffic Act</i>
<i>Heritage Act</i>	<i>Transport of Dangerous Goods By Road and Rail (National Uniform Legislation) Act</i>
<i>Lands Acquisition Act</i>	<i>Waste Management and Pollution Control Act</i>
<i>Litter Act</i>	<i>Water Act</i>
<i>Northern Territory Aboriginal Sacred Sites Act</i>	<i>Weeds Management Act 2001</i>

QUEENSLAND

<i>Aboriginal Cultural Heritage Act 2003</i>	<i>Petroleum Act 1923</i>
<i>Aboriginal Land Act 1991</i>	<i>Petroleum and Gas (Production and Safety) Act 2004</i>
<i>Agricultural and Veterinary Chemicals (Queensland) Act 1994</i>	<i>Petroleum (Submerged Lands) Act 1982</i>
<i>Agricultural Chemicals Distribution Control Act 1966</i>	<i>Plant Protection Act 1989</i>
<i>Chemical Usage (Agricultural and Veterinary) Control Act 1988</i>	<i>Queensland Heritage Act 1992</i>
<i>Environmental Protection Act 1994</i>	<i>Soil Conservation Act 1986</i>
	<i>Strategic Cropping Land Act 2011</i>
	<i>State Development and Public Works</i>

<i>Forestry Act 1959</i>	<i>Organisation Act 1971</i>
<i>Integrated Planning Act 1997</i>	<i>Sustainable Planning Act 2009</i>
<i>Land Act 1994</i>	<i>Torres Strait Islander Cultural Heritage Act 2003</i>
<i>Land Protection (Pest and Stock Route Management) Act 2002</i>	<i>Torres Strait Islander Land Act 1991</i>
<i>Marine Parks Act 2004</i>	<i>Vegetation Management Act 1999</i>
<i>Native Title (Queensland) Act 1993</i>	<i>Water Act 2000</i>
<i>Nature Conservation Act 1992</i>	<i>Work Health and Safety Act 2011</i>

SOUTH AUSTRALIA

<i>Aboriginal Heritage Act 1988</i>	<i>Heritage Places Act 1993</i>
<i>Agricultural and Veterinary Products (Control of Use) Act 2002</i>	<i>National Parks & Wildlife Act 1972</i>
<i>Climate Change and Greenhouse Emissions Reduction Act 2007</i>	<i>Native Vegetation Act 1991</i>
<i>Coast Protection Act 1972</i>	<i>Natural Resources Management Act 2004</i>
<i>Dangerous Substances Act 1979</i>	<i>Pastoral Land Management and Conservation Act 1989</i>
<i>Development Act 1993</i>	<i>Petroleum (Submerged Lands) Act 1982</i>
<i>Dog Fence Act 1946</i>	<i>Petroleum and Geothermal Energy Act 2000</i>
<i>Environment Protection Act 1993</i>	<i>Plant Health Act 2009</i>
<i>Fisheries Management Act 2007</i>	<i>Wilderness Protection Act 1992</i>
<i>Forestry Act 1950</i>	<i>Work Health & Safety Act 2012</i>

TASMANIA

<i>Aboriginal Lands Act 1995</i>	<i>Land Acquisition Act 1993</i>
<i>Aboriginal Relics Act 1975</i>	<i>Land Use Planning and Approvals Act 1993</i>
<i>Agricultural and Veterinary Chemicals (Control of Use) Act 1995</i>	<i>Major Infrastructure Development Approvals Act 1999</i>
<i>Boundary Fences Act 1908</i>	<i>National Parks and Reserves Management Act 2002</i>
<i>Climate Change (State Action) Act 2998</i>	<i>Native Title (Tasmania) Act 1994</i>
<i>Crown Lands Act 1976</i>	<i>Natural Resource Management Act 2002</i>
<i>Dangerous Goods (Road and Rail Transport) Act 2010</i>	<i>Nature Conservation Act 2002</i>
<i>Environmental Management and Pollution Control Act 1994</i>	<i>Petroleum (Submerged Lands) Act 1982</i>
	<i>Threatened Species Protection Act 1995</i>

<i>Forestry Act 1920</i>	<i>Water Management Act 1999</i>
<i>Gas Pipelines Act 2000</i>	<i>Weed Management Act 1999</i>
<i>Historic Cultural Heritage Act 1995</i>	<i>Work Health and Safety Act 2012</i>

VICTORIA

<i>Aboriginal Heritage Act 2006</i>	<i>Heritage Act 1995</i>
<i>Aboriginal Lands Act 1991</i>	<i>Land Acquisition and Compensation Act 1986</i>
<i>Catchment and Land Protection Act 1994</i>	<i>National Parks Act 1975</i>
<i>Climate Change Act 2010</i>	<i>Occupational Health and Safety Act 2004</i>
<i>Coastal Management Act 1995</i>	<i>Offshore Petroleum and Greenhouse Gas Storage Act 2010</i>
<i>Dangerous Goods Act 1985</i>	<i>Pipelines Act 2005</i>
<i>Environment Effects Act 1978</i>	<i>Planning and Environment Act 1987</i>
<i>Environment Protection Act 1970</i>	<i>Water Act 1989</i>
<i>Fences Act 1968</i>	<i>Wildlife Act 1975</i>
<i>Fisheries Act 1995</i>	
<i>Flora and Fauna Guarantee Act 1988</i>	

WESTERN AUSTRALIA

<i>Aboriginal Heritage Act 1972</i>	<i>Petroleum (Submerged Lands) Act 1982</i>
<i>Biosecurity and Agriculture Management Act 2007</i>	<i>Petroleum and Geothermal Energy Resources Act 1967</i>
<i>Bush Fires Act 1954</i>	<i>Petroleum Pipelines Act 1969</i>
<i>Conservation and Land Management Act 1984</i>	<i>Planning and Development Act 2005</i>
<i>Contaminated Sites Act 2003</i>	<i>Reserves (National Parks Conservation Parks Nature Reserves and Other Reserves) Act 2004</i>
<i>Dangerous Goods Safety Act 2004</i>	<i>Soil and Land Conservation Act 1945</i>
<i>Environment Protection Act 1986</i>	<i>Waterways Conservation Act 1976</i>
<i>Fish Resources Management Act 1994</i>	<i>Wildlife Conservation Act 1950</i>
<i>Heritage of Western Australia Act 1990</i>	
<i>Native Title (State Provisions) Act 1999</i>	

APPENDIX 4: GUIDELINES, POLICIES, CODES & STANDARDS

The following is a list of guidelines, policies codes, and standards relevant to the construction, operation and decommissioning of pipelines in Australia. This list is provided as a guide only, and due to changing legislation, varying requirements and the often complex nature of pipeline approvals, APIA advises its members to seek clarification applicable to their specific project circumstances from appropriate technical consultants and from the relevant Commonwealth, State or Territory regulatory authorities.

Commonwealth

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
Soil and Water	Best Practice Erosion and Sediment Control Guidelines	International Erosion Control Association
	The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) (currently under review)	SEWPaC
	National Water Quality Management Strategy (available from http://environment.gov.au/water/policy-programs/nwqms/index.html)	SEWPaC
	Australian and New Zealand Environment and Conservation Council (ANZECC). January 2000. National Strategy for the Management of Coastal Acid Sulfate Soils (ANZECC / ARMCANZ 2000).	ANZECC
Flooding	Floodplain management in Australia: best practice principles and guidelines	SCARM (CSIRO)
Flora and Fauna	Significant impact or referral guidelines for nationally listed species	SEWPaC
	Survey Guidelines for Nationally Threatened Species	SEWPaC
	National Biodiversity Conservation Strategy (available from http://environment.gov.au/biodiversity/publications/strategy-2010-30/pubs/biodiversity-strategy-2010.pdf)	SEWPaC
Noise and Air Quality	World Health Organisation (WHO) Guidelines for Air Quality (Chapter 3) 2000	WHO
	National Environment Protection (Air Toxics) Measure*	SEWPaC

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	National Environment Protection (Diesel Vehicle Emissions) Measure*	SEWPaC
	National Environment Protection (Ambient Air Quality) Measure*	SEWPaC
	National standards for criteria air pollutants – available from http://environment.gov.au/atmosphere/airquality/publications/standards.html	SEWPaC
Heritage	Burra Charter 1999	ICOMOS
Vibration	Best Practice Environmental Management in Mining: Noise, Vibration and Airblast Control 1998	SEWPaC.
Traffic	Austroads Guidelines	AUSTROADS
Waste	National Waste Policy: less waste, more resources	SEWPaC
	National Environment Protection (Movement of Controlled Waste between States and Territories) Measure	NEPC
	National Environment Protection (Used Packaging) Measure	NEPC
Weeds and Biosecurity	Introductory Weed Management Manual http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/index.html	SEWPaC
Safety	National code of practice for construction industry and implementation guidelines	DEEWR
Dangerous Goods	Australian Dangerous Goods Code	
Planning	Matters of National Environmental Significance: Significance Impact Guidelines 1.1	SEWPaC
	Matters of National Environmental Significance: Significant impact guidelines 1.2: Actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies	SEWPaC
Other - biodiversity offsets	EPBC Act 1999 Environmental Offsets Policy October 2012	SEWPaC
Other – site	National Environment Protection (Assessment of Site	SEWPaC

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
contamination	Contamination) Measure	
Other - wetlands	Australian National Guidelines for Ramsar Wetlands - Implementing the Ramsar Convention in Australia	SEWPaC

*National Environment Protection Measures were previously developed by the National Environment Protection Council, but are now made by the COAG Standing Council on Environment and Water. NEPMs are applicable to all Australian government jurisdictions, while the COAG SCEW is administered by SEWPaC.

New South Wales:

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
Consultation	Guideline for community consultation requirements for the exploration of coal and petroleum, including coal seam gas, March 2012	DRE
	Department Guidelines in the Preparation of an Environmental Incident and Complaints Report	DRE
Soil and Water	SEPP No. 14 - Coastal Wetlands	OEH
	Managing Urban Stormwater, Soils and Construction.	OEH
	Strategic Regional Land Use Policy Nov 2012 Guideline for Agricultural Impact Statements	DRE
	NSW Strategic Regional Land Use Policy	DRE
	NSW Government Aquifer Interference Policy	DRE
	NSW Water Quality and River Flow Objectives	OEH
Flooding	NSW Coastal Policy	DPI
	NSW Coastal Planning Guideline: Adapting to Sea Level Rise	DPI
Flora and Fauna	SEPP No. 44 - Koala Habitat Protection	OEH
	SEPP No. 46 - Protection and Management of Native Vegetation	OEH
	NSW Biodiversity Strategy (see http://www.environment.nsw.gov.au/biodiversity/nswbiostrategy.htm)	
	Policy and Guidelines for Aquatic Habitat Management and Fish Conservation (NSW) DPI 1999	DPI

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	Threatened Species Assessment Guidelines - The Assessment of Significance	OEH
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities	OEH
	Field Survey Methods	OEH
	The Biodiversity Banking and Offsets Scheme - established under Part 7A of the Threatened Species Conservation Act.	OEH
Noise and Air Quality	Interim Construction Noise Guidelines	OEH
Heritage	Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales	OEH
	Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW"	OEH
Vibration	Assessing Vibration: A Technical Guide (DECC 2006)	OEH
Traffic	AUSTROADS Guidelines	AUSTROADS
Waste	Environmental Guidelines: Use of Effluent by Irrigation	OEH
	Environmental guidelines for waste	OEH
	Environmental guidelines: Preparation of pollution incident response management plans	OEH
	NSW (DECC), Waste Classification Guidelines (Part 1, Classifying Waste, April 2008).	OEH
	Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DECC, 2007)	OEH
Weeds and Biosecurity	Draft NSW biosecurity strategy	DPI
Safety	Schedule of Onshore Petroleum Exploration and Production Safety Requirements	DRE
	Hazardous Industry Planning Advisory Paper No 6 Hazard Analysis	NSW
	Hazardous Industry Planning Advisory Paper No 7 Construction Safety	Planning
	Hazardous Industry Planning Advisory Paper No 8 HAZOP	NSW

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	Guidelines Hazardous Industry Planning Advisory Paper No 9 Safety Management Development in the Vicinity of Operating Coal Seam Methane Wells	Planning NSW Planning NSW Planning NSW Planning
Dangerous Goods	Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management - Part B Review of Best Practice and Regulation Storing and Handling Liquids: Environmental Protection (DECC, 2007) Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management – Part B: Review of Best Practice and Regulation (DECC, 2005) Storing and Handling Liquids: Environmental Protection - Participants Manual National Transport Commission Australia; Australian Code for the Transport of Dangerous Goods by Road or Rail 7th Edition; 2011 (ADG Code);	OEH OEH OEH OEH NTC
Planning	SEPP (mining, Petroleum Production and Extractive Industries) 2007 SEPP (Major Development) 2005 SEPP (State and Regional Development) 2011 SEPP (Rural Lands) 2008 SEPP No 71 – Coastal Protection SEPP No 55 – Remediation of Land SEPP No. 33 - Hazardous and Offensive Development Environmental management of exploration, mining and petroleum - guidelines Proponents Guidelines for the Review of Environmental Factors 2011 ESG2 Environmental Impact Assessment Guidelines - For Exploration, Mining and Petroleum Production activities subject	DRE DRE DRE DRE DRE DRE DRE DRE DRE OEH

Environmental Aspect	Guideline, Policy, Standard or Code	Agency
	to Part 5 of the EP&A Act Guidelines for developments adjoining land and water managed by the Department of Environment Climate Change and Water Is an EIS Required – Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Department of Planning, 1995) Planning for Bushfire Protection	DRE DRE NSW Rural Fire Service
Other	Guidelines for Digital Data Submission and Reporting of Onshore Petroleum Exploration in New South Wales	DRE

Victoria

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Guidelines for the preparation of Pipeline Consultation Plans (Pipelines Act 2005) How to Get the Best Out of Planning: A Guide to Facilitating Meetings	DEPI DPCD
Soil and Water	State Environment Protection Policy (Groundwaters of Victoria) 1997 State Environment Protection Policy (Waters of Victoria) 1988 State Environment Protection Policy (Prevention and Management of Contamination of Land) 2002 Managing Urban Stormwater: Soils and Construction Volume 1 4th Edition Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting Rehabilitation Manual for Australian Streams Best practice guideline for assessing and managing coastal acid sulphate soils Industry Standard- Contaminated Construction Sites Planning Practice Note: Potentially Contaminated Land	EPA EPA EPA Landcom ANZECC LWRRDC DEPI

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
		WorkSafe Victoria EPA
Flooding	The Victoria Flood Management Strategy	DSE- Water
Flora and Fauna	Victorian Native Vegetation Management Framework Native Vegetation- Guide for Assessment of referred planning permit applications Native Vegetation- Revegetation Planting Standards- Guidelines for establishing native vegetation for net gain accounting VPP Practice Notes - Native Vegetation Offsets VPP Practice Notes - Biodiversity	DEPI DEPI DEPI DPCD DPCD
Noise and Air Quality	EPA's Environmental guidelines for major construction sites State Environment Protection Policy (Air Quality Management) 1999 State Environment Protection Policy (Ambient Air Quality) 2001 State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) 1989	EPA EPA EPA EPA
Heritage	Aboriginal Heritage Planning Tool- online Information Sheet: Cultural Heritage Management Plans and Planning Heritage Overlay Guidelines	DPCD DPCD DPCD
Vibration	Technical Basis for Guidelines to Minimise Annoyance due to Blasting and Ground Vibration	ANZECC
Traffic	Guide to Traffic Generating Development and Road Design Guide Installation of Utility Services and Pipelines within Railway Boundaries (Engineering Standard) Third Party Access- VicTrack (online contact and application form)	RTA ARTC VicTrack

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	AS4799-2000 Installation of underground utility services and pipelines within railway boundaries	SAI Global
Waste	Industrial waste resource guidelines	EPA
Weeds and Biosecurity	Guidelines and Procedures for managing the environmental impacts of weeds on Public land in Victoria (2007) Biosecurity Guidelines for Movement of Equipment Contractors between Farms	DEPI DEPI
Planning	Planning: A short guide Using Victoria's Planning System Victorian Planning Provisions	DPCD DPCD DPCD

Queensland

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Standard conduct and compensation agreement 2010 Land Access Code Nov 2010	DEEDI DEEDI
Soil and Water	Monitoring and Sampling Manual 2009 (Environmental Protection (Water) Policy 2009) Environmental Protection (Water) Policy 2009 Approval of coal seam gas for beneficial use Baseline assessment guideline: Underground water impact reports and final reports Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998 Queensland Water Quality Guidelines 2007 Instructions for the treatment and management of Acid Sulfate Soils 2001 Environment Protection (Water) Policy 1997 Run-off control measures for erosion control in cropping land Erosion control in cropping land	DEHP DEHP DEHP DEHP QWQG DEHP DEHP DEHP DNRM

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	Erosion control in grazing lands Soil Conservation Measures – Design Manual for Queensland	DNRM DNRM DNRM
Flooding	SPP 1/03 – Mitigating the adverse impacts of flood, bushfire and landslide	DLGP
Flora and Fauna	Policy for native vegetation management offsets Queensland Government Environmental Offsets Policy Vegetation Management Regulation 2000 Regrowth Vegetation Code 2011 Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions Regional Vegetation Management Code for South East Queensland Bioregion Regional Vegetation Management Code for Western Bioregions Regional Vegetation Management Code for Coastal Bioregions	DEHP DEHP DEHP DEHP DEHP DEHP DEHP DEHP
Noise and Air Quality	Environment Protection (Air) Policy 1997 Environment Protection (Noise) Policy 1997 Prescribing Noise Conditions for Environmental Authorities for Petroleum and Gas Activities EcoAccess Guideline: Planning for Noise Control Ecoaccess Guideline: Assessment of Low Frequency Noise State Planning Policy 5/10 Guideline Air, Noise and Hazardous Materials	DEHP DEHP DEHP DEHP DEHP DEHP
Heritage	GLP: PMC: Guideline for Negotiating Indigenous Land Use Agreements for the delivery of public infrastructure (other than public housing) on Indigenous land Guide to compiling a connection report for native title claims in the Torres Strait Guide to the Pastoral ILUA template Guidelines for negotiation of an indigenous land use agreement (area agreement) Native title procedures: Mineral Resources Act 1989: Parts 12, 13, 18 & 19: Manual for applicants for prospecting permits	DEHP DEHP DEHP DEHP DEHP

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Traffic	Guidelines for Assessment of Road Impacts of Development (2006)	DTMR
Waste	Environment Protection (Waste Management) Policy 2000 Approval of a resource for beneficial reuse Waste tracking guideline	DEHP DEHP DEHP
Weeds and Biosecurity	Queensland Weed Spread Prevention Strategy Queensland Pest Animal Strategy	DAFF DAFF
Planning	A Guide to Environmental Impact Assessment Preparing Environmental Management Plans Role of the Environmental Protection Agency in Environmental Impact Assessment Techniques for Environmental Economic Evaluation National and State initiatives in environmental impact assessment Preparing terms of reference and environmental impact statements Assessment and approval process for environmental authorities for chapter 5A activities Guidelines for Hazard Analysis Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 (and Hazard Analysis Consultation Draft, July 2008) Risk Criteria for Land Use Safety Planning. Hazardous Industry Planning Advisory Paper (HIPAP) No. 4	DEHP DEHP DEHP DEHP DEHP DEHP DEHP DSDIP DSDIP

Western Australia

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Stakeholder Consultation Guideline. Available from http://www.dsd.wa.gov.au/documents/000098.slobhan.lynch.pdf	DSD

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Soil and Water	Acid Sulfate Soils Planning Bulletin No. 64 Acid Sulfate Soils Planning Guidelines Contaminated Sites Management Series: Assessment Levels for Soil, Sediment and Water, Draft for Public Comment, Version 3 Draft Treatment and management of soils and water in acid sulphate soil landscapes. Acid Sulfate Soils Guideline Series Identification and Investigation of Acid Sulfate Soils. Acid Sulfate Soils Guideline Series Guidelines for Dewatering, 2006	WAPC WAPC DEC DEC DEC DEC DoW
Flora and Fauna	Conservation of threatened flora in the wild 1992 Conservation of threatened and specially protected fauna in the wild 1991 Conserving threatened species and ecological communities (Draft) Preparation, review and amendment of monitoring protocols SOP No: 1.2 Establishing Vegetation Quadrats <i>SOP No:6.1</i> Establishing Vegetation Transects <i>SOP No:6.2</i> Observing animals from secondary signs SOP No: 7.2 Cage traps for live capture of terrestrial vertebrates SOP No: 9.2	DEC DEC DEC DEC DEC DEC DEC DEC
Noise and Air Quality	Summary of the environmental protection (noise) regulations 1997	DEC
Heritage	Aboriginal Heritage Site registration policy Aboriginal Heritage Site registration procedure Aboriginal Heritage Information access policy Aboriginal Heritage Due Diligence Guidelines European Heritage: State Cultural Heritage Policy (State Heritage Office)	DIA DIA DIA DIA SHO
Traffic	Application Kit and Guidelines for Organisations seeking to undertake works within road reserves; Complex Works	MainRoads WA

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Waste	Waste avoidance and resource recovery regulations 2008	DEC
Weeds and Biosecurity	Techniques for mapping weed distribution and cover in bushland and wetlands <i>SOP No: 22.1</i> Good Neighbour Policy (July 2007)	DEC DEC
Planning	Guide to Preparing an Environmental Scoping Document Guide to EIA Environmental Principles, Factors and Objectives Preparation, review, approval and amendment of standard operating procedures SOP No: 1.1 The Kimberley Science and Conservation Strategy The Salinity Strategy 2000	EPA EPA DEC DEC DEC
Offsets	WA Environmental Offsets Policy	DEC

South Australia

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Soil and Water	Environment Protection (Water Quality) Policy 2003 Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DEWNR DPIR
Flooding	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Flora and Fauna	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Noise and Air Quality	Environment Protection (Air Quality) Policy 1994 Environment Protection (Industrial Noise) Policy 1994	DEWNR DEWNR

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	Environment Protection (Machine Noise) Policy 1994 Environment Protection (Noise) Policy 2007 For information on air quality standards in SA, refer to the National Air Quality NEPM	DEWNR DEWNR SEWPaC
Waste	Environment Protection (Waste to Resources) Policy 2010 Environment Protection (Waste Management) Policy 1994 Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DEWNR DEWNR DPIR
Weeds and Biosecurity	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR
Planning	Refer to the relevant section in the Planning Policy Library, at http://www.sa.gov.au/upload/franchise/Housing,%20property%20and%20land/PLG/SA_Planning_Policy_Library_version_6.pdf	DPIR

Tasmania

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
Consultation	Land Owner's Questions, at http://www.mrt.tas.gov.au/pls/portal/docs/PAGE/MRT_INTERNET_PAGE_GROUP/MRT_EXPLORATION_AND_MINING/MRT_LAND_OWNERS_QUESTION_AND_A/OWNERS-QUESTIONS_2009.PDF	MRT
Soil and Water	Soil erosion – the issue and controls discussed in detail at http://www.dpiw.tas.gov.au/inter.nsf/ThemeNodes/TPRY-5YW2UG?open Guidelines for Assessing Applications for Well Driller's Licences Enforcement Policy for the Water Management Act 1999 Tasmanian Wetlands Strategy at http://www.dpiw.tas.gov.au/inter.nsf/WebPages/RPIO-4YH3AY?open	DPIPWE DPIPWE DPIPWE DPIPWE
Flora and Fauna	Threatened species listed at http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/SJON-	DPIPWE

Environmental Aspects	Guideline, Policy, Standard or Code	Agency
	58E2VD?open#ListingInformation Recovery plans listed at http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/LJEM-6H644R?open Native Plants and Animals Guides at http://www.dpiw.tas.gov.au/inter.nsf/ThemeNodes/SSKA-4X33SG?open	
Noise and Air Quality	Environment Protection Policy (Air Quality) 2004 Environment Protection Policy (Noise) 2003 (Draft)	DPIPWE DPIPWE
Heritage	A Guide to the Aboriginal Heritage Assessment Process, at http://www.aboriginalheritage.tas.gov.au/documents/guide%20to%20the%20aboriginal%20heritage%20assessment%20process%20.pdf Sampling Procedure For consultants excavating Aboriginal Heritage sites in Tasmania	DPIPWE DPIPWE
Weeds and Biosecurity	Tasmania Biosecurity Policy, at http://www.dpiw.tas.gov.au/inter.nsf/Attachments/LBUN-6Y57UE/\$FILE/OD02332_biostratbroch.pdf Tasmania Biosecurity Strategy at http://www.dpiw.tas.gov.au/inter.nsf/Attachments/LBUN-6Y57CM/\$FILE/OD02332_biostratnew.pdf Tasman Council Weed Management Strategy, at http://www.tasman.tas.gov.au/index.php/environment-health/natural-resource-management/weed-management	DPIPWE
Planning	Exploration procedures— Information for explorers at http://www.mrt.tas.gov.au/pls/portal/docs/PAGE/MRT_INTERNET_PAGE_GROUP/MRT_PUBLICATIONS/MRT_EXPLORATION_CODE_OF_PRACTICE/CODE_5B.PDF	MRT

GENERAL STANDARDS

AS 2507 -1998 The storage and handling of agricultural and veterinary chemicals

AS 4970 Protection of trees on development sites

AS /NZS 31000 Risk management – principles and guidelines (ISO 31000:2009)

AS 1210 Pressure vessels

AS 1929 Non-destructive testing –glossary of terms

AS 2430 Classification of hazardous areas

AS 2812 Welding, brazing and cutting of metals – Glossary of terms

AS 2832 Cathodic protection of metals

AS 2832.1 Part 1: Pipes and cables

AS/NZS 9001:2008 Quality Management Systems – Requirements

AS/NZS ISO 14001:2004-Environmental Management Systems – Requirements with guidelines for use

AS/NZS ISO 14004:2004-Environmental Management Systems – General guidelines and principles, systems and support technologies

AS/NZS ISO 14015:2003-Environmental Management – Environmental assessment of sites and organisations

AS/NZS ISO 14031:2000-Environmental Management – Environmental performance evaluation guidelines

AS/NZS ISO 19011:2004-Guidelines for quality and / or environmental management systems auditing

AS/NZS 1020 The control of undesirable static electricity

AS/NZS 3788 Pressure equipment – in service inspection

AS/NZS 4853 Electrical hazards on metallic pipelines

AGA PR 3 -805 A modified criterion for evaluating the remaining strength of a corroded pipe (RSTRENG)

XK0101 Purging principles and practice

ASME BS1G Manual for determining the remaining strength of Corroded pipelines: supplement to ASME B31, for pressure piping

AS 4897-2008 The design, installation and operation of underground petroleum storage tanks

AS 4970-2009 Protection of trees in development sites

AS/NZS ISO 31000:2009 Risk management – Principles and guidelines

AS/NZS 2566.1:2002 Buried flexible pipelines Part 1: Structural design

AS/NZS 2566.2:2002 Buried flexible pipelines Part 2: Installation

GAS STANDARDS

- AS 2885.0 Pipelines—Gas and liquid petroleum—General requirements
- AS 2885.1 Pipelines—Gas and liquid petroleum—Design and construction
- AS 2885.2 Pipelines—Gas and liquid petroleum—Welding
- AS 2885.3 Pipelines—Gas and liquid petroleum—Operation and maintenance
- AS 2885.4 Pipelines—Gas and liquid petroleum—Offshore submarine pipeline systems
- AS/NZS 2885.5 Pipelines—Gas and liquid petroleum—Field pressure testing
- AS/NZS 4645.1:2008 Gas distribution networks – Network management
- AS/NZS 4645.2:2008 Gas distribution networks – Steel pipe systems
- AS/NZS 4645.3:2008 Gas distribution networks – Plastic pipe systems
- 2430.1 Part 1: Explosive gas atmospheres

WATER STANDARDS

- AS 1554 Structural Steel Welding - Welding of Steel Structures
- AS 1726 Geotechnical Site Investigations

- AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design
- AS/NZS 2566.1 Buried Flexible Pipelines – Part 1: Structural Design – Commentary (Supplement to AS/NZS 2566.1)
- AS/NZS 2566.2 Buried Flexible Pipelines – Part 2: Installation

- AS 2865 Safe working in a confined space

- AS 3725 Loads on Buried Concrete Pipes
- AS 4087 Metallic Flanges for Waterworks Purposes
- AS 5667.1 Water Quality – Sampling.

OTHER USEFUL LINKS

Australian Society for Trenchless Technology

http://www.astt.com.au/trenchless_technology/guidelines/astt_guidelines/

International Erosion Control Association <http://www.austieca.com.au/region2>

APPENDIX 5: PIPELINE INSPECTION CHECKLIST

An indicative pipeline checklist is attached.

APPENDIX 6: FAUNA MANAGEMENT PRO-FORMA

FAUNA DATABASE
Fauna Survey Data Sheet

Insert Company Logo

Date _____

Fauna Clearer _____

Location (KP to KP) _____

Weather _____

KP	Northing	Easting	Scientific Name	Common Name	No.	Comments or Action Taken

APPENDIX 7: FUTURE DIRECTIONS CONSIDERATIONS

The following table is a list of items for further consideration by the pipeline industry in regard to the management of environmental aspects of our activities and operations. These items were identified in the latest review of the Code and are under further investigation and clarification from industry experts and regulatory authorities.

Sustainability Consideration of sustainability, and National Greenhouse Emission Reporting Scheme on pipeline construction and operational phases of facilities. Identify aspects, impacts and control measures.
CO₂ and other transmission pipelines Consideration of aspects and reconcile for adequacy against APIA CoEP
Further review of monitoring aspects of the Code.
Tidal and Marine Environments. Tidal and marine environments in coastal plain areas to be considered as they present additional influences to environmental management.
Contaminated land and UXO sites management

APPENDIX 8: ENVIRONMENTAL OFFSET SUMMARY TABLE

COMPARATIVE OUTLINE OF STATE & COMMONWEALTH ENVIRONMENTAL OFFSET POLICIES									
State/Territory	New South Wales	Western Australia	Queensland	Victoria	South Australia	ACT	NT	Commonwealth	Tasmania
Policy	Biobanking scheme, Biodiversity Certificates	Environmental Offsets Policy	Environmental Offsets	Native Vegetation Offsets -Net Gain	Significant Environmental Benefit Offsets	ACT and NT default to the C'wealth Environmental Offsets Policy, established under the EPBC Act in October 2012			No stand-alone Policy
Principles	Measures to avoid and mitigate impacts to be considered	Measures to avoid and mitigate impacts to be considered	Offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy	The three step approach: 1. Avoid adverse impacts, particularly through vegetation removal; 2. If impacts cannot be avoided, minimise through appropriate planning and design; 3. Identify appropriate offset options	When an application to clear native vegetation is approved, conditions are attached by the Department of Environment, Water and Natural Resources (DEWNR) and the Native Vegetation Council to ensure that the clearing is offset by restoration work that provides a significant environmental benefit	Suitable offsets must: 1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action			Examples of applied offsets refer to impact mitigation for listed MNES under the Commonwealth EPBC Act assessed under the Commonwealth / Tasmania Bilateral Agreement
	Residual impacts to be offset	Residual impacts to be offset	Environmental impacts must first be avoided, then minimised, before considering use of offsets for remaining impacts	All planning and responsible authorities must have regard to the offsets framework when considering proposals involving native vegetation, including deciding offsets	Offsets are designed to achieve the following priorities: to assist in the enhancement of biodiversity to meet targets established in regional NRM Plans and Biodiversity Plans, to enhance remnant native vegetation, to assist in achieving targets identified in the Naturelinks program or in established Naturelinks corridors, to assist in the rehabilitation, protection and management of key areas identified through biodiversity analysis, to encourage long term biodiversity outcomes such as addressing the effects of climate change, or to assist in the conservation of National, State or Regionally-listed plant spp and vegetation communities	2. be built around direct offsets but may include other compensatory measures			
	Offset to result in net improvement in biodiversity over time	Real and sustainable environmental outcomes.	Offsets must achieve an equivalent or better environmental outcome	An offset may be - an area of existing remnant vegetation that is protected and managed, an area that is revegetated and protected, an area that is set aside for regeneration or restoration, or any combination of the above		3. be in proportion to the level of statutory protection that applies to the protected matter			
	Offsets to be supported by sound ecological principles	Offsets to be supported by sound ecological principles	Offsets must provide environmental values as similar as possible to those being lost.	An offset should achieve a net gain in the quality and quantity of vegetation commensurate with the native vegetation lost, and should be secure and ongoing		4. be of a size and scale proportionate to the residual impacts on the protected matter			
	Offsets to be approved prior to impact occurring	Where possible offsets considered early in the assessment and decision making process	Offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values	Offsets to be considered at the proposal assessment stage - precise detail is not required at this stage. A secondary process shall accurately define amount of vegetation loss to be offset		5. effectively account for and manage the risks of the offset not succeeding			
	Offsets located in same or similar ecological characteristics to the area being impacted	Offsets located in same or similar ecological characteristics to the area being impacted	Offsets must be legally secured for the duration of the offset requirement	Offset to be enduring, enforceable and deliver long term outcomes. Condition on the permit may be sufficient to secure and enforce the offset requirement. Ongoing security of the offset		6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.4)			
	Offset to be enduring, enforceable and deliver long term outcomes	Offset to be enduring, enforceable and deliver long term outcomes		Quality vs quantity approach to measuring a sites condition and landscape context		7. be efficient, effective, timely, transparent, scientifically robust and reasonable			
	Offsets to be monitored /auditable and quantifiable	Offset will be proportionate to the significance of the environmental value being impacted		Costs to be equitably shared - benefits to landholder, community and region		8. have transparent governance arrangements including being able to be readily			
When it applies	Biobanking scheme generates costs, which are managed by use of an independent Biobanking Trust Fund. Refer to s127ZW-127ZZA of the Threatened Species Conservation Act 1995	Offsets to be monitored /auditable							
		Framework of adaptive management- take account of the potential risk, ensure mechanisms in place to minimise.							
	Part of assessment of applications under Environmental Planning and Assessment Act 1979, Native Vegetation Act 2003, National Parks and Wildlife Act 1974, grant of approval for a State Significant Development may include conditions for biobanking (s.89), in accordance with Part 7A of the Threatened Species Conservation Act 1995, with applicable procedures and assessment methodologies contained in the Threatened Species Conservation (Biodiversity Banking) Regulation 2008 applied.	Most often applied to proposals under the Environmental Protection Act (1986) that involve clearing native vegetation, but can also apply to developments under the Planning and Development Act (2005), Environmental Protection (Clearing of Native Vegetation) Regulation 2004 and the Mining Act 1978. Note that offset provisions are envisaged in the list of conditions that might be applied to clearing permits in the Environmental Protection Act 1986, s51	Queensland Government Environmental Offsets Policy (QGEOPI) has 3 issue-specific policies: Biodiversity Offsets Policy, Offsets for Net Gain of Koala Habitat in SE Queensland Policy and Policy for Vegetation Management Offsets	Offsets must be identified once a decision is made to allow removal of native vegetation as part of an amendment to a planning scheme that will result in the loss of native vegetation, a native vegetation precinct plan or, a planning permit. Offsets are NOT required for non-fatal pruning, thinning for ecological or commercial forestry reasons with no loss in habitat score, removal of regrowth within an established commercial plantation, removal of vegetation to improve a habitat score, or for removal of an environmental weed	The significant environmental benefit offsets and projects scheme applies to all applications for native vegetation clearance in South Australia	The policy relates to all matters protected under the Environment Protection and Biodiversity Conservation Act 1999			When development proposals in Tasmania involve impacts to Commonwealth-listed MNES species
	Alternative path to assessment of significance or species impact statement for the proposal.	When matters of state significance are not covered by Commonwealth action under the EPBC Act (in situations of joint assessment)	QGEOPI can be applied to developments managed under the Sustainable Planning Act 2009, to mining and / or petroleum development managed under the Environmental Protection Act 1994, to the taking of listed plant species under the Nature Conservation Act 1992 and to the construction of State roads under the Transport Infrastructure Act 1994	Responsible authorities should use the recommended default offsets set out in the practice note 'Assessing applications involving native vegetation removal' where they apply. In other cases, the steps described in more detail in the 'Native Vegetation – Guide for assessment of referred planning permit applications' should be followed		Offsets will not be considered until all reasonable avoidance and mitigation measures are considered, or acceptable reasons are provided as to why avoidance or mitigation of impacts is not reasonably achievable. The use of offsets to compensate for adverse impacts to heritage values is appropriate in some circumstances, and offsets for impacts on heritage values should improve the integrity and resilience of the heritage values of the property involved			
Method	In any situation, the scheme can apply when the Minister for Planning requires it (as part of a DA assessment) or when the Minister for Environment agrees it should apply (as part of a voluntary Biobanking Agreement)	When avoidance and mitigation options have already been considered	Requirement for offsets are determined by application of the QGEOPI principles to matters under consideration via the listed legislation above, and with respect to the ecological values being impacted and their conservation status			The role of, and opportunity for offsets is considered during the assessment stage of EPBC project processes			
	Biodiversity Banking - Biobanking enables 'biodiversity credits' to be generated by landowners who commit to enhance and protect biodiversity values on their land through a biobanking agreement. These credits can then be sold, generating funds for the management of the site. Credits can be used to counterbalance (or offset) the impacts on biodiversity values that are likely to occur as a result of development in urban areas. Biobanking statements cannot be issued for land subject to the Native Vegetation Act 2003, which applies to most land outside urban areas (ie. generally applies in rural areas) The credits can also be sold to those seeking to invest in conservation outcomes, including philanthropic organisations and government. The Biobanking Agreement is placed on the title.	Two categories are defined in the policy: Direct offsets , which are actions designed to provide for on-ground improvement, rehabilitation and conservation of habitat, and Indirect Offsets , which are actions aimed at improving scientific or community understanding and awareness of environmental values that are affected by a development or activity	Offsets may be land-based or may take the form of a monetary payment to an approved environmental trust (currently the Balance the Earth Trust). The payment is used by the Trust to purchase land to add to Queensland's protected area estate, or to purchase land that forms part of a strategic biodiversity corridor	Offsets may be secured by an agreement under s.127, or through an enforcement order under s.114 or s.124, of the Planning and Environment Act 1987. Agreements may also be completed under s.69 of the Conservation, Forests and Lands Act 1987 or the Victorian Conservation Trust Act 1972. It is possible to make a payment in lieu of an offset, based on the principles of need, nexus, equity and accountability, an offset payment should serve a planning purpose and: 1. fairly and reasonably relate to the permitted vegetation removal; 2. be a fair and reasonable cost; 3. be spent on native vegetation improvements and be accounted for in an open and transparent manner	Examples of works undertaken to offset approved native vegetation clearance include: establishment and management of a set-aside area to encourage the natural regeneration of native vegetation, the protection and management of an established area of native vegetation, entering into a Heritage Agreement on land where native vegetation is already established to further preserve or enhance the area in perpetuity, and, payment to the Native Vegetation Fund (only to be used when the options above are not possible)	The policy refers to 3 types of offsets: 1. Direct offsets are those actions that provide a measurable conservation gain for an impacted protected matter; 2. Other compensatory matters are those actions that do not directly offset the impacts on the protected matter, but are anticipated to lead to benefits for the impacted protected matter, for example, funding for research or educational programs; 3. Advanced offsets are a supply of offsets for potential future use, transfer or sale, for example, protection or improvement of habitat for the conservation of a protected matter before an impact is undertaken			Process is managed by the EPA Division of the Department of Primary Industries, Parks, Water and the Environment through the Environment Management and Pollution Control Act 1994. The process involves creating suitable covenants under the Nature Conservation Act 2002
	Ecosystem credits can only be used to offset biodiversity impacts in the same ecological community, or in another community of the same formation that has an equal or greater percentage of land cleared and the same predicted threatened species. Species credits can only be used to offset biodiversity impacts of the same species	Methodology guidelines have been foreshadowed in the Environmental Offset Policy, but have not yet been produced	Offset Transfer - the proponent may enter into an agreement with an Offset Broker, the offset must meet the requirements of the policy and must be legally secured within 12 months	Offsets are identified through a 3-step process: 1. Calculate the vegetation loss, 2. determine the net gain to be achieved, 3. identify the offset criteria and other relevant planning scheme objectives, 4. identify the appropriate offset.		Development of an offsets package should be conducted in consultation with the Commonwealth Environment Department, and reference should be made to the guideline EPBC Act 1999 Environmental Offsets Policy (http://environment.gov.au/epbc/publications/pubs/offsets-policy.pdf), the 'how to' guide (http://www.environment.gov.au/epbc/publications/pubs/offsets-how-to-use.pdf), and the Offsets Assessment Guide (http://www.environment.gov.au/epbc/publications/pubs/epbc-reform-offset-guide.pdf)			
	Refer also to the specific methodology in the Threatened Species Conservation (Biodiversity Banking) Regulation 2008	Use of offsets will be determined on a case-by-case basis, and will only be used as a last resort, after due consideration of avoidance and mitigation strategies	Direct Offset - proposed by the proponent at time of application. This requires that an offset area, a legally binding mechanism and offset area management plan are assessed by the administering authority prior to grant of a development permit	More information is in the VPP Practice Note 'Native Vegetation Offsets', and 'Native Vegetation - Guide for assessment of referred planning permit applications'					
Key elements in an offset plan			An offset area must be protected from clearing through use of a legally-binding mechanism, supported by an offset area management plan and registered on title and/or approved as required by a legally-binding mechanism	Bushbroker is a system to register and trade native vegetation credits. A native vegetation credit is a gain in the quality and / or quantity of native vegetation that is subject to a secure and ongoing agreement. For more information on Bushbroker, go to www.dse.vic.gov.au/nativevegetation					
	The key elements of an offset plan (termed a Biobanking Agreement) are as laid out in s.127E(1)(a)-(f) of the Threatened Species Conservation Act 1995.	The WA Environmental Offsets Policy does not refer to development of an offset plan	An offset area is managed by an offset area management plan. This management plan must be in place at the time that the offset area is legally secured. The purpose of the OAMP is to ensure the offset area is managed in a way that will maximise the chance of the offset meeting the purpose of the policy to which it relates	The VPP Practice Note does not refer to development of an offset plan	The DEWNR Significant environmental benefit offsets page does not refer to development of an offset plan	An offsets package must respond to the principles listed above and must consist of a minimum of 90% direct offsets. Additional key considerations for regulators include: the offset must account for the status of the protected matter that is being impacted; suitable offsets must be additional to what is already required; the offset must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced; the offset must be informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific uncertainty; and, where relevant, the quality of the offset site must be at least equal to that of the impact site			Not directly applicable, as there is currently no formal policy or stand-alone offsets mechanism in Tasmania. Precedents indicate that proponents can anticipate that a package equivalent to a package developed under the Commonwealth scheme would be appropriate

Appendix G Schematic of Phillip Creek Compressor Station showing Nitrogen Reduction Skid

