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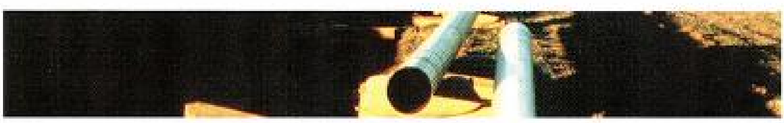
Flora, fauna & ecology : Eastern Gas Pipeline : draft environmental impact statement (Commonwealth), environmental impact statement (New South Wales), environmental effects statement (Victoria)

Eastern Gas Pipeline

Draft Environmental Impact Statement
(Commonwealth)

Environmental Impact Statement
(New South Wales)

Environment Effects Statement
(Victoria)



Background Paper

BHP

Westcoast Energy

No. 5

Flora, Fauna & Ecology

Biosis Research Pty Ltd

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Study Team

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Pam Tickner and Vesna Marcetic assisted with report preparation.

Acknowledgments

There are many people to thank in a project this large. We wish to acknowledge the support and assistance that the staff of both Westcoast Energy Australia Engineering Pty Ltd provided throughout the study. We would also like to thank the staff of the various state and federal government agencies who were most helpful in giving assistance, data and advice. Included in this group are staff from Victorian DCNR, NSW National Parks and Wildlife Service, Australian Heritage Commission, Australian Nature Conservation Agency, various Universities throughout Australia and a number of private consultants.

There are also a number of private landholders who allowed access to their land and provided valuable assistance in the field stages of the project.

INTRODUCTION

PROJECT DESCRIPTION

BHP Petroleum (Pipelines) Pty Ltd (BHPP) and Westcoast Energy Australia (Pipelines) Pty Ltd, a subsidiary of Westcoast Energy Inc of Vancouver, British Columbia, Canada, are proposing to jointly construct a natural gas pipeline connecting the existing Victoria-based gas-related infrastructure with that of New South Wales. The proposed pipeline is a commercial venture based on the expressions of interest by many New South Wales gas consumers for an alternate gas supply to that of the Cooper/Eromanga Basin and by several Victoria gas producers for additional markets to those in Victoria. BHP is a major domestic gas producer and end user and is of the opinion that such projects are vital to the stimulation of regional economic growth and to enhance the global competitiveness of domestic industry. The proposed pipeline is also in alignment with the Hilmer Report and the Council of Australian Governments (CoAG) policies and directives for increased competition and economic efficiency in the gas industry.

The Eastern Gas Pipeline Project plans to supply the NSW gas market from the middle of 1997. So that this can be accomplished, the joint venture partners are proposing to construct an underground natural gas pipeline from Longford to Wilton via Cann River, Cooma, Hoskinstown and Nowra to supply the NSW and Sydney gas market.

This project reports on an assessment of the flora, fauna and ecology along the proposed corridor of the Eastern Gas Pipeline Project in order to minimize the environmental impact of the proposed pipeline and to meet the relevant legislative requirements of the Commonwealth, Victorian and New South Wales governments.

The overall aim of the flora, fauna and ecology studies was to provide high quality information necessary to:

- describe the environment of the pipeline route
- identify actual constraints to route selection
- identify constraints on the proposed project
- advise on ameliorative measures available in the construction or design phase to minimize or make the impact acceptable
- identify areas where it will be required to gather further information.

STUDY AREA

This report is based on the proposed route 5.1. The construction of the pipeline will require an easement 20 metres in width. The width may vary in confined or sensitive areas or in areas where extra space is required (for example, road or railway crossings and approaches to steep river crossings.) Certain other areas such as those occupied by Meter Stations, Sales Tap Stations and Compressor Stations will require more space.

The study covered the entire length of the proposed pipeline route. As well as concentrating upon the 20 m wide construction zone required for the laying of the pipeline, the study also examined the flora , fauna and ecology within a corridor extending one kilometre either side of the proposed pipeline route. Any effects which may have been determined to extend beyond this two kilometre corridor are also reported and assessed.

Locations along the proposed pipeline route (version 5.1) are defined in terms of the number of kilometres from the start of the pipeline at Longford. These numbers are designated as kilometre points (KPs).

The proposed route traverses four biogeographical regions, the South East Coastal Plain, South East Corner, South Eastern Highlands and Sydney Basin (Thackway and Cresswell 1995), and encounters a wide range of vegetation communities and fauna habitats.

DELINEATION OF ROUTE SEGMENTS

For the purposes of reporting, the route has been divided into nine segments. These segments represent distinct landscape boundaries and to some degree reflect ecological distinctions. These are based on Route Option 5.1 and are outlined below:

	Location	KP
1	Gippsland Coastal Plains (Longford-Mossiface)	0-95
2.	Gippsland Coastal Forests (Mossiface-Cann Valley)	95-227.5
3.	Cann River Valley (Cann Valley-border)	227.5-273.5
4.	Monaro Plains (border-Numeralla River)	273.5-410.5
5.	Mountain Valleys (Numeralla River-Hoskinstown)	410.5-505.5
6.	Hoskinstown-Nerriga Hills (Hoskinstown-Endrick River)	505.5-577
7.	Morton Plateau & Slopes (Endrick River-Shoalhaven R.)	577-637.5
8.	Illawarra Coastal Plain (Shoalhaven R.- Illawarra escarpment)	637.5-702
9.	Wilton Tablelands (Illawarra escarpment-Wilton)	702-731

REPORT STRUCTURE

This report is set out in two main sections. The first contains the key information required for route assessment; it is intended that this section forms the EES/EIS chapter. It abbreviates much of the technical and background information, but provides more detail on key issues and conclusions. The second section is a series of appendices that contain the fully detailed information from which the first section was derived.

The reader wishing to gain an overview of the ecological values along the proposed pipeline route and an assessment of potential impacts and options for amelioration need only read the first section. Should detail on technical points or specific locations along the route be required, refer to the appendices.

ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The aims of the study follow the principles of Ecologically Sustainable Development as detailed in Hare *et al.* (1990). These aims consider the following factors to ensure the preservation of the environment for future generations:

Inter-generational Equity

The present generation should ensure that the next generation is left with an environment that is at least as healthy, diverse and productive as the one the present generation experiences. Owing to the massive and irreversible rate of loss of species and habitats at present, we have an additional responsibility to give the highest priority to conserving the world's natural environment and species.

Conservation of Biodiversity and Ecological Integrity

Conservation of biodiversity and the protection of ecological integrity should be a fundamental constraint on all economic activity. The non-evolutionary loss of species and genetic diversity needs to be halted and the future of evolutionary processes secured.

Anticipatory and Precautionary Policy Approach

Policy decisions should err on the side of caution, placing the burden of proof on technological and industrial developments to demonstrate that they are ecologically sustainable.

METHODOLOGY

GENERAL

This section provides an overview of the methodology; full details are contained in Appendices 1, 2 and 3.

Data Sources

Data on the flora, fauna and stream ecology of the pipeline corridor were collected through field assessment, map and aerial photo interpretation, literature review, discussions with researchers and naturalists and from several databases. Key databases consulted were the Flora Information System (FIS) and the Atlas of Victorian Wildlife (AVW) of the Department of Conservation and Natural Resources (CNR), the flora and fauna databases held by the New South Wales National Parks and Wildlife Service, and the fauna database of the Australian Museum.

Field Assessment

Field work on terrestrial flora and fauna was undertaken in two phases with Phase 2 being a spring assessment of sites selected during Phase 1. Phase 1 field work was undertaken by three teams, one in Victoria (Spread I), one working from the Victoria-NSW border to the Endrick River (Spread II), and one working from Endrick River to Wilton (Spread III). The same teams were used in spring although additional botanists were used in Spread II.

Table 1. Dates of field trips for EGP flora, fauna and stream ecology studies (all during 1995).

Survey Team	Season	Date
Team 1 (Victoria):	Winter:	May 24-June 2
		June 14-June 23
		July 3-July 7
	Spring:	October 16-October 20
Team 2 (border-Endrick River):	Winter:	May 28-June 4
		July 2-July 8
	Spring:	October 1-November 5
Team 3 (north of the Endrick River):	Winter:	May 30-June 2
		June 27-June 30
		July 12-July 15
		July 19-July 22
		July 24-July 29
		June 31-August 4
	Spring:	October 16-October 26
Stream Ecology Team:	Winter:	July 14-July 21

The entire route was examined from the air, while areas of native vegetation (including roadside vegetation) were examined from a vehicle or on foot. Access to most areas was provided by the extensive road and track network in the corridor; in unroaded areas access was by foot. Where vehicular access was possible the route was surveyed at regular and appropriate intervals dependent on the habitats encountered. Emphasis was placed on surveying the natural habitats along the pipeline route; there was only minor survey effort in cleared areas.

A fourth team undertook the stream ecology assessments for the whole route. This work concentrated on deriving conservation value and hazard indices for streams based on existing data. Field work was conducted on selected streams along the whole route to validate the indices.

Spring Surveys

Areas were identified during the winter field studies where further surveys in spring would be required to assess the presence of seasonal species of flora and fauna. These mainly comprise:

- flora surveys in orchid- and herb-rich areas in Spread I
- flora surveys in native grasslands in Spread II that were heavily grazed or drought affected
- fauna surveys in native grasslands and woodlands in Spread II that are potential habitat for significant reptiles and amphibians
- flora surveys for seasonal species in Spread III (Morton National Park and other sites of significance)
- focussed fauna surveys in Spread III.

The dates of these surveys are listed in Table 1.

FLORA

Vegetation communities along the proposed pipeline route were surveyed and mapped, observations were made on their condition, and lists of vascular plant species (ferns, conifers, flowering plants) were compiled for each landscape division of the proposed route.

The bulk of fieldwork was undertaken during late autumn and early winter with areas identified as requiring additional investigation evaluated during spring. Survey dates are given in Table 1.

Limitations

The majority of flora survey was conducted at a time of the year when many seasonal plants were dormant below the soil surface. Dried remains and immature buds of some species were found but additional species would be found if the entire route were surveyed in spring. For most parts of the route, surveys are likely to be reasonably complete as non-seasonal species (eg trees and shrubs) dominated most areas and significant sites were also revisited in spring. Areas such as the Monaro Plains, however, are dominated by grassy ecosystems which contain a wide array of annual and/or seasonal species. It is likely, therefore, that the Monaro Plains portion of the pipeline route would contain more plant species than recorded in the recent survey. To compound this problem, the Plains are still recovering from a severe drought and are heavily grazed.

Most areas of native vegetation were surveyed; the only areas not surveyed were small areas of private land where access was refused.

FAUNA

The fauna was surveyed using a range of techniques as follows:

- active searching
- Elliott trapping
- hair-tubing
- pit-fall trapping
- artificial spider burrows
- scat analysis
- spotlighting
- call playback
- frog census
- bird survey.

Survey dates are given in Table 1.

Limitations

The Phase I survey was carried out over a short time-frame during winter when some animals are less likely to be observed. Amphibians, reptiles and bats are rarely encountered in colder months and migratory species may not be present. Phase 2 surveys only targeted specific locations.

To overcome the problem of sampling seasonally inactive or absent animals, the report incorporates results from previous field surveys conducted in the general area, the consultant's own records from the region and those held in biological databases. Surveys targeted rare or significant species, including those listed on the amended Schedule 12 by the National Parks and Wildlife Service of New South Wales.

STREAM ECOLOGY

The stream ecology assessment involved the following tasks:

- identify each stream potentially affected by pipeline activities
- develop and implement a procedure to determine the relative conservation value of each stream
- develop and implement a procedure to determine the relative hazards to which each stream is potentially exposed by pipeline activities
- identify problematic areas where streams of high conservation value are potentially exposed to high levels of hazard
- identify any information required for a more effective assessment.

All streams, marked on 1:25,000 topographic and supplied GIS maps, which intersect the pipe route were identified as streams to be potentially affected by pipeline construction activities. Each stream crossing point was given an identifying number and its location defined. The following stream categories were used:

1. small tributary streams (1st to ~3rd order streams with catchments < ~2 km^2)
2. minor trunk streams (~3rd to ~4th order streams with catchments ~2 km^2 to ~5 km^2)
3. major trunk streams (~4th to ~5th order streams with catchments > ~5 km^2)
4. minor rivers (~5th order streams or greater, width < ~10 m)
5. major rivers (~5th order streams or greater, width > ~10 m)
6. minor estuary (width < ~100 m)
7. major estuary (width > ~100 m)
8. agricultural drains.

The location of wetlands and areas subject to inundation were also noted.

Conservation Value Index

Information was gathered with the aim of developing an index which would collectively reflect the occurrence of the following features:

1. recognised valuable areas in which diminished integrity of stream ecosystems would diminish intrinsic values
2. the naturalness of fish communities
3. high conservation value fish species
4. high recreational value fish species,
5. high conservation value freshwater crayfish species, and
6. valuable areas for scientific research.

Emphasis was placed on fish and crayfish as these are the taxa for which information on conservation status is most adequate, and the general public are familiar with them. The six components above formed the basis of the derived index. The method by which scores were attributed to each component is detailed in Appendix 3.

Approach Hazard Index

A range of features of the route where the pipeline is approaching a stream crossing will determine the magnitude of any resultant impact (approach hazard):

1. steep bank slope
2. damage to riparian vegetation which leads to bank destabilisation
3. catchment in pristine state
4. high rainfall intensity
5. high soil erodibility
6. dominance of acidic soils, which if disturbed could allow acidic waters and any associated dissolved metallic constituents to enter streams.

The method by which scores were attributed to each component is given in Appendix 3. Three approach hazard variables were calculated to avoid major loss of information caused by gaps in the data on soil erodibility and soil acidity:

A. approach hazard without soil factors - standardised scores summed across 4 slope variables, 2 riparian vegetation variables, 2 catchment condition variables, and 1 rainfall intensity variable.
B. approach hazard with soil erosion factor only - standardised scores summed across the variables above, plus the soil erodibility variable which had its weight doubled.
C. approach hazard with both soil factors included - standardised scores summed across the variables above, plus soil acidity.

Within-Stream Hazards Index

For situations where stream sediments will be disturbed in pool habitats, an index can be derived which indicates whether the sediments may contain toxic materials (biocides, metals, etc.) arising from upstream land use or natural sources. Land uses which could result in the accumulation of toxic materials in stream sediments are agriculture, industry and urban development. Natural sources of toxic materials could include areas of mineralisation or certain soil types which contain, for example, elevated levels of aluminium or iron. The occurrence of the above natural sources can in some situations be indicated by areas with marked soil acidity. Since information on upstream land uses can be obtained for the whole route, and information on soil acidity has major gaps, two within-stream hazard indices were developed:

A. Within-stream hazard - land use factors only
B. Within-stream hazard - land use + soil acidity.

Combined Index

The sensitivity of streams to disturbance was identified by combining the conservation value index (CV) with the three approach hazard (AH) indices. It was not considered worthwhile to undertake this procedure with the within-stream hazard indices at this stage. Three identifiers of sensitive streams were thus available:

1. CV + AH with soil factors
2. CV + AH with soil erosion factor only (data set limited)
3. CV + AH with both soil factors (data set very limited).

Turbidity of Stream Water

Substantial sets of turbidity data were available for 29 sites, most of which were located on streams which intersected the pipe route (the others drained catchments near the pipe route and thus provide an indication of stream conditions in areas near the route). Details of the sites and sampling periods are given in Table 5. To obtain an indication of the duration which stream biota are typically exposed to high turbidity levels along the pipe route, the turbidity data were examined at specific points on yearly flow duration curves (flow duration data supplied by the DWR in NSW, and the Rural Water Corporation in Victoria), the 50 and 10 percentile flow exceedence levels.

RESULTS

FLORA

This section provides a summary of the results collected for flora. Full details are provided in Appendix 1.

Plant Species

A total of 1251 indigenous and 171 introduced vascular plant species (ferns, conifers, flowering plants) was recorded over the entire proposed route. The number of species recorded in each sub-division of the proposed route is presented in Table 2.

Table 2. Summary of vascular flora species richness. Numbers in parenthesis are those previously recorded in Victoria by CNR.

Route Sub-division	Indigenous Species	Introduced Species	Significant Species	Total Species
Gippsland Coastal Plains (Longford-Bairnsdale)	157 (103)	39 (17)	11	196 (120)
Gippsland Coastal Foothills (Bairnsdale-Cann Valley)	432 (455)	52 (18)	26	484 (473)
Cann River Valley (Cann River-Vic/NSW border)	313 (342)	43 (28)	12	356 (370)
Monaro Plains (Vic/NSW border-Numeralla River)	242	52	9	294
Mountain Valleys (Numeralla River-Hoskinstown)	244	73	6	317
Hoskinstown-Nerriga Hills (Hoskinstown-Endrick River)	349	49	23	398
Morton Plateau & slopes (Endrick River-Shoalhaven River)	298	1	15	337
Illawarra Coastal Plain (Shoalhaven River-Illawarra Escarp)	301	15	27	326
Wilton Tablelands (Illawarra Escarpment-Wilton)	391	4	12	395
Total	**1251**	**171**	**135**	**1422**

Significant Plant Species

A total of 25 nationally significant (rare or threatened Australian plants or ROTAP), 18 state significant and 92 regionally significant taxa (species or sub-species) was recorded. These are listed below according to the sub-division of the pipeline in which they were recorded and their level of significance (national, state and regional).

Table 3. Significant plant species recorded along the EGP route. Codes for route segments: GCP - Gippsland Coastal Plains, GCF - Gippsland Coastal Forests, CRV - Cann River Valley, MP - Monaro Plains, MV - Mountain Valleys, HNH - Hoskinstown-Nerriga Hills, MPS - Morton Plateau & Slopes, ICP - Illawarra Coastal Plains, WT - Wilton Tablelands. Ratings Codes: N - national, S - state, R - regional; sub-codes follow Gullan *et al.* (1990) and Briggs and Leigh (*in prep.*).

Route Segment	Common Name	Species Name	Rating	Pipeline KP
GCP:				
	Purple Diuris	*Diuris punctata* var. *punctata*	S (v)	62
	Dwarf Milkwort	*Polygala japonica*	S (v)	63
	Mitchell's Wattle	*Acacia mitchellii*	R	33-34
	Mayfly Orchid	*Acianthus caudatus*	R	40
	Showy Bossiaea	*Bossiaea cinerea*	R	40
	Windmill Grass	*Chloris truncata*	R	62
	Spurred Helmet-orchid	*Corybas aconitiflorus*	R	4
	Forest Red Gum	*Eucalyptus tereticornis*	R	7-57
	Varied Raspwort	*Haloragis heterophylla*	R	33-34
	Bushy Clubmoss	*Lycopodium deuterodensum*	R	33-34
	Soft Bush-pea	*Pultenaea mollis*	R	35
GCF:				
	Small Autumn Greenhood	*Pterostylis longipetala*	N (3rci)	164
	River Leafless Bossiaea	*Bossiaea riparia*	S (r)	218
	Showy Willow-herb	*Epilobium pallidiflorum*	S (d)	226
	Lacy Wedge-fern	*Lindsaea microphylla*	S (r)	198
	Cluster-headed Mat-rush	*Lomandra longifolia* ssp. *exilis*	S (r)	120-140
	Tangle Orchid	*Plectorrhiza tridentata*	S (r)	184.5
	Slender Mud Grass	*Pseudoraphis paradoxa*	S (e)	110-111
	Number Nine Wire-grass	*Aristida calycina* var. *calycina*	R	177.5
	Spurred Helmet-orchid	*Corybas aconitiflorus*	R	7 sites between 4 & 145
	Bronze Caladenia	*Caladenia iridescens*	R	Easement in Colquhoun
	Wetland Wallaby-grass	*Danthonia semiannularis*	R	96
	Large-leaf Hop-bush	*Dodonaea triquetra*	R	105-112
	Sticky Hop-bush	*Dodonaea viscosa*	R	112.5
	Apple-topped Box	*Eucalyptus angophoroides*	R	34 sites between 76 & 243
	Swamp Stringybark	*Eucalyptus conspicua*	R	125-145
	Brittle Gum	*Eucalyptus mannifera*	R	100-103
	Tight Bedstraw	*Galium curvihirtum*	R	135-143
	Red-stem Cranesbill	*Geranium neglectum*	R	222.5
	Silky Guinea-flower	*Hibbertia sericea*	R	109-110
	Broad-leaf Stinkweed	*Opercularia ovata*	R	196,228
	Sword Tussock-grass	*Poa ensiformis*	R	96
	Hairy Mint-bush	*Prostanthera hirtula*	R	122-132
	Rusty-hood	*Pterostylis* aff. *rufa*	R	224
	Bentham's Bush-pea	*Pultenaea benthamii*	R	82
	Soft Bush-pea	*Pultenaea mollis*	R	87
	Halo Bush-pea	*Pultenaea linophylla*	R	99-192
CRV:				
	Small Autumn Greenhood	*Pterostylis longipetala*	N (3rci)	253
	Giant Maidenhair	*Adiantum formosum*	S (r)	235.1
	Pinkwood	*Beyeria viscosa*	S (r)	268
	Prickly Oxylobium	*Oxylobium ilicifolium*	S (r)	254
	Spiny Bossiaea	*Bossiaea obcordata*	R	247-264
	Fitzgerald's Spider Orchid	*Caladenia fitzgeraldii*	R	253,263
	Bronze Caladenia	*Caladenia iridescens*	R	242.8
	Early Caladenia	*Caladenia praecox*	R	260-264
	Veined Helmet-orchid	*Corybas dilatatus*	R	268
	Forest Bent-grass	*Deyeuxia frigida*	R	266
	Bog Bent-grass	*Deyeuxia gunniana*	R	271
	One-flower Early Nancy	*Wurmbea uniflora*	R	242.8, 252-266

Table 3 cont. Significant plant species recorded along the EGP route. Codes for route segments: GCP - Gippsland Coastal Plains, GCF - Gippsland Coastal Forests, CRV - Cann River Valley, MP - Monaro Plains, MV - Mountain Valleys, HNH - Hoskinstown-Nerriga Hills, MPS - Morton Plateau & Slopes, ICP - Illawarra Coastal Plains, WT - Wilton Tablelands. Ratings Codes: N - national, S - state, R - regional; sub-codes follow Gullan *et al.* (1990) and Briggs and Leigh (*in prep.*).

Route Segment	Common Name	Species Name	Rating	Pipeline KP
MP:				
	Australian Anchor Plant	*Discaria pubescens*	N (3RCa)	286.6, 352.8
	Austral Dandelion	*Taraxacum aristum*	N(rare)	282
	Bedstraw	*Galium roddii*	S	420
	Pennywort	*Hydrocotyle* sp. aff. *tripartita*	S	295.4, 304.3
	Knawel	*Scleranthus fascicularis*	S	380, 400
	Blue Pincushion	*Brunonia australis*	R	391
	Red-flowered Lotus	*Lotus cruentus*	R	286.6, 380
	Wedge-leaf Everlasting	*Ozothamnus cuneifolius*	R	274
	Poison Rice-flower	*Pimelea pauciflora*	R	352.8
MV:				
	Austral Toad-flax	*Thesium australe*	N (3ECi)	465.4
	Trailing Hop-bush	*Dodonaea procumbens*	S (r)	415, 420,424,434
	Guinea-flower	*Hibbertia calycina*	S	480
	Australian Piert	*Aphanes australiana*	R	424
	Blue Pincushion	*Brunonia australis*	R	443, 457
	Flat Spurge	*Chamaesyce drumondii*	R	424
HNH				
	Guinea-flower	*Hibbertia calycina*	S	562
	Prostrate Cone-bush	*Isopogon prostratus*	S (r)	545, 554, 565
	Banksia	*Banksia paludosa*	R	544, 545, 567
	Hairpin Banksia	*Banksia spinulosa spinulosa*	R	523, 545
	Bossiaea	*Bossiaea ensata*	R	562
	Pale Grass-lily	*Caesia parviflora*	R	531
	Pennywort	*Centella cordifolia*	R	513, 523
	Conospermum	*Conospermum taxifolium*	R	545, 554, 562
	Small Waxlip Orchid	*Glossodia minor*	R	554
	Red Wedge Pea	*Gompholobium uncinatum*	R	545, 567
	Hakea	*Hakea eriantha*	R	545
	Needlewood	*Hakea teretifolia*	R	545
	Guinea Flower	*Hibbertia linearis*	R	545
	Guinea Flower	*Hibbertia rufa*	R	568
	Blady Grass	*Imperata cylindrica* var. *major*	R	545
	Beard Heath	*Leucopogon appressus*	R	545, 534, 508
	Mat-rush	*Lomandra elongata*	R	508, 545
	Mat-rush	*Lomandra hystrix*	R	566
	Red-beaks	*Lyperanthus nigricans*	R	514
	Conestick	*Petrophile canescens*	R	545, 554, 565
	Pomaderris	*Pomaderris* species A	R	557
	Narrow Groundsel	*Senecio tenuiflorus*	R	545, 566, 577
	Daisy	*Vittadinia sulcata*	R	557
MPS:				
	Wattle	*Acacia subtilinervis*	N (3RCa)	579-580, 593.6, 601-602, 617,636.7, 642.3
	Boronia	*Boronia subulifolia*	2RC-	587
	Mallee Ash	*Eucalyptus langleyi*	N (2V)	601, 624-625, 642.3
	Pigeon House Ash	*Eucalyptus triflora*	N (2RCa)	578-580, 592.1
	Ettrema Mallee	*Eucalyptus sturgissiana*	N (2VC-)	604.8, 607.8, 615.7
	Gully Grevillea	*Grevillea barklyana* ssp *macle.*	N (3RCA)	624-626,
	Tea-tree	*Leptospermum epacridoideum*	N (2RC-)	593.6, 611.5, 617.2
	Tea-tree	*Leptospermum sejunctum*	N (2K)	599.2, 636, 638.6, 642.3
	Platysace	*Platysace stephensonii*	N (3RC-)	593.6,

Table 3 cont. Significant plant species recorded along the EGP route. Codes for route segments: GCP - Gippsland Coastal Plains, GCF - Gippsland Coastal Forests, CRV - Cann River Valley, MP - Monaro Plains, MV - Mountain Valleys, HNH - Hoskinstown-Nerriga Hills, MPS - Morton Plateau & Slopes, ICP - Illawarra Coastal Plains, WT - Wilton Tablelands. Ratings Codes: N - national, S - state, R - regional; sub-codes follow Gullan *et al.* (1990) and Briggs and Leigh (*in prep.*).

Route Segment	Common Name	Species Name	Rating	Pipeline KP
MPS cont:				
	Rulingia	*Rulingia hermannifolia*	3RCa	594
	Dwarf Bottlebrush	*Callistemon subulatus*	R	599.4
	Budawong Ash	*Eucalyptus dendromorpha*	R	578-606
	Stringybark	*Eucalyptus imitans*	R	637.6, 639
	Mallee	*Eucalyptus multicaulis*	R	601
ICP:				
	White Cynanchum	*Cynanchum elegans*	N (3ECi)	677.3, 697.3
	Illawarra greenhood	*Pterostylis gibbosa*	N (2E)	686.9,
	Zieria	*Zieria granulata*	N (2VCi)	668,
	Zieria	*Zieria* species M	N (2E)	642.3
	Austral Bugle	*Ajuga australis*	R	695.2
	Native Holly	*Alchornea ilicifolia*	R	674.9, 678.2
	Prickly Alyxia	*Alyxia ruscifolia*	R	698.7
	Illawarra Flame Tree	*Brachychiton acerifolius*	R	638.2
	Native Cascarilla	*Croton verreauxii*	R	666.3,-668
	Dampiera	*Dampiera scottiana*	R	636, 638, 639
	Broom Bitter-pea	*Daviesia genistifolia*	R	695.7
	Coast Grey Box	*Eucalyptus bosistoana*	R	691.2
	-	*Geijera latifolia*	R	701.1, 698.7
	Native hibiscus	*Hibiscus heterophyllus*	R	674.9
	Pennywort	*Hydrocotyle peduncularis*	R	685.5
	-	*Lespedeza juncea* ssp *sericea*	R	686.2
	Tea-tree	*Leptospermum squarrosum*	R	695.7,
	Milk-vine	*Marsdenia rostrata*	R	695.2
	Honey-myrtle	*Melaleuca linariifolia*	R	687.9
	Euodia	*Melicope micrococca*	R	666.9
	Snow Wood	*Pararchidendron pruinosum*	R	666.9
	-	*Passiflora cinnabarina*	R	698.7
	-	*Peperomia leptostachya*	R	638.2
	Black Apple	*Planchonella australis*	R	666.9
	Hazel Pomaderris	*Pomaderris aspera*	R	695.2
	-	*Sicyos australis*	R	698.7
	-	*Trochocarpa laurina*	R	666.9
	-	*Zornia dyctiocarpa*	R	695.2
WT:				
	Darwinia	*Darwinia grandiflora*	N (2RC-)	709, 710, 712.2
	Guinea-flower	*Hibbertia nitida*	N (2RC-)	713.2-714.1
	Mat-rush	*Lomandra fluviatilis*	N (3RC-)	09.3
	Geebung	*Persoonia bargoensis*	N (2V)	723.9
	Heath	*Epacris purpurascens* var *purp.*	N (2KC)	724, 724.5-726.1
	Bush-pea	*Pultenaea aristata*	N (2VC-)	712.3
	Pink-bells	*Tetratheca neglecta*	N (3RC-)	712.2
	Grevillea	*Grevillea diffusa subsp diffusa*	S	709, 710, 713.8, 721-722
	Hairpin Banksia	*Banksia cunninghamii* ssp *cunn.*	R	725.7-726
	Privet-leaved Stringybark	*Eucalyptus ligustrina*	R	708, 711.1
	Honey-myrtle	*Melaleuca squamea*	R	709
	Geebung	*Persoonia mollis* ssp *nectens*	R	720.8, 724.3

Vegetation Communities

The vegetation communities (or Ecological Vegetation Classes - EVC) encountered in each section of the proposed route are described below and mapped (Map 1). We have used existing community classifications where these are available; we have created new classifications for a few poorly known or undescribed communities. Most of the vegetation encountered along the route in Victoria has been mapped and described by Woodgate *et al.* (1994). Each segment of the corridor is described below. Occurrences of vegetation communities which are significant at a national, state or regional level have been placed within sites of biological significance (see section under this heading).

Gippsland Coastal Plains

Within the pipeline corridor the natural vegetation of this region consists of **Coastal Grassy Forest**, **Lowland Forest**, **Grassy Dry Forest**, **Riparian Shrubland** (*sensu* Woodgate *et al.* 1994), **Forest Red Gum Grassy Woodland** and **Central Gippsland Plains Grassland** (CNR 1992a & b).

Forest Red Gum Grassy Woodland and Central Gippsland Plains Grassland are listed communities in Victoria under the Flora and Fauna Guarantee Act (1988). The woodland is dominated by Forest Red Gum *Eucalyptus tereticornis* with common co-dominants including Red Box *Eucalyptus polyanthemos* and Coast Grey Box *Eucalyptus bosistoana.* Its open understorey often supports scattered small trees such as Lightwood *Acacia implexa* and Black She-oak *Allocasuarina littoralis* over a variety of herbs and grasses. The Plains Grassland community is dominated by Kangaroo Grass *Themeda triandra* and also includes a wide variety of other grasses and herbs; trees and shrubs occur rarely.

Coastal Grassy Forest has been nominated for listing on the Flora and Fauna Guarantee Act (1988) by CNR. It is rare, with only 90 ha now remaining in East Gippsland (Woodgate *et al.* 1994), none of which is undisturbed. The overstorey of this community is generally dominated by Coast Manna Gum *Eucalyptus pryoriana.* The understorey supports an open shrub or small tree stratum of a range of species such as Silver Banksia *Banksia marginata*, Saw Banksia *Banksia serrata*, Coast Banksia *Banksia integrifolia*, Black Wattle *Acacia mearnsii* and Cherry Ballart *Exocarpos cupressiformis*. After fire, grasses and herbs, particularly orchids, dominate the ground stratum, but in the absence of fire shrubs increase and the understorey can appear heathy. Relatively intact examples of this community are considered to be of at least state significance.

Riparian vegetation is very sensitive to disturbance, a fact that is generally illustrated by the high percentage of weed species and their cover in comparison to other communities. Relatively intact riparian vegetation is of at least regional significance (Forbes *et al.* 1981, Cherry *et al.* 1986, Brown *et al.* 1987, Bramwell *et al.* 1993).

Gippsland Coastal Foothills

Vegetation communities in this section are **Lowland Forest** and **Damp Forest** with scattered areas of **Shrubby Dry Forest**, **Limestone Box Forest**, **Banksia Woodland**, **Wet Forest**, **Riparian Forest**, **Warm Temperate Rainforest**, **Riparian Swampy Forest**, **Riparian Scrub**, **Grassy Dry Forest**, **Lowland Clay Heathland**, **Wet Heathland** (*sensu* Woodgate *et al.* 1994) and **Gallery Rainforest** (Beadle 1981, Floyd 1989, Cameron 1992, CNR *in prep.*).

Any occurrence of the rare communities Limestone Box Forest, Gallery Rainforest and Lowland Clay Heathland was considered to be of state significance. Limestone Box Forest is endemic to Victoria and is found mainly on outcropping Tertiary limestones between Metung and Orbost. The overstorey is dominated by Coast Grey Box *Eucalyptus bosistoana,* Blue Box *Eucalyptus bauerana* and Red Ironbark *Eucalyptus tricarpa*. The understorey generally has a tall shrub layer of Hazel Pomaderris *Pomaderris aspera*, Sweet Pittosporum *Pittosporum undulatum*, Cherry Ballart *Exocarpos cuppressiformis* and the vulnerable species Limestone Blue Wattle *Acacia caerulescens*. The ground layer is either bare or grass- and herb-rich (Woodgate *et al.* 1994).

Gallery Rainforest is a strictly riparian community dominated by Kanooka *Tristaniopsis laurina*. Unlike other rainforest communities this EVC supports few vines, ferns or shrubs and is herb rich as its habitat is subject to regular disturbance from flooding. This community has recently been described by CNR (*in prep.*).

Lowland Clay Heathland was recorded from less than 1800 ha in East Gippsland where it is widespread and uncommon (Woodgate *et al.* 1994). Swamp Stringy Bark *Eucalyptus conspicua* is usually present as a sparse overstorey with Yertchuk *Eucalyptus consideniana* often found on the margins. Tall shrubs present include Scrub She-oak *Allocasuarina paludosa*, Crimson Bottlebrush *Callistemon citrinus*, Burgan *Kunzea ericoides* and Prickly Tea-tree. Small shrubs included Common Heath *Epacris impressa*, Swamp Heath *Epacris paludosa* and Tangled Guinea Flower *Hibbertia empetrifolia*. The orchid flora of this community may also be quite diverse.

Relatively undisturbed examples of riparian communities are considered to be of at least regional significance, while occurrences of Wet Heathland are also considered to be of regional significance. Lowland Forest sub-communities dominated by Swamp Stringy Bark *Eucalyptus conspicua* was considered rare by Kemp *et al.* (1993) and is of state significance.

Cann River Valley

This section of proposed pipeline corridor passes through dry eucalypt forest. Near the Victorian/New South Wales border the proposed corridor climbs to the southernmost extent of the Monaro Tablelands and this region supports wetter eucalypt forests. The most common vegetation communities include **Shrubby Dry Forest**, **Lowland Forest**, **Damp Forest** and **Heathy Dry Forest** with occurrences of **Riparian Scrub Complex**, **Herb Rich Forest**, **Warm Temperate Rainforest**, **Riparian Forest** and **Wet Forest** (*sensu* Woodgate *et al.* 1994).

Intact examples of Herb Rich Forest are considered to be of at least regional significance. This community has one or more box eucalypts dominating the overstorey with Gippsland Blue-gum *Eucalyptus globulus* ssp. *pseudoglobulus* being a good indicator of this community. Shrubs are generally infrequent except after disturbance and the community is more notable for the diversity of grasses and herbs.

Monaro Plains

In New South Wales, many of the vegetation communities along the Monaro Tablelands have been mapped and described by Costin (1954), with several communities re-evaluated by Benson and Wyse Jackson (1994), and Benson (1994a, 1994b). Grasslands and grassy woodlands were the dominant natural vegetation communities occurring on the Monaro Plains. Of the 250,000 hectares of Monaro native grasslands that existed prior to European settlement, not more than 50% remain in a semi-natural state, with very few sites remaining in good condition (Benson and Wyse Jackson 1994). The following communities occur along the EGP route:

Medium Dry Tussock Grassland (Community 4, Benson 1994a; Community M3, Benson and Wyse Jackson 1994) dominated by Tussock Grass *Poa sieberiana* occurred predominantly around and south of Cooma.

Tall Wet Tussock Grassland (Community 8, Benson (1994); Community M5, Benson and Wyse Jackson (1994); Wet Tussock Grassland, Costin (1954)) dominated by Common Tussock Grass *Poa labillardieri* and Saw Sedge *Carex apressa*, was found commonly along drainage lines and creeks, and over broad expanses on flood plains. Most Tall Wet Tussock Grasslands along the proposed pipeline route appeared to be in poor condition, with inter-tussock spaces often dominated by exotic pasture species.

Kangaroo Grass Grassland on volcanic soils (Community 3, Benson 1994; Community M2, Benson and Wyse Jackson 1994) dominated by Kangaroo grass *Themeda triandra* and supporting herbs such as Common Everlasting *Chrysocephalum apiculatum*, Scaly Buttons *Leptorhyncos squamatus* and Variable Plantain *Plantago varia* were found in areas near Cooma and north of Michelago.

Sub-alpine to Savannah Woodland (Costin 1954) occurred in the southern regions of the Monaro Tablelands. At higher altitudes, Snow Gums *Eucalyptus pauciflora* or *Eucalyptus niphophila* grew above an understorey of herbs such as Grey Tussock-grass *Poa sieberiana*, Woodruffs *Asperula pusilla* and *A. conferta*, and shrubs including Urn Heath *Melichrus urceolatus*, Goodenia *Goodenia obtusifolia*, Rice Flower *Pimelia curviflora* var. *sericea* and Daphne Heath *Brachyloma daphnoides*. Savannah Woodland (Costin 1954; Specht *et al.* 1974), occurring at lower altitudes, consisted of Yellow Box *E. melliodora*, Red Stringybark *E. macrorhynca* and Candlebark *E. rubida* as the predominant canopy species over the *Poa sieberiana* and shrub ground flora.

Mountain Valleys

Between the Numerella River and Michelago, the dominant vegetation communities were the **Medium Dry** and **Tall Wet Tussock Grasslands** of the Monaro Plains. A sample of **Kangaroo Grass Grassland** on volcanic soils (Community 3, Benson 1994; Community M2, McDougall & Kirkpatrick 1994) occurred north of Michelago. However, the community has resulted from historical tree removal and is considered to be a modified native community.

Dry Shrubby Grassland (not previously described) was dominated by Kerosene Grass *Aristida ramosa*, Wallaby Grasses *Danthonia* spp. and Spear Grasses *Stipa* spp. and shrub species such as Urn Heath *Melichrus urceolatus*, Bitter Cryptandra *Cryptandra amara* and Darling Pea *Swainsona sericea*. Dry Shrubby/Grassy Woodlands often consisted of Dry Shrubby Grassland with an overstorey of Candlebark *Eucalyptus rubida*, Red Stringybark *E. macrorhynca* and Yellow Box *E. melliodora*. The associated grasslands, in some instances, were the result of tree removal and therefore considered to be modified natural communities. These communities were most common around Michelago and extending to the south. Some examples occurred to the immediate north-east of Michelago.

The forests of the Tinderry Range were densely shrubby **Dry Sclerophyll Forests** (*Eucalyptus macrorhynca-E. rossii* alliance as per Costin 1954; Specht *et al.* 1974). West of the Tinderry Range were predominantly **Dry Shrubby Forests**, dissected by Burgan *Kunzea ericoides* Scrub. **Dry Grassy Woodland** dominated areas with shallow stony sôils.

Riparian Scrub/Forest occurred along the Queanbeyan River and Urialla Creek. Apple Box *Eucalyptus bridgesiana*, Ribbon Gum E. *viminalis*, Candlebark *E. rubida*. River Lomatia *Lomatia myricoides* and Tea Tree *Leptospermum squarrosum* were common components of the riparian and near-riparian overstorey. The understorey consisted mainly of tall shrubs and a sparse herb and grass layer. Burgan *Kunzea ericoides* scrub formed thickets along the dry hillsides.

Tall Wet Tussock Grassland dominated the Molonglo River flood plains.

Hoskinstown-Nerriga Hills

Much of the vegetation within this region was **Dry Grassy** and **Shrubby Woodland or Forest** which was dominated by mixed eucalypt species. Dry Grassy and Dry Shrubby Woodlands occurred on shallow stony clay soils of the Turallo Range, with Broad-leaf Peppermint *E. dives*, Red Stringybark *E. macrorhynca*, Candlebark *E. rubida* and occasionally Red Box *E. polyanthemos* dominating the overstorey. The lower stratum was often sparsely shrubby, with Common Hovea *Hovea linifolia*, Guinea Flower *Hibbertia obtusifolia*, Spur Velleia *Velleia paradoxa*, Kerosene Grasses *Aristida* spp, Wallaby Grasses *Danthonia* spp, Grass Trigger-plant *Stylidium graminifolium* and various geophytic orchids and lilies.

Dry Tall Shrubby Forests and **Dry Shrubby Forests** most often occurred on sandy and sandy loam soils of the Shoalhaven district. These communities, dominated by White Gum *Eucalyptus rossii*, Brittle Gum *E. mannifera* and Broad-leafed Peppermint *E. dives*, often supported many proteaceous species, indicating nutrient-poor soils.

Riparian Scrub (Tea Tree and Melaleuca) and Riparian Forest (River Peppermint *Eucalyptus elata*) was found along seasonal streams and permanent rivers. These communities occurred between the Hoskinstown region and Morton National Park.

Morton Plateau and Slopes

Vegetation types for Morton Plateau and Slopes has been described by The Budawang Committee (1982 & 1988) and Mills (1992).

River Flat Forest occurs along both banks of the Nerriga River. The understorey is generally disturbed and consists mainly of a coarse cover of low shrubs and grasses. Common tree species are River Oak *Casuarina cunninghamiana*, close to the river and Ribbon Gum *Eucalyptus viminalis* and Apple Box *E. bridgesiana* on the floodplain.

Sassafras High Forest is dominated by Brown Barrel *Eucalyptus fastigata*, Monkey Gum *E. cypellocarpa*, Ribbon Gum *E. viminalis* and Narrow-leaved Peppermint *E. radiata*. This vegetation type occurs on basalt-derived soils at Sassafras. In the study area, much of this community has been cleared, and the understorey generally consists of grasses.

Bulee Gap Woodland extends from the Endrick floodplain upslope to Bulee gap. Mills (1992) distinguishes three vegetation types on the slopes: an alliance of Peppermint *Eucalyptus dives*, Apple Box *E. bridgesiana*, Brittle Gum *E. mannifera*, Candlebark *E. rubida* and Narrow-leaved Peppermint *E. radiata* on the lower, gentler slopes; a taller woodland with Silvertop Ash *E. sieberi*, Yellow Stringybark *E. muelleriana* and Blue-leave

Stringybark *E. agglomerata* occurring on the upper, steeper slopes, and an alliance of Ironbark Peppermint *E. smithii*, Silvertop Ash *E. sieberi* and and Blue-leave Stringybark *E. agglomerata*, often with an understorey of Black Sheoak *Allocasuarina littoralis* occurring around the escarpment.

Mallee/Heath vegetation occurs on flat rock platforms between Bulee Gap and Willies Creek. Apart from emergent mallees *Eucalyptus dendromorpha*, the height of the canopy rarely exceeds 2.5 m. Common heath species are Burgan *Kunzea ambigua,* hakeas and wattles.**Heathland** and **Heathland/Scrubland** occur on rocky surfaces, especially where drainage is poor. Several stands occur between Sassafras and Deans Gap Road. Common species are *Hakea teretifolia, Calytrix tetragona* and *Baeckea brevifolia*. Sedge species are common ground covers.

Scribbly Gum Woodland and **Grey Gum Woodland** (see next section) occur at the northern end of the Morton tablelands section.

Further south Silvertop Ash *Eucalyptus sieberi,* Yertchuk *E. consideniana* and Brittle Gum *E. mannifera* become co-dominant in variations of these vegetation types.

Illawarra Coastal Plains

Vegetation types for the Illawarra Coastal Plain have been described by WCC (1995), CALM (1994) and Mills & Jakeman (1995).

Scribbly Gum Woodland

Scribbly Gum *Eucalyptus sclerophylla* may be the dominant tree species or may be co-dominant with Red Bloodwood *E. gummifera,* Yellow Bloodwood *E. eximia*, White Stringybark *E. globoidea* or *E. imitans*. Smaller tree and shrub species include Black Sheoak *Allocasuarina littoralis, Banksia* spp, *Hakea* spp and Mountain Devil *Lambertia formosa*. This vegetation type occurs on soils derived from the Shoalhaven Group on both sides of the Shoalhaven River.

Grey Gum-Stringybark Forest/Woodland may merge with Scribbly Gum Woodland in response to altered aspect, soil type or topography. In general this vegetation occurs where soils are sandy, well-drained and rocky and where the topography is sloping rather than flat. Common species are Grey Gum *Eucalyptus punctata,* and Blue-leave Stringybark *E. agglomerata* and Red Bloodwood *E. gummifera*. Understorey is generally sparse, consisting of low shrubs and sedges. This vegetation type occurs on both sides of the Shoalhaven River.

Remnant stands of **Spotted Gum Forest** occur on both sides of the Shoalhaven River, especially on soils derived from the Coolangatta Group (Hazelton 1992). These remnant stands generally occur on farmland, so understorey usually consists of improved pasture. Spotted Gum *Eucalyptus maculata* may occur in monotypic stands or with Blackbutt *E. pilularis* as co-dominant.

The following vegetation types occur from Nowra to Farmborough Heights:

Improved Pasture is generally dominated by exotic grasses, especially Kikuyu Grass *Pennisetum clandestinum* and Clover *Trifolium* spp. Scattered trees, and small shrub thickets occur in some paddocks, but trees and shrubs are absent from much of this vegetation type.

Riparian Woodland/Forest generally occurs as a narrow band of vegetation along the banks of creeks passing through improved pasture. On the floodplain dominant trees are River Oak *Casuarina cunninghamia* (replaced by *Casuarina glauca* in saline conditions), Cabbage Gum *Eucalyptus amplifolia,* Forest Red Gum *E. tereticornis,* Woolybutt *E. longifolia,* Prickly-leaved Tea Tree *Melaleuca styphelioides* and *Melaleuca decora*. Understorey is generally disturbed by cattle and may consist of a mixture of native and introduced grasses, shrubs and climbers. On steeper slopes and foothills, especially south of Jamberoo, the riparian vegetation may include rainforest species or small stands of closed forest. Emergent species include *Ficus* spp and Cabbage Palm *Livistona australis*. Common understorey species include Grey Myrtle *Backhousia myrtifolia*, *Guioa semiglauca,* Lilly Pilly *Acmena smithii* and Red Olive Plum *Cassine australis*.

Small stands of remnant or regrowth **Woodland (Disturbed)** in the West Dapto area are generally dominated by Forest Red Gum *Eucalyptus tereticornis* and Prickly-leaved Tea Tree *Melaleuca styphelioides*. Other tree species include, White Stringybark *Eucalyptus globoidea,* Thin-leaved Stringybark *E. eugenioides,* Coast Grey Box *E. bosistoana,* Blackbutt *E. pilularis*, Sydney Blue Gum *E. saligna*/Bangalay *E. botryoides* hybrid and Grey Ironbark *E. paniculata*. Understorey usually consists of grazed grass, but a sparse shrub understorey of *Bursaria spinosa*, *Melaleuca linariifolia* and *Acacia* spp. occasionally occurs.

Saddleback High Forest is similar in structure to the Illawarra High Forest (see next section), although the dominant canopy species are Brown Barrel *Eucalyptus fastigata,* Yellow Stringybark *E. muelleriana,* Blackbutt *E. pilularis,* White-topped Box *E. quadrangulata* and, Sydney Blue Gum *E. saligna*/Bangalay *E. botryoides*. The proposed easement passes through examples of this vegetation type on the north and south slopes of Saddleback Mountain.

Shrubland (Disturbed) occurs on rocky hilltops that have been cleared then abandoned for farming and can contain plant species of conservation significance. Examples include *Cynanchum elegans* (Matthes & Nash 1993), *Pimelea spicata* (Nash & Matthes 1993), *Zieria granulata* (Mills & Jakeman *in prep.*) and *Alchornea ilicifolia* (WCC 1995). Common shrub species include *Melaleuca armillaris*, Black Wattle *Acacia mearnsii,* Large Mock-olive *Notelaea longifolia,* Whalebone Tree *Streblus brunonianus, Clerodendrum tomentosum,* Coffee Bush *Breynia oblongifolia* and Tree Violet *Hymenanthera dentata*.

Closed Forest/Rainforest occurring on escarpments and hillsides is generally regrowth after selective logging. Mills & Jakeman (1995) describe 12 rainforest types occurring in the Illawarra region. These descriptions are used to describe the rainforest vegetation in the study area, even though the disturbed nature of much of the vegetation makes a clear definition uncertain.

i) Subtropical Rainforest

A large stand of subtropical rainforest occurs at Whispering Gallery, to the east of the proposed easement. This vegetation type occurs on steep rocky slopes on soils derived from the Gerringong Volcanics. The proposed easement passes through several stands of this vegetation type between Foxground and Albion Park. Common tree species are *Ficus* spp, Whalebone Tree *Streblus brunonianus*, Wild Quince *Alectryon subcinereus,* Koda *Ehretia acuminata* and Giant Stinging Tree *Dendrocnide excelsa*. Common Shrub understorey and ground cover species include Pittosporum *Pittosporum undulatum,* Orange Thorn *Citriobatus pauciflorus, Doodia aspera, Maclura cochinchinensis* and Coffee Bush *Breynia oblongifolia*.

ii) Dry Subtropical Rainforest

This vegetation type occurs on north and west-facing slopes. The proposed easement passes through an extensive stand of this vegetation type on the northern side of Saddleback Mountain. Mills & Jakeman (1995) observed that deciduous trees are common in this vegetation type. Common species are Giant Stinging Tree *Dendrocnide excelsa*, Flame Tree *Brachychiton acerifolius*, Koda *Ehretia acuminata*, White Cedar *Melia azedarach* and Red Cedar *Toona ciliata*. Ground cover is generally sparse.

iii) Backhousia Thicket

This vegetation type occurs along the edges of some rainforest stands and along some streams, and may consist of monotypic bands of Grey Myrtle *Backhousia myrtifolia*, although Large Mock-olive *Notelaea longifolia*, Cheese Tree *Glochidion ferdinandi*, *Clerodendrum tomentosum* and Pittosporum *Pittosporum undulatum* may also be common.

iv) Warm Temperate Rainforest

This vegetation type occurs in Bomaderry Creek gorge, to the east of the proposed easement. A small disturbed stand does, however, occur on the cliffs of the north bank of the Shoalhaven River, within twenty metres of the proposed easement. Common tree species are Coachwood *Ceratopetalum apetalum*, Jackwood *Cryptocarya glaucescens*, Lilly Pilly *Acmena smithii* and Sassafras *Doryphora sassafras*. In the study area the understorey mainly consists of lantana, although small shrubs, ferns and vines may form a sparse cover in less disturbed sites.

The proposed easement passes through several stands of **Shrubland** at North Nowra, on shallow sandy soils. The dominant shrub species are Burgan *Kunzea ambigua*, although the rare shrub species *Acacia subtilinervis* and *Leptospermum sejunctum* may also be common (Whelan & Leonard 1994).

Components of **Mixed Subtropical/Warm Temperate Rainforest** occur on the escarpment slopes to the north of Mount Kembla. Because of the disturbed nature of the vegetation along the proposed easement, emergent eucalypts occur in areas where the canopy had been opened. Common tree species are Red Cedar *Toona ciliata*, Silver Quandong *Elaeaocarpus kirtonii*, , Wild Quince *Alectryon subcinereus*, *Ficus spp*, Sassafras *Doryphora sassasfras* and Cabbage Palm *Livistona australis*. Understorey shrubs include Orange Thorn *Citriobatus pauciflorus*, Brittlewood *Claoxylon australe*, Large Mock-olive *Notelaea venosa* and Scentless Rosewood *Synoum glandulosum*. Vines, herbs and ferns are generally common.

Wilton Tablelands

Vegetation types for Wilton tablelands have been described by Briggs and Leigh (1994).

Blackbutt-Blue Gum High Forest, a tall open forest of Blackbutt *Eucalyptus pilularis*-Grey Ironbark *E. paniculata*, , Sydney Blue Gum *E. saligna*/Bangalay *E. botryoides*-*Syncarpia glomulifera*, occurs on extensive sections of the Illawarra Escarpment where soils are derived from the Narrabeen series. In most cases the vegetation is regrowth. Understorey varies in floristics and structure according to aspect and topography, although species such as Two-veined Hickory *Acacia binervata*, Forest Oak *Allocasuarina torulosa*, *Leucopogon lanceolatus* and *Indigofera australis* are common in most areas. The proposed easement passes through sections of this vegetation type from Mount Kembla to Mount Brisbane. Small disjunct patches also occur in sections of the proposed easement between Nowra and Mount Kembla.

Illawarra High Forest is a tall open-forest of Ironbark Peppermint *Eucalyptus smithii*- White-topped Box *E. quadrangulata*- Monkey Gum *E. cypellocarpa* and Yellow Stringybark *E. muelleriana*. This vegetation type merges with Blackbutt-Blue Gum High Forest at higher altitudes, particularly on ridge tops between Mount Kembla and Mount Brisbane. Understorey shrubs are more commonly mesic species such as *Cryptocarya glaucescens*, Pencil Cedar *Polyscias murrayi* and Two-veined Hickory *Acacia binervata*, although Black Wattle *Acacia mearnsii* and White Dodwood *Ozothamnus diosmifolius* may be common in disturbed areas.

Sydney Sandstone Ridge Top Woodland occurs along a major section of the proposed easement between Harry Graham Drive and the abandoned airstrip. Benson & Howell (1994) subdivide this vegetation type into 6 subgroups:

i) Woodland (*Eucalyptus oblonga-E. gummifera-E. racemosa-E. sieberi)*
ii) Woodland (*Eucalyptus sieberi-E. gummifera-E. racemosa)*
iii) Woodland/Open-woodland (*Eucalyptus haemastoma)*
iv) Open-forest (*Eucalyptus sieberi-E. sclerophylla-E. piperita)*
v) Open-woodland (*Eucalyptus sclerophylla)* (not recorded in the study area)
vi) Closed-scrub (*Banksia ericifolia-Hakea teretifolia)*.

Woronora Plateau Upland Swamps occur throughout this segment. Sub-units i); ti-tree thicket and v); banksia thicket are the most frequently occurring in the study area, although small stands of sub-units ii) cyperoid heath, iii) sedgeland and iv) restioid heath are common, especially where drainage lines cross the easement.

Grey Box-Ironbark Woodland (Benson & Howell 1994) occurs patchily from Wilton to the southern end of the Wilton Bypass. Dominant tree species are Grey Box *Eucalyptus moluccana*, Forest Red Gum *E. tereticornis* and Narrow-leaved Ironbark *E. crebra*. Some stands of shrub understorey occur, but grasses are more common. A small stand of the transitional vegetation type **Shale-Sandstone Forest/Bargo Brush Woodland** occurs between the southern extent of the Grey Box Ironbark woodland and the Sydney Sandstone Ridge top woodland. Dominant tree species are Blackbutt *Eucalyptus pilularis*, Coast Grey Box *E. bosistoana*, Red Mahogany *E. resinifera*, Grey Gum *E. punctata* and Narrow-leaved Ironbark *E. crebra*.

FAUNA

This section provides a summary of the results collected for fauna. Full details are provided in Appendix 2.

Overall Species

A total of 59 mammal species (47 native), 269 bird species (257 native), 46 reptile species (all native) and 34 frog species (all native) was recorded from the study area, from both our surveys and from pre-existing data.

The recorded terrestrial vertebrate fauna is summarised in Table 4.

Table 4. Summary of fauna species richness recorded for each section of the proposed route.

Section of route	Indigenous species	Introduced species	Total species
Gippsland Coastal Plains (Longford-Bairnsdale)	242	18	260
Gippsland Coastal Forests (Bairnsdale-Cann Valley)	304	14	318
Cann River Valley (Cann River-Vic/NSW border)	123	9	132
Monaro Plains (Vic/NSW border-Numeralla River)	144	8	152
Mountain Valleys (Numeralla River-Hoskinstown)	106	8	114
Hoskinstown-Nerriga Hills (Hoskinstown-Endrick River)	141	8	149
Morton Plateau & slopes (Endrick River-Shoalhaven River)	103	6	109
Illawarra Coastal Plain (Shoalhaven River-Illawarra Escarpment)	110	9	119
Wilton Tablelands (Illawarra Escarpment-Wilton)	104	10	114
Total	**384**	**24**	**408**

Significant Species

A total of 76 significant fauna species have been recorded in the corridor, including six nationally significant species (four in NSW, four in Vic). Eighteen species of state significance were recorded from NSW and 45 from Victoria. Nine species of regional significance were recorded from NSW and 10 from Victoria. Significant species results are summarised in Table 5. Details are set out in Appendix 2.

		Status Vic	Status NSW	Gippsland Coastal Plains	Gippsland Coastal Forests	Cann River Valley	Monaro Plains	Mtn Valleys	Hoskins -town - Nerriga Hills	Morton Plateau & Slopes	Illawarra Coastal Plain	Wilton Table-lands
Platypus	*Ornithorhynchus anatinus*		R	V	V	V	N	N			B	
Spot-tailed Quoll	*Dasyurus maculatus*	S(v)	S(v)		V		N					
Brush-tailed Phascogale	*Phascogale tapoatafa*	S(r)		V								
White-footed Dunnart	*Sminthopsis leucopus*	R	S(v)	V		V						
Southern Brown Bandicoot	*Isoodon obesulus*	R	S(t)		OV							
Yellow-bellied Glider	*Petaurus australis*		S(v)	V	OV	OV				O	O	O
Squirrel Glider	*Petaurus norfolcensis*	S(r)	S(v)							N		?
Feathertail Glider	*Acrobates pygmaeus*	R	R	K	V	OV	N				J	O
Eastern Pygmy-possum	*Cercartetus nanus*		R		OV	OV					J	
Koala	*Phascolarctos cinereus*	R	S(v)	V	V		N		N	N		
Long-nosed Potoroo	*Potorous tridactylus*	R	S(v)		V							
Long-footed Potoroo	*Potorous longipes*	N(e)	N(e)		V							
Brush-tailed Rock Wallaby	*Petrogale penicillata*	S(e)	S(v)									
Wallaroo	*Macropus robustus*	S(r)								O	O	O
Little Red Flying Fox	*Pteropus scapulatus*	R			V							
Grey-headed Flying Fox	*Pteropus poliocephalus*	S(r/c)								O	D	
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	S(r/c)			V							
Common Bent-wing Bat	*Miniopterus schreibersii*	S(r/c)	S(v)		V							
Large-footed Myotis	*Myotis adversus*	S(r)	S(v)		V							
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	R			V	V						
Eastern Broad-nosed Bat	*Scotorepens orion*	S(i)			V	V						
Water Rat	*Hydromys chrysogaster*	R			V						B	
Smoky Mouse	*Pseudomys fumeus*	S(r)			V							
Magpie Goose	*Anseranas semipalmata*	S(ex)	S(v)	V	V							
Blue-billed Duck	*Oxyura australis*	S(r)	S(v)	V	V							
Freckled Duck	*Stictonetta naevosa*	S(r)	S(v)	V								
Cape Barren Goose	*Cereopsis novaehollandiae*	S(r)		V								
Australasian Gannet	*Morus serrator*	S(r/c)		V	V							
Darter	*Anhinga melanogaster*	S(r/c)			OV						B	
Black-faced Cormorant	*Leucocarbo fuscescens*	S(r/c)			V							
Pied Cormorant	*Phalacrocorax varius*	S(r/c)		V	V						D	

Table 5. Significant fauna species recorded for each section of the proposed route.

		Status Vic	Status NSW	Gippsland Coastal Plains	Gippsland Coastal Forests	Cann River Valley	Monaro Plains	Mtn Valleys	Hoskins -town - Nerriga Hills	Morton Plateau & Slopes	Illawarra Coastal Plain	Wilton Table-lands
Australian Pelican	*Pelecanus conspicillatus*	S(r/c)		OV	OV						D	
Little Egret	*Egretta garzetta*	S(r/c)		V	V							
Great Egret	*Ardea alba*	S(r/c)		OV	OV		N				O	
Australasian Bittern	*Botaurus poiciloptilus*	S(i)	S(v)	V	V							
Glossy Ibis	*Plegadis falcinellus*	S(r/c)		V	V				N			
Royal Spoonbill	*Platalea regia*	S(r/c)		V	V		N				W	
Square-tailed Kite	*Lophoictinia isura*	S(v)	S(v)		V		N				D	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	S(r)		V	V						O	O
Grey Goshawk	*Accipiter novaehollandiae*	S(r)		V	V						D	
Grey Falcon	*Falco hypoleucos*	S(v)	S(v)		V							
Black Falcon	*Falco subniger*	S(r)		V	V							
Peregrine Falcon	*Falco peregrinus*	R	R	OV	V	O	N				W	
Lewin's Rail	*Rallus pectoralis*	S(r)	R		V							
Baillon's Crake	*Porzana pusilla*	S(i)		V	V							
Eastern Curlew	*Numenius madagascariensis*	S(r)			V							
Pied Oystercatcher	*Haematopus longirostris*		S(v)	V	V							
Hooded Plover	*Charadrius rubricollis*	N(v)	N(v)		V							
Caspian Tern	*Hydroprogne caspia*	S(r/c)		V	V							
Crested Tern	*Sterna bergii*	S(r/c)		V	V							
Whiskered Tern	*Chlidonias hybridus*	S(r/c)		V			N					
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	S(v)	S(v)		V					N	O	
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*		S(v)	V	V							
Swift Parrot	*Lathamus discolor*	N(v)	N(v)	V	V							
Turquoise Parrot	*Neophema pulchella*	S(r)	S(v)		V					N		
Ground Parrot	*Pezoporus wallicus*	S(r)	S(v)							N		
Powerful Owl	*Ninox strenua*	S(r)	S(v)		V						D	
Barking Owl	*Ninox connivens*	S(r)	R	V								
Sooty Owl	*Tyto tenebricosa*	S(r)	S(v)		V		N					
Eastern Bristlebird	*Dasyornis brachypterus*	S(v)	S(v)							ON		
Pilotbird	*Pycnoptilus floccosus*		R		OV	O					O	
Striated Fieldwren	*Calamanthus fuliginosus*		S(v)							O		
Regent Honeyeater	*Xanthomyza phrygia*	N(e)	N(e)	V	V				N	N		
Scarlet Honeyeater	*Myzomela sanguinolenta*	R	R	V	V						W	

Table 5. Significant fauna species recorded for each section of the proposed route.

		Status Vic	Status NSW	Gippsland Coastal Plains	Gippsland Coastal Forests	Cann River Valley	Monaro Plains	Mtn Valleys	Hoskins -town - Nerriga Hills	Morton Plateau & Slopes	Illawarra Coastal Plain	Wilton Table-lands
Pink Robin	*Petroica rodinogaster*		S(v)	V	OV	OV	N		N	N		
Crested Shrike-tit	*Falcunculus frontatus*		R	V	OV	OV			ON		W	O
Olive Whistler	*Pachycephala olivacea*		S(v)	V	OV	O	N			O	O	O
Striped Legless Lizard	*Delma impar*	N(v)	N(v)				O					
Lined Earless Dragon	*Tympanocryptis. l. pinguicola*	S(e)	N				O					
Swamp Skink	*Egernia coventryi*	S(v)			V							
Eastern Water-skink	*Eulamprus quoyii*	S(i)									D	O
McCoy's Skink	*Nannoscincus maccoyi*		R		V		N				O	
Southern Water Skink GROUP	*Eulamprus tympanum*	S(i)			V	V	ON					
Heath Monitor	*Varanus rosenbergi*	S(r)	S(v)							A		
Tree Goanna	*Varanus varius*	S(i)		V	V	V				O	D	
Diamond Python	*Morelia spilota*		R								D	
Death Adder	*Acanthophis antarcticus*	S(ex)					N					
Yellow-faced Whip Snake	*Demansia psammophis*	S(r)									D	O
Broad-headed Snake	*Hoplocephalus bungeroides*	N(e)	N(e)							N		
Little Whip Snake	*Suta flagellum*		S(v)						O			
Green and Golden Bell Frog	*Litoria aurea*		S(t)		OV							
Blue Mountains Tree Frog	*Litoria citropa*	S(r)				V				P		O
Large Brown Tree Frog	*Litoria jervisiensis*	S(i)			V							
Growling Grass Frog	*Litoria raniformis*		S(t)		V		N					
Giant Burrowing Frog	*Heleioporus australiacus*	S(r)	S(v)	V	V	V					P	O
Red-crowned Toadlet	*Pseudophryne australis*		S(v)									
Martin's Toadlet	*Uperoleia martini*	S(i)			V							
Tyler's Toadlet	*Uperoleia tyleri*	S(i)			V						B	

Status: N = national, S = state & R = regional significance. Victoria: (ex) = extinct, (e)endangered, (v) vulnerable, (r) rare, (i) insufficiently known, (r/c) restricted colonial breeding or roosting sites, (t) threatened. NSW: (t) threatened, (v) vulnerable & rare.

Data source: O = this survey, A = Australian Museum database, V = Atlas of Victorian Wildlife, N = NSW NPWS database, B = Barrett (1994), D = Daly (1995a,b,c), J = Mr. H. Jones *pers. comm.*, P = previously recorded by Daly adjacent to route, W = Wollongong City Council (1995).

Table 5. Significant fauna species recorded for each section of the proposed route.

Fauna Habitats

A habitat type is formed by particular structural and floristic vegetation features which provide a specific set of resources that support a particular community of fauna species. Habitat types broadly correspond to the vegetation communities described for the corridor (see Flora). It should be noted that boundaries drawn around these habitats are artificial, as many fauna species move between habitats or utilise more than one habitat according to changing conditions or season.

There are 15 broad habitat types present: 10 natural and five anthropogenic (created by human alteration). The anthropogenic habitats are highly altered and are generally poor fauna habitat, usually containing only the most common taxa. Of the natural habitats only the Regrowth Forest is a poor habitat for fauna. Woodland / Forest Remnants may support less diversity than similar unfragmented habitats but their importance lies in being relatively rich islands within anthropogenic habitats. Significant fauna species were recorded in all natural habitats except Regrowth Forest.

Anthropogenic Habitats

Improved Pasture

A highly altered habitat type, generally on private land, dominated by introduced grasses and herbs, often with mature, isolated remnant trees. In Victoria, this habitat dominated the Gippsland Coastal Plains, formed a significant proportion of the Gippsland Coastal Forests and was present in the Cann River Valley. In NSW it occurred at Sassafras, Shoalhaven River (southern river flats) North Nowra to Foxground, Jamberoo to Mt Kembla and west of the Cordeaux Catchment Area to Wilton. It supports a small number of common native fauna species and a range of introduced species.

Semi-native Pasture

This is a natural habitat which has usually been modified by human management and usually occurs on private land. This habitat dominated the Monaro Plains and was common in the Mountain Valleys segment. It supports a small number of common native fauna species and a range of introduced species; less modified examples are potential habitat for several significant species of reptiles and frogs.

Easement

This is mostly a highly altered habitat type although some riparian areas may remain. Easement occurs on Crown and private land and includes Electricity Commission Easement and telecommunications easement, and Rail and minor Road Reserves. As defined here it excludes the crossing of the Pasture habitats described above. The simple structure of this habitat is artificially maintained by regular mowing or slashing to remove tree and shrub species. Much of the proposed route follows existing easements. Fauna present tend to be a sub-set of those utilising adjacent habitats, plus some open country species.

Pine Plantations

Pine plantation is a highly altered habitat type. A large area of pines occurs near the Victorian/New South Wales border in the southern section of the Monaro Plains, with smaller areas also occurred in private land in the Gippsland Coastal Plains. It supports a moderate number of mainly common native fauna species and a range of introduced species.

Urban Areas

Urban areas are considerably altered from their natural state. Small areas occur along the proposed pipeline. The fauna is dominated by introduced species.

Natural Habitats

Native Grassland

This habitat once dominated the Monaro Plains and was common in the Mountain Valleys segment, but has now largely been altered to Semi-native Pasture. Occasional small remnants remain that are predominantly native. It generally supports a small number of native fauna species and introduced species but has high potential as habitat for several significant species of reptiles and frogs.

Wetlands

This habitat is mainly found in flood plain areas which are seasonally or permanently wet. Extensive areas of this habitat occurred between Longford and the Avon River area in the Gippsland Coastal Plains, near the Victorian border in the Monaro Plains, with patchy occurrences elsewhere. It is utilised by waterbirds, frogs and other wetland species.

Heath/Mallee Heath/Scrubland

This habitat is characteristically found on sandy or peaty soils. While the structural diversity was lower in comparison to some habitats, there was a high floristic diversity, and a moderate to high faunal diversity. It is important habitat for a range of significant species. This habitat occurs in the Gippsland Coastal Plains, Gippsland Coastal Forests, drainage lines in the lower area of the Cann River Valley, in the Hoskinstown-Nerriga Hills sections, on the Morton Plateau and on the Wilton Tablelands.

Woodland/Forest Remnant

These remnants occur as islands resulting from the clearance for agriculture or timber production of larger areas of Woodland or Forest. Woodland/Forest Remnants are usually adjacent to and often surrounded by Pasture. The ground layer is often disturbed by the grazing of domestic stock and the trees thinned by woodcutting for firewood and other purposes. This habitat mainly occurred in the Gippsland Coastal Forests between Bairnsdale and Orbost, in the southern area of the Monaro Plains, in the hill country north of Michelago in the Mountain Valley segment, and on the Illawarra Coastal Plains. While the native fauna present is usually less diverse than in the original forest, these remnants are important for maintaining populations of native species within the rural landscape and can support significant species.

Woodland

This high quality habitat is structurally complex and floristically diverse, and occurs in all segments of the route. Its floristics vary considerably from north to south, but in all areas it is important habitat for native fauna and often supports very diverse faunal assemblages. In Victoria, good examples of this habitat occurred at Perry River in the Gippsland Coastal Plains and in the Gippsland Coastal Forests, while in NSW it occurred in all segments. It was uncommon in the Monaro Plains, more widespread in the Mountain Valleys and Hoskinstown-Nerriga Hills (but with only a few areas in relatively natural condition), occurred on the slopes of the Morton Plateau (where it was rich in fauna), was patchily distributed on the Illawarra Coastal Plains segment, and was the dominant habitat type on the Wilton Tablelands.

Dry Forest/Open Forest

Dry Forest/Open Forest is characterised by a tall mature eucalypt overstorey, a patchy middle vegetation stratum and a low ground layer of grasses and small shrubs. Structurally, this habitat is quite simple although it can be floristically rich. This habitat occurred in the Colquhuon, Lake Tyers and west of Cann River areas (Gippsland Coastal Forests), in the lower hills of the Cann River Valley, and in the hill country from north-east of Michelago to the Endrick River (it was the richest habitat for fauna in this segment).

Riparian Woodland/Forest

This natural habitat occurs as a narrow band along moister drainage lines. It is diverse and structurally rich with a mix of both specialist species and species from the adjacent habitats. Riparian Woodland/Forest is usually characterised by an over-storey of mature hollow-bearing trees, a dense to open mid-storey of shrubs and tree-ferns and a low dense under-storey of herbs and grasses. The fauna is rich with specialist Riparian species and fauna from adjacent habitats using the local resources for food, shelter or movement along this corridor to other habitats. Riparian Woodland/Forest is an important habitat and refuge for both these groups of fauna. This habitat was extensively found in moist drainage lines in the Gippsland Coastal Forests and the Cann River Valley. It also occurred in the Gippsland Coastal Plains, the Mountain Valleys, the Hoskinstown-Nerriga Hills and the Illawarra Coastal Plains (mostly along creeks in pasture areas).

Regrowth Forest

This habitat has a history of over a century of logging and regular burning. This has effectively reduced the diversity and structure of the flora and consequently of the fauna. Old growth trees with hollows for native fauna to shelter and breed are scarce. The shrub layer was usually sparse but in some areas dense patches of disturbance-tolerant species were found. This habitat is extremely poor in resources for fauna and this was reflected in the paucity of fauna recorded in this survey or by other surveys. Any resource-rich patches (such as areas with remnant Red Ironbark or Mountain Grey Gum trees) which exist in this habitat therefore become disproportionately important. This faunal habitat corresponds to the vegetation communities Damp Forest and Lowland Forest. This habitat occurred extensively in the State Forest areas of the Gippsland Coastal Forest and the Cann River Valley.

Wet Forest

This habitat occurs in high rainfall areas and is characterised by mature, old growth trees containing large numbers of hollow-bearing trees. This is a high-quality habitat, especially for arboreal mammals. This habitat type was found on the upper escarpment of the Cann River Valley, at Sassafras on the Morton Plateau, on the Illawarra Coastal Plains (Mt Saddleback) and on the Wilton Tablelands (escarpment and ridge tops).

Closed Forest/Rainforest

Closed Forest/Rainforest occurs in the Gippsland Coastal Foothills, Cann River Valley, and the Illawarra Coastal Plains (Saddleback Mountain and the northern edge of the Shoalhaven River). It is important habitat for a range of fauna, including a number of habitat specialists.

CONDITION OF VEGETATION AND HABITATS

The condition of flora and fauna habitats along the proposed pipeline route varies from relatively intact to highly altered and invaded by introduced plants and animals. The conservation value of substantial portions of the proposed route has been significantly influenced by factors such as vegetation clearance, soil disturbance (mining, ploughing, road construction etc.), altered fire regimes, invasion of introduced predators and grazing by domestic stock and rabbits.

Gippsland Coastal Plains

This region is largely on private land which has been substantially cleared for agriculture. Remnants of natural habitats remain along roadsides, railways and in scattered patches on private and crown land. Most of these remnants have been heavily disturbed and support many weed species and introduced animals. The proposed route passes through private land to the south of the only biological reserve within the proposed 2km corridor (Providence Ponds Flora and Fauna Reserve, LCC 1983). In this vicinity the proposed route passes through a relatively intact isolate of Coastal Grassy Forest. This rare and important community was encountered on the east bank of the Perry River and occupied approximately 80 ha of private land.

Gippsland Coastal Forests

From Bairnsdale to Bruthen the native vegetation has been largely cleared for agriculture. Some high quality woodland corridors and good quality remnant forest areas exist for fauna within this agricultural area. Further east the proposed corridor is largely forested with relatively small areas of cleared land at Nowa Nowa, Tostaree, Waygara, Cabbage Tree Creek, Club Terrace and Tonghi Creek, and a larger area of cleared land surrounding Orbost. The proposed route, however, generally follows an existing powerline easement. While this cleared and regularly slashed easement does support many weed species, native plants still predominate in most areas. Exceptions to this are areas of easement adjacent agricultural land. Much of this easement is being invaded by introduced herbivores and predators which use the easement as an access to forage in adjacent native habitat.

Between Bruthen and Nowa Nowa the proposed corridor passes through areas of the Colquhoun State Forest which are designated for hardwood timber production (LCC 1983). The proposed route utilises some existing narrow roads and a portion of an abandoned railway easement. However, substantial lengths of the route 5.1 in this area are through native forest not adjacent to an existing track. This forest has been subjected to selective timber harvesting, frequent and recent fuel reduction burning and smaller areas of clearfell timber harvesting. As a result old-growth forest is rare in this section of the proposed corridor and is restricted to areas adjacent the railway easement, some of the roads, and some general sections of the forest. Such forest is important habitat for native fauna.

Between Nowa Nowa and Orbost substantial lengths of the proposed route follow an existing powerline easement. Approximately five kilometres of native forest which includes relatively undisturbed areas, are also traversed. From Orbost to Tonghi Creek the proposed route follows an existing cleared and maintained powerline easement. Native vegetation along this easement is generally least disturbed where deeply incised streams cross the easement. These remaining riparian areas are valuable habitat and corridors for native fauna. In these easement areas trees and large shrubs have been removed and regrowth is regularly slashed. Much of this easement is being invaded by introduced herbivores and predators which use the easement as an access to forage in adjacent native habitat.

East of Tonghi Creek the proposed corridor enters the Noorinbee Forest Block. In crossing Reed Bed Creek the proposed corridor passes through relatively intact and floristically diverse native vegetation. Further east the proposed route is generally aligned with Reed Bed Creek Road which supports native vegetation on either side. This area east of Tonghi Creek generally contains high quality habitat for native fauna.

Cann River Valley

Much of the flood plain of the Cann River and many of the surrounding undulating hills have been cleared for agriculture. While the proposed pipeline corridor utilises much of this existing cleared land it passes through state forest at the southern and northern ends of this section. In the south the route is within the Noorinbee Forest Block where it is initially aligned with existing forest roads. The proposed route then enters relatively intact native forest for approximately five kilometres before emerging into cleared agricultural land. Most of this native forest area currently supports a diverse fauna but is designated for hardwood timber production.

South of Chandler's Creek the proposed pipeline generally traverses cleared agricultural land or follows an existing easement which is approximately 20 m wide. The vegetation of the existing easement was sparse and generally dominated by native herbs and grasses although weeds were a common occurrence. This section of the easement appeared to be maintained by soil scalping with a bulldozer. Relatively little of this easement has yet been invaded by introduced herbivores.

West of Chandler's Creek the proposed route passes through approximately 500 m of relatively undisturbed Heathy Dry Forest which is high quality fauna habitat. It then roughly follows the present alignment of the Buldah Road and then Buldah Gap Road. These generally narrow roads pass through native forest as they climb from the valley to reach the Victorian/New South Wales border. Clearfelled coupes (areas harvested for timber) in various stages of regeneration were common along the Buldah Gap Road. Other areas have been subjected to control burns and/or wildfire. The proposed pipeline route is occasionally diverted from the road alignment to follow either a relatively narrow telecommunications easement or traverse undisturbed forest. The habitats vary in qualify for fauna within this State Forest area with the less managed habitats being of higher value.

Monaro Plains

Since European settlement, much of the Monaro Plains grasslands and grassy woodlands have been developed for grazing and/or pasture. Although remnants remain, most suffer from weed invasion and varying degrees of grazing pressure. All areas on the Monaro Plains potentially affected by the proposed pipeline exhibit some level of existing disturbance. Large expanses are now improved pasture, resulting in the almost total loss of indigenous flora. Many areas are infested with noxious weeds such as African Love Grass *Eragrostis curvula*, Serrated Tussock *Nasella trichotoma*, Spear Thistle *Cirsium vulgare* and Saffron Thistle *Carthamus lanatus*, and an array of other exotic species.

Medium Dry Tussock Grasslands were often found to be heavily grazed by stock. Some properties were found to be in fair to good condition, yet all were grazed and weed-invaded to some extent.

Most Tall Wet Tussock Grasslands along the proposed pipeline route appeared to be in poor condition, with inter-tussock spaces often dominated by exotic pasture species.

Intact Sub-alpine Woodland was rare along the route, due to historical tree-removal which has resulted in this community being reduced to rare occurrences on isolated hill-tops. The understorey was totally modified in most cases. Any remaining trees were obviously senescing, and seedling recruitment was non-existent due to continued grazing. However, despite their isolation and poor condition, most remaining trees were being utilised as forage and nesting sites by a variety of birds.

Savannah Woodlands were often reduced to remnants along rocky hillsides, with the understorey often grazed. The route did not appear to affect this community in the Monaro Plains region.

Mountain Valleys

Kangaroo Grass Grasslands were not often encountered along the pipeline route. Those which were located in the mountain valleys regions were in fair to good condition, indicated by the presence of orchid species and Austral Toad-flax *Thesium australe*. Soil disturbance usually results in massive weed invasion and, often, a significant reduction in native species richness.

Dry Shrubby Grasslands/Grassy Woodlands of the mountain valleys were generally in poor condition due to tree removal, cultivation and fertilisation for agricultural purposes. The few areas still supporting recognisable remnants of these communities were under pressure from grazing and weed invasion.

One intact example of Sub-alpine Woodland was encountered; most were degraded by past clearance and grazing.

Dry Sclerophyll Forest of the Tinderry Range was considered to be in excellent condition, providing excellent habitat for arboreal and terrestrial fauna. Floristically, this community was species-rich and suffered little from weed invasion. The greatest impact on the vegetation has been subdivision into small blocks, although many still support intact vegetation.

Riparian Scrub/Forest communities of the mountain valleys were uncommon along the route. These communities often formed valuable habitat corridors along rivers and creeks.

Hoskinstown-Nerriga Hills

Much of the original Dry Grassy and Shrubby Woodlands and Forests of the mountain valleys region have been cleared, selectively logged or grazed. Extensive woodland remnants occur on hills such as the Turallo Range. Despite grazing and logging, many of the remnants were considered to be in fair to good condition, with shrubby understoreys offering excellent fauna habitat in some instances. In general, this community has suffered from large-scale fragmentation.

Dry Tall Shrubby Forests and Dry Shrubby Forests were found on sandy or sandy-loam soils which occurred intermittently from KP 522 through to the Endrick River. Most examples of these communities occurring along the corridor were considered to be in good to excellent condition. Many sites support a species-rich flora, with several species being recorded from well-outside their previously known range.

Riparian Scrub and Riparian Forest occurring within the pipeline corridor was often reduced to very narrow bands along permanent water-courses. The tributaries to the Massey Creek formed a wetland system and riparian association in very good condition, with stock grazing having been removed in recent years.

Morton Plateau & Slopes

Much of the River Flat Forest (Sassafras and banks of the Nerriga River) has been cleared and the understorey generally consists of a coarse cover of low shrubs and grasses.

The remainder of the vegetation in this segment - Bulee Gap Woodland (Endrick floodplain up-slope to Bulee Gap), Mallee/Heath (rock platforms between Bulee Gap and Willies Creek), Heathland and Heathland/Scrubland (widespread on the plateau), Scribbly Gum Woodland and Grey Gum Woodland (northern end of the Morton Plateau) - are in excellent condition.

Illawarra Coastal Plains

Scribbly Gum Woodland and Grey Gum-Stringybark Forest/Woodland on both sides of the Shoalhaven River is in good condition, but remnant stands of Spotted Gum Forest generally occur on farmland, so the understorey usually consists of improved pasture.

The area from Nowra to Farmborough Heights is highly disturbed, and the proposed easement passes through patchy remnant vegetation. Some regrowth occurs, especially on steeper sites, although whether the existing vegetation type is typical of the original floristics is difficult to assess (see Fuller 1982). Riparian Woodland/Forest mostly occurs as a narrow band of vegetation along the banks of creeks through improved pasture and the understorey is generally disturbed by cattle and may consist of a mixture of native and introduced grasses, shrubs and climbers. Small stands of remnant or regrowth Woodland (Disturbed) occur in the West Dapto area.

The Saddleback High Forest on the north and south slopes of Saddleback Mountain are generally in good condition, although some areas are disturbed. Closed Forest/Rainforest occurring on escarpments and hillsides is generally regrowth after a long period of selective logging, especially for Red Cedar *Toona ciliata* (Mills & Jakeman 1995). Shrubland (disturbed) occurs on rocky hilltops that have been cleared then abandoned for farming but can still contain plant species of conservation significance.

Wilton Tablelands

Most areas of Blackbutt-Blue Gum High Forest on the Illawarra Escarpment are regrowth, recovering from logging which ceased after 1945 (Fuller 1982). Small disjunct patches also occur in sections of the proposed easement between Nowra and Mount Kembla. On the ridge tops between Mount Kembla and Mount Brisbane, occurrences of Illawarra High Forest varies in condition from good to disturbed.

Sydney Sandstone Ridge Top Woodland and Woronora Plateau Upland Swamps in excellent condition occur along the proposed easement between Harry Graham Drive and the abandoned airstrip. Patchy Grey Box-Ironbark Woodland and small stands of Shale-Sandstone Forest/Bargo Brush Woodland occur near Wilton. Most areas have understoreys that have been altered to some extent.

STREAM ECOLOGY

This section provides a summary of the results of the stream ecology studies. Full details are provided in Appendix 3.

Identification of Streams to be Affected

Over 1000 streams and nine major rivers in 17 major catchments (see Table 6 for list of catchments) will be crossed by the proposed pipeline. Other water bodies that will be crossed are two estuaries, a number of agricultural drains and 27 wetlands or areas subject to inundation (impacts on wetlands are discussed in the Flora and Fauna section). The route tends to traverse the lower parts of catchments or to follow major valleys in Victoria, while in NSW it more frequently crosses upper catchment areas. Thus there were similar numbers of large streams and rivers identified in both Victoria and NSW (38 and 41 respectively), despite the shorter length of pipeline route in Victoria, while the number of smaller streams is disproportionately higher in NSW.

Conservation Value of Streams

Key features of the fish and crayfish taxa found in fresh waters about and downstream of the proposed route were the known and possible occurrence of:

- ten high conservation-value fish species (the background to their status nationally, and in Victoria and NSW is given in Appendix 3)

- eight high recreational-value fish species (5 in Victoria, 7 in NSW)
- two crayfish species considered to have very high conservation-value (one in each state)
- eleven crayfish species considered to have high conservation value (6 in each state)
- ten introduced fish species (8 in each state).

Table 6. Details of catchments to be traversed by the proposed pipeline.

Catchment name	Length of catchment traversed (km)	Drainage Division	State
Latrobe R. (Lake Wellington)	15	SE Coastal	VIC
Lake Wellington main drain	7	SE Coastal	VIC
Avon R. (Lake Wellington)	7	SE Coastal	VIC
Perry R. (Lake Wellington)	12	SE Coastal	VIC
Tom Ck. (Lake Victoria)	12	SE Coastal	VIC
Mitchell R. (Lake King)	25	SE Coastal	VIC
Nicholson R. (Lake King)	9	SE Coastal	VIC
Slaughter House Ck. (Lake King)	2	SE Coastal	VIC
Tambo R. (Lake King)	11	SE Coastal	VIC
Missisippi Ck. (North arm)	2	SE Coastal	VIC
Lake Tyers tributaries		SE Coastal	VIC
Stoney Ck. (Toorloo arm)	12	SE Coastal	VIC
Boggy Ck. (Nowa Nowa arm)	5	SE Coastal	VIC
Ewing Marsh tributaries		SE Coastal	VIC
Hospital Ck.	8	SE Coastal	VIC
Hartland R.	3	SE Coastal	VIC
Dinner Ck.	2	SE Coastal	VIC
Simpson Ck.	5	SE Coastal	VIC
Unidentified tribs	4	SE Coastal	VIC
Snowy R. (lower reaches)	8	SE Coastal	VIC
Brodribb R.		SE Coastal	VIC
Brodribb R.	3	SE Coastal	VIC
Other tribs	7	SE Coastal	VIC
Cabbage Tree Ck.	12	SE Coastal	VIC
Yeerung R.	6	SE Coastal	VIC
Bemm R.	29	SE Coastal	VIC
Cann R.	66	SE Coastal	VIC
Snowy R. (upper reaches)		SE Coastal	NSW
Bombala R.	71	SE Coastal	NSW

Maclaughlin R.	10	SE Coastal	NSW
Bobundara Ck.	6	SE Coastal	NSW
Murrumbidgee R.		Murray-Darling	NSW
Small direct tribs.	26	Murray-Darling	NSW
Numeralla R.	48	Murray-Darling	NSW
Bredbo R.	6	Murray-Darling	NSW
Michelago Ck.	19	Murray-Darling	NSW
Queanbeyan R.	21	Murray-Darling	NSW
Molonglo R.	22	Murray-Darling	NSW
Lake George (southern tribs.)	12	Internal	NSW
Shoalhaven R. (upper reaches)		SE Coastal	NSW
Reedy Ck.	16	SE Coastal	NSW
Gilbert Ck.	2	SE Coastal	NSW
Sandy Ck.	4	SE Coastal	NSW
Boro Ck.	3	SE Coastal	NSW
Shoalhaven R.	1	SE Coastal	NSW
Small direct tribs.	19	SE Coastal	NSW
Corang R.	5	SE Coastal	NSW
Bindi Bindi Ck.	3	SE Coastal	NSW
Shoalhaven R. (Morton NP)		SE Coastal	NSW
Endrick R.	13	SE Coastal	NSW
Ettrema Ck.	5	SE Coastal	NSW
Yalwal Ck.	29	SE Coastal	NSW
Jervis Bay catchment		SE Coastal	NSW
Parma Ck.	4	SE Coastal	NSW
Shoalhaven R. (lower reaches)		SE Coastal	NSW
Shoalhaven estuary	1	SE Coastal	NSW
Direct tribs.	11	SE Coastal	NSW
Bomaderry Ck.	2	SE Coastal	NSW
Abernethys Ck.	2	SE Coastal	NSW
Direct tribs. Broughton estuary	10	SE Coastal	NSW
Broughton Ck.	14	SE Coastal	NSW
Illawara coast streams		SE Coastal	NSW
Minimurra R.	10	SE Coastal	NSW
Macquarie Rivulet	7	SE Coastal	NSW
Duck Ck.	2	SE Coastal	NSW
Mullet Ck.	8	SE Coastal	NSW
Alan Ck.	10	SE Coastal	NSW
Nepean R.	24	SE Coastal	NSW

Full listings of conservation value indices are given in Appendix 3.

The Cann River and the Bemm River catchments in Victoria had the highest conservation values of catchments along the proposed route, and all eight Victorian catchments were in the top ten with respect to conservation value. The Murrumbidgee River tributaries and Nepean River tributaries, had the highest conservation indices in NSW. The higher conservation status of streams in Victoria reflects the following factors:

- the high richness of crayfish fauna in East Gippsland
- headwater areas tend to be less species-rich than middle to lower reaches
- knowledge of the stream biota is much less comprehensive in NSW and, as a result, NSW does not have a comprehensive list of fish of state significance
- some species are at the southern edge of their distribution in East Gippsland and are considered significant in Victoria but not in NSW.

Water Quality

The most marked feature of the existing water quality in streams along the route that is relevant to ecological functioning are the higher turbidity levels in Victorian streams compared with NSW streams. This difference is partially because the pipeline route in NSW mainly traverses headwater areas, while in Victoria it either traverses steep sections of catchments (Cann River), or catchment sections close to river mouths (Brodribb River to the Latrobe River). However, differences in geology and land use practices also play an important role.

Approach-Hazard Indices

Full listings of conservation value indices are given in Appendix 3.

Approach-Hazard Without Soils Factors

The tributaries of Lake Tyers (Vic) had the greatest mean index values. The Bemm and Cann Rivers with their tributaries (Vic) had the next greatest mean values, followed by the Shoalhaven River tributaries about Morton National Park (NSW). Six out of ten of the catchment groups with the highest mean index values were in NSW. The catchment group with the greatest maximum index value was the Cann River and tributaries (Vic). The next greatest maximum value was the Murrumbidgee River tributaries catchment group (NSW).

Approach-Hazard With Soil Erosion Factor Only

Gaps in data on soil erodibility meant that adequate information was available for only ten catchment groups. The Cann River and tributaries (Vic) had the greatest mean index values and the maximum index value. The Nepean River tributaries (NSW) had the next greatest mean values. The next greatest maximum value was the Murrumbidgee River tributaries catchment group (NSW).

Approach-Hazard With Both Soil Factors

Gaps in data on soil acidity meant that adequate information was available for only five catchment groups, none of which were in Victoria. The Jervis Bay tributaries, followed by the Nepean River tributaries had the greatest mean index values. The greatest maximum index value occurred in the Murrumbidgee River tributaries followed by the Shoalhaven River estuary tributaries.

Identification of Sensitive Areas

Values for the combined conservation value (CV) and approach hazard indices were calculated to provide an assessment of potentially sensitive stream crossings.

CV + Approach-Hazard Without Soils Factors

The Bemm and Cann Rivers (Vic) with their tributaries (Vic) had by far the greatest mean values, i.e. they appear to be the most sensitive areas. Similarly, these catchment groups had by far the greatest maximum values. The next greatest mean value occurred in the Lake Tyers tributaries group (Vic) followed by the lower Snowy and tributaries group (Vic).

Seven out of ten of the catchment groups with the highest mean index values were in Victoria. All of the top five such groups were also in Victoria.

CV + Approach-Hazard With Soil Erosion Factor Only

The Cann River and tributaries (Vic) had the greatest mean index values and the maximum index value and this catchment group appears to be the most potentially sensitive of those for which adequate information was available. The Nepean River tributaries (NSW) had the next greatest mean values. The next greatest maximum value was the Murrumbidgee River tributaries catchment group (NSW).

CV + Approach-Hazard With Both Soil Factors

Gaps in data on soil acidity meant that adequate information was available for only five catchment groups, none of which were in Victoria. The Nepean River tributaries, followed by the Jervis Bay tributaries had the greatest mean index values. The greatest maximum index value occurred in the Murrumbidgee River tributaries followed by the Shoalhaven River estuary tributaries.

SITES OF BIOLOGICAL SIGNIFICANCE

Sites of biological significance were identified on the basis of their importance for significant species, significant communities or for other special ecological attributes, (including high species richness, presence of old-growth vegetation and presence of key ecological resources) and importance for scientific research (Map 2). Sites were rated as national, state or regional significance.

NATIONAL SIGNIFICANCE

Perry River (KP 33-34)

This isolated area of Coastal Grassy Forest, which is an endangered community, occurs on the Gippsland Coastal Plains south west of Providence Ponds Flora and Fauna Reserve on Quaternary dunes of the Perry land system (LCC 1982). The area has not been burnt for at least 30 years (I. Kininmonth *pers. comm*) and there is an abundance of orchids and large, old-growth banksias. While no national or state significant species were recorded, the site did support a number of outstanding features including a disjunct occurrence of Snow Gum *Eucalyptus pauciflora* and numerous old-growth Silver Banksia *Banksia marginata*. The latter were about 8 m tall with trunk girths of approximately 2 m (possibly among the largest and oldest individuals of this species in Victoria). Six regionally significant plants were recorded.

This complex and floristically diverse vegetation is high quality habitat for fauna. The site supports a high density and diversity of arboreal mammals and birds although we recorded no significant species in our survey. Two fauna species of State significance have been recorded (Tree Goanna, Grey Goshawk) and two regionally significant species.

Bellbird Creek (KP 181.7-187.5)

The vegetation of this site includes Lowland Forest, Damp Forest, Wet Heathland, Riparian Scrub Complex and Warm Temperate Rainforest none of which is considered to be old-growth (Woodgate *et al.* 1994). Most of this area is designated as a Special Management Zone (181.7-186.1) with a Special Protection Zone around Bellbird Creek (CNR 1995).

Three fauna species of national significance (Long-footed Potoroo, Swift Parrot and Regent Honeyeater) have been recorded in this area. The Long-footed Potoroo, a species of national significance due to its rarity and highly restricted distribution, has been recorded from many sites in this area. This is one of the two highest concentrations of records known. This alone ranks this site of national conservation significance. A further six species which are listed as of state significance were recorded (Spot-tail Quoll, Common Bent-wing Bat, Masked and Sooty Owls, Glossy Black Cockatoo and Tree Goanna).

Cooma Grasslands (KP 390-392)

These grasslands are found on private land near Cooma which supports an excellent example of temperate medium dry tussock grassland. The lower to mid-slopes are dominated by *Danthonia* spp. and *Stipa* spp. interspersed with *Bothriochloa macra* and larger *Poa* tussocks. Upper slopes support dense to open *Poa sieberiana* tussocks with scattered Tree Violet *Hymenanthera dentata* (*H. "intricata"* Tonkinson, pers. comm.). The site has had no history of ploughing, pasture improvement or fertiliser addition (Devereux, pers. com.). A high diversity of reptile species were detected at the site including the nationally vulnerable Striped Legless Lizard (*Delma impar*) and Southern Lined Earless Dragon (*Tympanocryptis lineata pinguicola*). The site has national significance for the conservation of both of these species and their grassland habitat.

Bulee Gap (KP 577.5-579.6)

Two nationally significant plants occur in this small area: *Eucalyptus triflora* and *Acacia subtilinervis*. The vegetation is diverse and in good condition. Three communities are present: Mallee/Heath, Bulee Gap Woodland and Bulee Gap Woodland/Forest. There are large stands of Black Forest-oak, the seeds of which are the main food of the Glossy Black Cockatoo (state significance) in southern New South Wales (Garret 1992, pers. obs.). No Cockatoos were observed feeding at the time of the survey, however the cones of numerous casuarinas indicated that Glossy Black Cockatoos probably were using the site. The sandstone outcrops of the gap are suitable habitat for the Broad-headed Snake and the Brush-tailed Rock Wallaby (see Table 5). Both of these species have been located in Morton National Park (Wong 1993, Wong, *pers. comm.*).

In some areas the canopy is dominated by manna gum (*Eucalyptus viminalis*) and Sydney Peppermint (*E. piperita*). Both species are utilised by Koalas as feed trees in New South Wales (Pahl, 1990). Furthermore the National Parks database indicates a koala has been detected in the area.

During this survey a individual Heath Monitor was sighted on the western slopes of Bulee Gap. This species is listed as vulnerable in New South Wales.

Sassafras West (KP 593-594)

Five nationally significant plants occur in this small area: *Acacia subtilinervis, Eucalyptus triflora*, *Leptospermum epacrideideum, Platysace stephensonii* and *Rulingia hermannifolia*. The vegetation consists of Scribbly Gum Woodland, Sassafras High Forest and Heathland, all in good condition.

Yerriyong (KP 624-625.5)

Two nationally significant plants occur in this small area: *Eucalyptus langleyi* (in a stand extending several hundred metres) and *Grevillea barklyana* subsp *macleayana*. The vegetation is Mallee/Heath in good condition.

Sydney Water Catchments (KP 708-727)

Seven nationally significant plants (Darwinia *Darwinia grandiflora*, Guinea-flower *Hibbertia nitida*, Mat-rush *Lomandra fluviatilis*, Geebung *Persoonia bargoensis*, Heath *Epacris purpurascens* var. *purpurascens*, Bush-pea *Pultenaea aristata* and Pink-bells *Tetratheca neglect*), one of state significance (*Grevillea diffusa* ssp. *diffusa*) and four regionally significant plants occur throughout this area. The vegetation is mainly Sydney Sandstone Ridgetop Forest/Woodland, with areas of Sydney Sandstone Gully Forest and Sydney Sandstone Ridgetop Forest Closed Scrub. The area supports a diverse small mammal fauna, five species of small mammal were detected in only 100 trap nights of Elliot trapping.

The endangered fauna associated with area include the Heath Monitor, Giant Burrowing Frog and the Red Crowned Toadlet. During this survey tadpoles of the Giant Burrowing Frog were detected.

STATE SIGNIFICANCE

Dowd's Morass (KP 7.3-8)

This is a high quality habitat for wetland birds. Two species (Royal Spoonbill, Great Egret) which are listed as 'restricted/colonial' breeders (Baker-Gabb 1993) have been recorded nesting here as well as many other waterbirds listed under International Treaties.

Bridle Creek (Colquhoun State Forest) (KP 95-98.5)

This drainage system supports areas of Gallery Rainforest dominated by Kanooka *Tristaniopsis laurina* surrounded by mature Shrubby Dry Forest. Gallery Rainforest is rare in both an Australian and Victorian context (CNR *in prep.*). Tree Goannas and Giant Burrowing Frogs have been recorded and we observed a high density of arboreal mammals at this site.

Stony Creek (Colquhoun State Forest) (KP 109-111.5)

A 200m corridor centred on Stony Creek has been designated a Special Protection Zone by CNR (1995) due to the occurrence of the rare Slender Mud Grass *Pseudoraphis paradoxa*, the presence of Koalas and of regionally representative examples of the EVCs Riparian Forest and Riparian Scrub Complex. Between KP 109 and 110 the proposed pipeline intersects areas mapped as old-growth Lowland and Damp Forest. The area supports a high density and diversity of arboreal mammals. The Stony Creek area provides high quality habitat for amphibians and Martin's Toadlet (State significance) has been recorded here.

Lake Tyers State Park (KP 119.9-122)

The vegetation of this conservation reserve is mapped as Lowland Forest and three regionally significant plant species have been recorded. Three fauna species of state significance (Powerful Owls, Square-tailed Kites and Turquoise Parrots) have been recorded here.

Tostaree East (KP 126.8-129.8)

Much of this forest habitat is in good condition and supports a wide variety of fauna. Significant bird species recorded here included Hooded Plover, Australian Bittern, White-bellied Sea-Eagle, Powerful and Masked Owls, and many records of Turquoise Parrots. Eastern Horseshoe and Eastern Broad-nosed Bats were trapped by Kemp *et al.* (1993).

The vegetation in this section is mapped as Clay Heathland and Lowland Forest by Woodgate *et al.* (1994). Kemp *et al.* (1993) describe the vegetation of this area in more detail and indicate the presence of a sub-community of Lowland Forest dominated by the regionally significant species Swamp Stringybark *Eucalyptus conspicua*. This sub-community was observed along the proposed route in this site. The sub-community is described as unusually species rich, although some-what disturbed and rare and restricted in East Gippsland and the state. Woodgate *et al.* (1994) identified 1781 ha. (less than 0.2% of public land) of Clay Heathland in East Gippsland. This community is clearly rare and restricted on a regional if not statewide basis.

This area also includes a Dieback Monitoring site (KP 128.2-128.8) which is being used for scientific investigations into the impact of dieback (presumably *Phytopthora cinnamomi*) in this region by CNR. This particular area is listed as a special management zone by CNR. The construction of the pipeline may compromise this study and potentially spread this pathogen.

Hartland River (KP 130.5-130.7)

A 200 m buffer zone surrounding a known population of Slender Mud Grass *Pseudoraphis paradoxa*, which is endangered in Victoria, has been defined as a Special Protection Zone CNR (1995).

Simpson Creek (KP 139-140.5)

This area around Simpsons Creek is a regional wildlife corridor and is designated by CNR (1995) as Special Protection Zone buffered on either side by narrow areas defined as Special Management Zones. The vegetation is Limestone Box Forest (Woodgate *et al.* 1994), a community endemic to Victoria and considered to be of State conservation significance by Kemp *et al.* (1993).

Eight fauna species of State significance have been recorded: four bats (Eastern Horseshoe Bat, Common Bent-wing Bat, Large-footed Myotis and Eastern Broad-nosed Bat), three birds (Masked and Sooty Owls, Turquoise Parrot) and a reptile (Tree Goanna).

Newmerella (KP 142-143.5)

This site is designated as a Special Management Zone (CNR 1995) and supports Lowland Forest and Limestone Box Forest to the south of the Princess Highway (Woodgate *et al.* 1994). Significant fauna records include Eastern Horseshoe-bat, Sooty Owl, Masked Owl, Glossy Black Cockatoo, breeding records of Square-tailed Kite and Tree Goanna. The rare orchid Cobra Greenhood *Pterostylis grandiflora* is also recorded in this site but not close to the proposed pipeline route.

Bemm River (KP 193-195, 199.6-199.8 & 202-202.7)

The proposed pipeline route intersects the Bemm River Scenic Reserve three times. Vegetation communities present within the proposed corridor include Lowland Forest, Damp Forest, Riparian Forest and Warm Temperate Rainforest. No old-growth is mapped in this area by Woodgate *et al.* (1994). The Bemm River Scenic Reserve is considered a conservation reserve by CNR (1995) while KP 193-193.5 is a Special Management Zone for the protection of Sooty Owl, Powerful Owl and Swamp Skink. Three significant species of amphibian (Giant Burrowing Frog, Large Brown Tree Frog and Tyler's Toadlet) have also been recorded in this area.

Lind National Park (KP 206.8-212.4)

The vegetation communities of this site include Wet Forest, Damp Forest, Lowland Forest, and Shrubby Dry Forest with areas of old-growth present (Woodgate *et al.* 1994). The area also supports a regionally significant occurrence of Warm Temperate Rainforest (CNR in prep.) and is described as a site of botanical significance by Forbes *et al.* (1981). Three fauna species of state significance (Long-footed Potoroo, Eastern Horseshoe and Common Bent-wing Bats) were recorded.

Reed Bed Creek (KP 219-226)

A substantial proportion of the catchment of Reed Bed Creek north of the Princess Highway is described as a site of biological significance by Brown *et al.* (1987). The site covers 1006 ha and is particularly diverse. Brown *et al.* (1987) recorded 281 native plants, three of which (Red-stem Cranesbill *Geranium neglectum*, Apple-topped Box *Eucalyptus angophoroides* and Sandfly Zieria *Zieria smithii*) were considered significant in their report. The depleted species Showy Willow-herb *Epilobium pallidiflorum* may also occur in this swampy area. The Reed Bed Creek site encompasses eight EVCs: Lowland Forest, Wet Forest, Damp Forest, Riparian Forest, Warm Temperate Rainforest, Riparian Swampy Forest, Riparian Scrub and Wet Heathland. The proposed forest management plan for the East Gippsland Forest Management area (CNR 1995) shows a linear (at least 200m wide) Special Protection Zone, restricting the development of roads and timber harvesting in this area. The site is also designated as a high priority for fuel reduction burning and is noted as an area of high erosion hazard. The proposed route also traverses Riparian Scrub Complex mapped as old-growth by Woodgate *et al.* (1994).

The complex and diverse floral communities make the Reed Bed Creek area a rich site, particularly for birds, and the wetland areas provide excellent habitat for amphibians. Brown *et al.* (1987) observed the Blue Mountains Tree Frog (state significance) and two other regionally significant species of fauna in this area. We observed a high diversity and density of arboreal mammals here. Swamp Skinks have been recorded in this vicinity and the site provides potential habitat for these rare and restricted animals.

Chandler's Creek (KP 249-256)

This area is designated a Special Protection Zone to conserve Powerful Owl (CNR 1995) but also contains many records of Blue Mountain Tree Frogs (AVW). The proposed pipeline route also intersects areas of old-growth Riparian Forest and Heathy Dry Forest (Woodgate *et al.* 1994). The Buldah Road south of Buldah Gap forms the boundary of two sites of biological significance described by Cherry *et al.* (1986). A population of approximately 200 plants of the rare species Prickly Oxylobium *Oxylobium ilicifolium* was recorded adjacent to this road and in general the area is noted for its rich orchid flora. Four other species, Spiny Bossiaea *Bossiaea obcordata,* Fitzgerald's Spider Orchid, *Caladenia fitzgeraldii*, Square-lip Bird-orchid *Chiloglottis trapeziformis* and Rusty-hood *Pterostylis* aff. *rufa*, considered to be of regional significance were also recorded in this area by Cherry *et al.* (1986).

Kelly Creek (KP 260.8-262)

This area is known to contain good habitat for amphibians. It has been designated a Special Protection Zone to conserve Giant Burrowing Frog (CNR 1995) and also contains many records of Blue Mountain Tree Frogs (AVW).

Central Buldah (KP 264.5-265.5)

This site occurs between Granite Creek and Fiddlers Green Track and includes the sites of biological significance defined by Cherry *et al.* (1986). The area is noted for its biodiversity as well as a rich orchid flora. The regionally significant species Forest Bent-grass *Deyeuxia frigida* and Rusty-hood *Pterostylis aff. rufa* were recorded adjacent to the proposed pipeline by Cherry *et al.* (1986). This area supports old-growth forest although the proposed route does not intersect mapped old-growth (Woodgate *et al.* 1994).

Buldah Old-growth (KP 266.5-267.5)

This site occurs on the east side of Buldah Gap Road, 5 to 6 km south of the Victoria/New South Wales border. Part of this area was also designated a site of biological significance by Cherry *et al.* (1986) to represent unharvested examples of the EVCs Riparian Forest, Wet Forest and Damp Forest as well as protection for the rare species Pinkwood *Beyeria viscosa*. This area supports old-growth forest although the proposed route does not intersect mapped old-growth (Woodgate *et al.* 1994). A Special Management Zone for the Powerful Owl is immediately west of the proposed route and this site also provides suitable habitat for these large owls.

Rock Flat Travelling Stock Reserve (KP 380.1-380.4)

This 32 hectare reserve supports a good example of Medium, Dry Tussock Grass *Poa sieberiana-Stipa* Alliance, with about 50% of the area considered to be in a semi-natural state. The site has become a repository for many indigenous flora species (A. Herbert *pers. comm.*), and is considered to be of high conservation value. The site was recommended for listing by the Australian Heritage Commission (Benson and Wyse Jackson 1994), and has since been registered (Australian Heritage Commission 1995). The rare shrub *Dodonea procumbens* occurs on the site. The south-west corner of the travelling stock route has been targeted for development in construction of the pipeline. It is strongly recommended that the site be completely avoided.

Bredbo Grasslands (KP 413.7-414.1)

Private land near Bredbo supports an excellent stand of *Poa sieberiana-Themeda australis* grassland. The site has been recommended for conservation as a nature reserve by Benson and Wyse Jackson (1994). The rare shrub *Dodonea procumbens* occurs on the site. The pipeline route currently avoids the site. Similar significant grasslands also occur north of this area but not on the pipeline route (Benson and Wyse Jackson 1994).

Dry Woodland (KP 507-508)

During reptile pit fall surveys an individual Little Whip Snake (*Suta flagellum*) was caught at this site. This represents only the second known locality supporting this species in New South Wales (Longmore pers. comm.). The Little Whip Snake is listed as vulnerable to extinction in New South Wales.

Waterboard Proteaceous Forest (KP 543.2-545.2)

This community was found to be more typical of near-coastal regions to the east of the Great Dividing Range. The canopy was of mixed eucalypt species, supporting a tall shrub understorey of *Banksia* species, *Persoonia* species and *Petrophile canescens*, with *Melaleuca, Lomandra* and *Hakea* species along the creek lines. Many of the species on site were recorded outside previously-known ranges, including the rare ground-covering shrub *Isopogon prostrata*. Considering the disjunct occurrence of this vegetation community, and the rare taxon, the site is considered to be of State Significance. This site is planned to be inundated by a proposed Sydney Water dam.

Pipeline construction within this community could have a significant impact on stands of *Isopogon prostrata* and by fragmenting portions of the vegetation. Avoidance or careful construction on a narrowed easement utilising existing minor tracks and easements such as an existing Telstra easement to the east is recommended.

Waterboard Proteaceous Forest with Wet Heaths (KP 552-554.5)

A high-quality dry forest was found between KP 552-554.5. This site supported a Eucalypt-dominated overstory with a similar complement of proteaceous species as the previous significant community (KP. 543.2-545.2). The site was dissected by wet heaths/soaks which contributed to the high species diversity. These heath communities were not located at any other site along the proposed pipeline route. The rare shrub *Isopogon prostrata* was found at this site. A large chorus of the frog *Paracrinia haswelli* were heard calling in drainage lines at this site. This is the first record of this frog species above the coastal escarpment, the nearest known record being Fitzroy Falls (Osborne, pers. comm.). The entire area could be avoided by realigning the pipeline route to utilise cleared land to the south.

Morton National Park West (KP 579.6-589)

The Mallee/Heath, Scribbly Gum Woodland and Sassafras High Forest present in this area was all in good condition. One significant plant, Boronia *Boronia subulifolia* was recorded along the proposed route but no significant fauna species were recorded. The condition of the vegetation and habitat and its overall role as a component part of the Morton National Park contributes substantially to the significance of this site.

Yerriyong and Colymea Forests (KP 594-624, 625.5-631)

Scattered occurrences of five nationally significant plants: *Acacia subtilinervis*, *Eucalyptus sturgissiana*, *Leptospermum epacrideideum*, *Leptospermum sejunctum* and *Rulingia hermannifolia*, and two regionally significant plants. The vegetation consists of Scribbly Gum Woodland, Open Forest, Tall Open Forest/Closed Forest and Mallee/Heath, all in good condition. Striated Fieldwrens and Yellow-bellied Gliders (both state significance) have been recorded in this area.

Shoalhaven River Forests (KP 635-639.5)

Two plant species of national significance (*Acacia subtilinervis, Leptospermum sejunctum*) and four regionally significant plants occur here. Yellow-bellied Gliders and Glossy Black Cockatoos (both state significance) were detected in this area, and there are good stands of Black Forest Oak, the food tree of the cockatoo.

The sandstone cliffs of the Shoalhaven River have been identified as significant (Daly and Murphy 1995) but the current route of the pipeline does not affect them.

Cumberland Plain Forest (KP 728-729)

The Cumberland Plain adjoins the sandy soils of the Wilton Tablelands in a small section of land close to Wilton. This area has a different vegetation type to that which exists over the majority of the Wilton Tablelands. The section of eucalypt forest managed by Sydney Water contains grey gum, forest red gum and Sydney peppermint, these species constituting over 15% of the canopy. This forest type provides potential habitat for the Koala. The current pipeline route follows an existing easment and should not require the removal of many trees.

REGIONAL SIGNIFICANCE

Mount Raymond Regional Park (KP 161.3-164)

Within the proposed corridor this conservation reserve supports Lowland and Damp Forest, none of which has been mapped as old-growth (Woodgate *et al.* 1994). The rare orchid Small Autumn Greenhood *Pterostylis longipetala* (as *P. reflexa*) has been recorded from this reserve (Willis 1970) while Beauglehole (1981) records the regionally significant orchids Plain-lip Spider Orchid *Caladenia clavigera* and Bearded Greenhood *Pterostylis plumosa*. Four species of fauna (White-bellied Sea-Eagle, Powerful Owl, Glossy Black Cockatoo and Tree Goanna - all state significance) have been recorded from this area. The site is considered to be of at least regional conservation significance.

Yeerung River-West Branch (KP 179-179.8)

CNR (1995) has identified areas here as a Special Protection Zone (Linear reserve on Yeerung River west branch) and a Special Management Zone which was partially designed to conserve Masked Owls. The vegetation communities present include Riparian Scrub Complex, Wet Heathland and Lowland Forest with some old-growth forest present within the proposed corridor (Woodgate *et al.* 1994). Undisturbed riparian vegetation in this region was considered significant by Bramwell *et al.* (1993). Fauna values include Smoky Mouse, Sooty and Masked Owls, Swift Parrot, and Tree Goanna records and a species-rich area for birds. The site is considered to be of at least regional conservation significance.

Combienbar Road (KP 230.5-231.1)

This area is designated a Special Management Zone to conserve Powerful Owl (CNR 1995). Tree Goannas and Blue Mountain Tree Frogs have also been recorded in this area. We recorded a high density and diversity of arboreal mammals here. This site is considered to be of at least regional conservation significance.

Neilson Creek (KP 235.1)

The rare species Giant Maidenhair *Adiantum formosum* was recorded on private land by Forbes *et al.* (1981) at the intersection of Neilson Creek and the West Cann Road (FIS quadrat No. C20058). Eastern Broad-nosed Bats have been observed in the area and Blue Mountain Tree Frogs have been recorded upstream of the Neilson Creek crossing. This site is considered to be of regional conservation significance.

Mount Canterbury (KP 272.9-273.5)

This site is bounded by Buldah Gap Road and the state border to the north and extends to Mt. Canterbury in the south. The area was described as a site of biological significance by Cherry *et al.* (1986). It is considered a special management zone by CNR (1995) because of the presence of a high density of arboreal mammals. The site is considered to be of regional conservation significance.

Cooma North Tussock Grasslands (KP 397.7-401.5)

These grasslands are a very good example of medium dry tussock grassland interspersed with patches of *Stipa-Danthonia*. The site provides potential habitat for significant reptile species and the rare shrub *Dodonea procumbens* has been located in nearby areas thus likely to occur on site. The site is at least of regional significance because of the extensive area covered by such high quality grasslands.

Rock Flat Grasslands (KP 379-380.1 and 380.4-384.2)

Medium, dry tussock grasslands immediately to the south of the Rock Flat travelling stock reserve (KP 379-380.1) have considerable conservation significance. *Themeda triandra* occurs on the well-drained northern slopes. The extensive rock cover provides habitat for several reptile species and provides potential habitat for both the Striped Legless Lizard (*D. impar*) and the Southern Lined Earless Dragon (*T. l. pinguicola*). Extensive tussock grasslands to the north of the travelling stock reserve (KP 380.4-384.2) are also considered significant as the area presents high quality habit and flora species richness. Although significant taxa were not located on site, it is likely that these areas may be of state significance, due to the high quality of the vegetation and potential reptile habitat.

South Michelago Grassland (KP 449.8-450.6)

A small area of high quality mixed species grassland occurs south of Michelago (KP 449.8-450.6). The site is covered predominantly by Tussock Grass *Poa sieberiana*. High native species richness is influenced by apparent low grazing pressure.

East Michelago Grasslands (KP 455-455.9)

This area of naturally treeless grassland near Michelago provides potential habitat for both the Striped Legless Lizard and the Southern Lined Earless Dragon. The site supports a good cover of native perennial tussock grasses, dominated by *Stipa*, *Danthonia* and *Aristida* spp. The floristic composition and extensive rock cover suggest the site has had a low disturbance history. While neither the Striped Legless Lizard or Southern Lined Earless Dragon were found during these surveys more intensive surveys incorporating pitfall trapping and other trap methods may detect these species at this site. These factors indicate that the site may actually be of state or national significance.

Themeda *Grassland/Grassy Woodland (KP 464.8-466)*

This grassland/grassy woodland with a understorey dominated by Kangaroo Grass was considered as regionally significant due to its high proportion and cover of native plants and due to the presence of the endangered plant Austral Toad-flax. Faunal surveys undertaken in late spring/early summer revealed a high diversity of reptile species.

Massey Creek Tributaries and Riparian Thickets/Forests (KP 511-513.2)

The proposed route will affect several tributaries of Massey Creek and its associated wetlands. Several of these drainage lines support riparian thickets dominated by *Eucalyptus viminalis* and examples of old *Banskia marginata*. The most intact sections of riparian thicket can be avoided by minor realignment of the pipeline; a larger route realignment, commencing from KP 510.5, would avoid the entire Massey Creek tributary section.

Wetland (KP 512-513.2)

The site supports a wetland of high floristic diversity which is in exceptionally good condition despite some areas being grazed by stock. Amphibian fauna is also likely to be significant. Care should be taken to avoid altering the hydrology of this site.

Dry Shrubby Forest (KP 513.2-515)

The proposed pipeline route crosses Massey Creek at KP 513.4 immediately after entering a section of riparian thicket/forest. Once across the creek, the vegetation would be classified as dry shrubby forest. The vegetation is in good condition with some light grazing by sheep. However, a new fence has been installed to keep stock from the waters of the Massey Creek. The fenceline easement is approximately 15-18 metres wide through the dry forest, and runs almost the entire extent of the forested area. This should be utilised for the greatest part of the development through this forest.

An extensive wombat burrow system exists near the river banks at KP 514.6-514.8. This may be avoided by a minor realignment to the north.

Woodland (KP 522-525)

Private land supporting excellent examples of the Dry and Damp Shrubby Forests. The vegetation on site is almost completely intact, with only a portion of the north-western corner having undergone selective logging. The vegetation is extensive and continuous, supporting a rich and diverse flora.

Queanbeyan River (KP 481.5)

The riparian community an important habitat link between the Googong Reservoir forest and the extensive forests to the south east. *Eucalyptus cinerea triplex* (nationally rare) may be present as the full extent of the species' range has not yet been determined (P. Barrow pers. comm.) and the nearest known stand occurs to the east of the route near KP 483.8. The site supports a high diversity of reptile species including one of the most easterly known records of the Small-eyed Snake (*Rhinoplocephalus nigrescens*).

Route option 8.1 appears a more suitable option with respect to the most sensitive areas of vegetation. Easement width must be minimised and soils stabilised satisfactorily following laying of gasline. The site should be allowed to regenerate. Manual revegetation would not be necessary.

Sassafras High Forests (KP 589-593)

Within Morton National Park is Sassafras, a small farming settlement on volcanic soils. The original Sassafras High Forests have been mainly cleared for agricultural land use and important remnants occur along the existing road easement. This area is of significance because of the existence of a population of Koalas (state significance). The forest is composed of Brown Barrel *Eucalyptus fastigata* and Monkey Gum *Eucalyptus cypellocarpa*, which are known food trees of Koalas.

Saddleback Mountain (KP 666-670)

This site contains Closed Forest and Saddleback High Forest and supports five regionally significant plant species (and one nationally significant species well away from the route). Spot-tailed Quolls (state significance) have been previously located in this area (H. Jones *pers. comm.*).

Mount Kembla (KP 702-704)

The vegetation of this site includes the significant communities Closed Forest and Blackbutt-Bluegum High Forest. No endangered fauna are known from this site although it is suitable for Spot-tailed Quolls and Sooty Owls.

Illawarra Escarpment (KP 705.3-708)

The vegetation of this site includes the significant communities Closed Forest, Illawarra High Forest and Sydney Sandstone Ridgetop Woodland. No endangered fauna are known from this site although it is suitable for Spot-tailed Quolls and Sooty Owls.

LINKAGES /CORRIDORS

Wildlife corridors are habitats that connect larger habitat areas. They may be linear in configuration, such as remnant vegetation along road reserves or rail lines, or may consist of a mosaic of inter-connected blocks of remnant habitat. They provide a dispersal route for large or mobile species which disperse or migrate between larger areas of habitat. They also prevent demographic changes occurring in fauna populations that may result from prolonged isolation from other populations of the same species by facilitating low rates of gene flow. Wildlife corridors themselves have inherent values for native fauna.

An assessment of existing wildlife corridors in the study area was undertaken as part of the present study. Within the Victorian section of the study area CNR (1995) has identified a series of linear reserves which are designated as Special Protection Zones.The identified wildlife corridors that intersect the route are listed below:

KP	Name	Type	Notes	Mitigation
2.5	Hebbarts/Murtnaugh Roads	Roadside strip. Cul-de-sac	High quality	narrow easement
4.0	Vale Road	Minor. Road reserve		"
8.0-9.0	La Trobe River	Minor. Riparian		"
28.0	Bengworden Road	Road reserve		"
37.5	(unnamed)	Minor. Road reserve	Links two large areas of habitat	"
41.5	Frews Road	Minor. Road reserve		"
43.5	Stacey Creek and Stacey Road	Minor. Roadside/ Riparian strip		"
39.5-40.8	Meerlieu Road	Roadside strip. Cul-de-sac		"

51.5	Robbins Road	Roadside strip. Cul-de-sac		"
53.5	Scotts Lane	Roadside strip. Cul-de-sac		"
56.7	Red Court Lane	Roadside strip. Cul-de-sac		"
57.5	Princes Highway	Roadside strip. Cul-de-sac		"
74.5	(unnamed)	Major woodland corridor	Private land	
77.5	(unnamed)	Major woodland corridor	Private land	
79.5	Princes Highway	Major roadside strip	Links two habitats	
86.0-88.0	(unnamed)	Major roadside strips	High quality. Links habitats. Private land	
110.0-111.5	Stony Creek / Mundic Creek	Major. Riparian. DCNR Special Protection Zone		
138.0-139.0	(unnamed)	Minor forest corridor	Links two large areas of habitat	
138.5-139.1	Simpson Creek	Major. Riparian. DCNR Special Protection Zone		
161.0-218.5	(unnamed)	Major. Riparian strips/Drainage lines	Along existing easement	
179.0-179.2	Yeerung River West Branch	Major. Riparian. DCNR Special Protection Zone		
184.9-185.1	Bellbird Creek	Major. Riparian. DCNR Special Protection Zone		
208.3-208.5	Little Pyramid Creek	Major. Riparian. DCNR Special Protection Zone		
221.5-222.4	Reed Bed Creek / Tonghi Creek	Major. Riparian. DCNR Special Protection Zone		
242.5	unnamed creek	Major. Riparian	Warm Temperate Rainforest	
310.0-310.5	Bombala River (south crossing)	Major. Riparian	Lightly timbered watercourse through pasture	
315.0	(unnamed)	Minor. Roadside strip. Cul-de-sac	Within pasture	
353.5	Maclaughlin River	Minor. Riparian strip	Much degraded. Through pasture/lightly timbered country.	
481.0-482.0	Queanbeyan River	Major. Riparian strip	Wide riparian/forest strip bordered by pasture. Links two large areas of habitat	
505.5-508.0	(unnamed)	Major. Woodland corridor	Part of a long band of Woodland (Turallo Range) running north-south	
521.0	Mulloon Creek	Minor. Riparian	Much degraded riparian strip within pasture	

KP	Name	Type	Notes	Mitigation
522.0-525.0	(unnamed)	Minor. Woodland corridor	Links habitat to the west and north-east (some subdivision and clearing of the latter)	
526.0	Manar Creek	Minor. Riparian	Lightly vegetated riparian strip within pasture. Links Woodland to the west and east	
532.5-534.0	Reedy Creek/Private property	Major. Riparian/Woodland	Creek and adjacent Woodland link wooded areas to the north and south	
557.5	Shoalhaven River	Major. Riparian/Woodland	One of few links to the north and south in this area	
562.0	Ningee Nimble Creek	Minor. Riparian, in parts adjacent to forest	Surrounding forest also makes links north-south, although this is the only riparian link	
566.0	Corang River	Minor. Riparian	Short stretch of river through pasture, between forest to the north and south	
574.0	Titringo Creek	Minor. Riparian	Lightly timbered watercourse within pasture, linking areas on a local scale	
577.5-588, 593-628	Morton Plateau	Major. Links northern and southern parts of major conservation reserve and state forests	Already affected by road, HT powerline & telecommunications easements	Avoid further increasing width of existing easements and road
650.8	creek	Minor. Riparian	Short stretch of creek through pasture	Narrow easement
666-670	Saddleback ridge	Major. Ridge	Important link from escarpment to coastal plains	Avoid if possible; narrow easement
678-679.5	Mt Terry	Minor. Ridge	Patchy link from escarpment to coastal plains	Narrow easement
699-699.5	Mt Kembla	Minor. Ridge	Short link in disturbed woodland from escarpment to coastal plains	Narrow easement
705-762	Sydney Water Catchments	Major. Links northern and southern parts of major conservation reserve and state forests	Already affected by track, HT powerline & telecommunications easements	Avoid further increasing width of existing easements and track

IMPACT ASSESSMENT

POTENTIAL ECOLOGICAL IMPACTS

The proposed pipeline has the potential to impact on ecological processes in a number of different ways. Generalised potential impacts and their ecological consequences are described below. Options to minimise the potential short and long term effects of these impacts are also provided.

The potential effects of pipeline construction on flora and fauna may be divided into seven major categories:

- vegetation clearance
- fragmentation and barrier effects
- spread of weeds and plant pathogens
- disturbance to fauna (noise, lighting)
- impacts on significant species
- effects on aquatic systems
- effects on wilderness, reserves, etc.

Vegetation Clearance

Where pipeline construction requires clearing of native vegetation, there will be a direct loss of native flora and of habitat for native fauna. Locally, the loss of vegetation will be minor, as the clearance for the pipeline in any one location will be small. However, cumulative effects need consideration, as does the potential for the local loss of important ecological resources. The loss of significant species is dealt with in a separate section.

Cumulative Vegetation Loss

All vegetation is of at least local significance for conservation. This is particularly true in areas which have been largely cleared for agriculture where all remnants, from disturbed roadsides to individual trees within paddocks are of ecological value. The expansion of existing easements should therefore be avoided where possible. Any areas of native vegetation which are cleared should be revegetated as soon as possible.

Clearing of native vegetation decreases the amount of available habitat, particularly for fauna species which have larger home range requirements. This long lasting influence can have a detrimental affect on the variety and density of the fauna present. The magnitude of the effect is inversely proportional to the size of the fragment. In a modified landscape some areas of vegetation function as links between larger, less disturbed areas. Fragmentation of these corridors increases the isolation of remnant native vegetation and affects the movement of birds, small terrestrial vertebrates and the population dynamics of vertebrate fauna across all habitat types. Fragmentation and increased isolation of existing remnant native vegetation should be avoided.

Native Vegetation Clearance Controls (Victoria)

Clearance of native vegetation in Victoria requires a permit from the Department of Conservation & Natural Resources. This EIS/EES provides the information required for the Department to assess the granting of such a permit.

Protection and Management of Native Vegetation (NSW - SEPP 46)

Clearance of over two hectares of native vegetation in New South Wales requires the consent of the Director-General of Land and Water Conservation. Information collected for this EES/EIS provides the basic information required to determine where such a permit would be required and a basic framework from which to construct the Vegetation Management Plan required to accompany any application for vegetation clearing.

Loss of Ecological Resources

Relatively undisturbed native vegetation supports plants in various growth stages, from new seedlings to mature individuals. In many instances the old-growth components of a vegetation community provide important habitat and resource features for other species (eg hollows, nectar, a substrate for epiphytes). The loss of such individuals during the construction phase would be detrimental to local fauna such as tree foraging and nesting birds and arboreal mammals. Resource-rich trees, such as Red Ironbark *Eucalyptus tricarpa* and Mountain Grey Gum *E. cypellocarpa*, also act as an important focus for local fauna, particularly nectar-feeding birds and mammals. Such trees are often a limited resource. The impact of losing such individuals is greater where such trees are rarer, as in roadside corridors, clearfelled and re-growth forest. Loss or damage to such trees should be avoided.

Fragmentation and Barrier Effects

Fragmentation, Edges and Microclimatic Change

Boundaries or edges of native vegetation generally experience higher levels of environmental stress and more frequent disturbance than areas more remote from such boundaries. Disturbed environments provide altered microclimatic conditions suitable for plant species with colonising tendencies, particularly introduced plants and disadvantage non-edge species, particularly those dependant on stable mesic conditions. Native vegetation in a fragmented landscape is usually bounded by broad edge zones of semi-native (weed invaded) vegetation. Fragmentation and reduction in an area may result in entire remnants effectively becoming edge zones. In these situations, weed invasion and loss of sensitive interior species are probable. Weed invasion along native vegetation boundaries is widespread and characteristic in Victoria, and has been mapped in remnant vegetation in eastern Melbourne (Yugovic *et al.* 1990) and in the Black Forest area which is becoming increasingly fragmented due to urban development (Yugovic *et al.* 1994). The phenomenon of marginal degradation is one of the primary reasons for having reserve buffers. Such microclimatic change also influence fauna populations with smaller ground dwelling species such as amphibians, small lizards and other smaller vertebrates which live in moist, cool shady areas most affected.

Barrier Effects

The proposed pipeline has the potential to be a barrier to the movement of some animal species. There are many existing barriers already present in the study area of similar dimensions to the pipeline easement: roads, electricity easements, firebreaks, etc. The pipeline in most cases would be following such existing easements, some of which may require widening.

The pipeline route would be a permeable barrier (it might slow or restrict movement but would not be expected to stop it). It is relatively narrow, it will not be fenced, and, in areas of native vegetation, the ground layer plants will be allowed to re-grow. The cleared area will be greatest during construction (20 m) but trees and shrubs will be allowed to re-grow after construction except for a 5-6 m band above the actual pipeline. Mobile species (birds, bats, large mammals, large reptiles) will cross the easement easily. Any barrier effect is most likely to affect smaller ground dwelling and arboreal mammals, shade-tolerant reptiles and amphibians.

The greatest potential for the pipeline easement to act as a barrier is where it intersects wildlife corridors. A wildlife corridor is an area of habitat that links two or more habitat areas. A wildlife corridor can be natural (eg. a ribbon of riparian forest along a stream) or can result from vegetation clearance (e.g. a stand of roadside vegetation connecting two uncleared stands of remnant bushland in an otherwise cleared farming area). Wildlife corridors provide connections between sub-populations, allowing the connected sub-populations to function as a larger "meta-population". This creates a more stable situation, particularly in terms of enhancing a species' chances of surviving events such as bushfire, drought or disease. These larger meta-populations can also maintain higher levels of genetic diversity through the avoidance of inbreeding.

Roads, utility easements and cleared farmland have been shown by research, both in Australia and overseas, to pose barriers to some species of small mammals and birds (Adams and Geis 1983, Barnett *et al.* 1978, Leedy and Adams 1982, Mader 1984, Mansergh and Scotts 1989, Schreiber and Graves 1977, Swihart and Slade 1984, Wegner and Merriam 1979). The effects of a barrier on migratory species or species that make long distance movements are obvious, however most such species are easily able to cross relatively small barriers such as the pipeline easement. For species which do not move long distances, the barrier formed by the pipeline easement is most likely to inhibit local or home range movements. Small bird and mammal species will often use utility corridors as one edge of their home range (Barnett *et al.* 1978, Kroodsma 1982). For arboreal mammals, the pipeline easement may also act as a barrier between suitable canopy trees.

Biological barriers may have both genetic and demographic effects on populations (demographic effects are those which alter the birth and death rates and other factors such as lifespan), some of which may ultimately lead to extinctions of sub-populations or even species (Lande 1988).

Demographic processes are affected by such factors as:

- variations in birth and death rates
- variations in the environment
- variations in mating success, particularly where they are density-dependant
- edge effects
- local extinctions and re-colonisations for patchily distributed species.

The latter two factors are those that the pipeline easement has the most potential to influence. Edge effects include a decline in habitat quality near a habitat boundary and any loss of individuals that disperse into unsuitable habitat. Any decline in habitat quality adjacent to the pipeline easement is likely to be only a short-distance effect in most instances, related to changes in the vegetation. The effect of most concern would be the possible isolation of sub-populations, increasing the chances of local extinction and decreasing the chances of re-colonisation.

The genetic effects potentially associated with any biological barrier occur where sub-populations become isolated or fragmented. The effects are very different for small populations as compared to large populations. Small populations that are isolated can suffer from significant deleterious effects associated with inbreeding and with the loss of genetic variation through genetic drift. A large population that is split into two populations that are still large will not be affected by either of these processes, although the two populations may slowly diverge genetically.

Inbreeding can cause inbreeding depression (Berger 1990, Ralls *et al.* 1988). Inbreeding depression is a problem in very small population sizes (perhaps 500-1000 individuals), such as might arise where small sub-populations were isolated from the main population. Inbreeding, if it occurs, would only be a problem at the sub-population level in habitat isolates, and is therefore most unlikely to have a species-wide effect or to affect populations in large natural areas.

Genetic drift occurs when an isolated or small population looses genetic variation due to the chance loss of alleles (forms of a particular gene). Because the population is isolated, the lost genetic variation cannot be replaced by gene flow from another population; it can only be replaced by the very slow and random process of mutation, a process that may be too slow to ensure the long term viability of the population. However, the rates of dispersal between populations required to prevent genetic drift occurring are surprisingly low - one or two individuals per generation (Lande and Barrowclough 1987, Sherwin and Murray 1990) - and these figures seem to be of general applicability throughout a wide range of organisms. Thus, a barrier has to cause very low levels of gene flow before genetic drift comes into play.

Minimising Barrier Effects

The potential for the pipeline easement to act as a barrier can be minimised by:

- following existing barriers (eg easements, roads)
- minimising its width
- providing narrowed or uncleared crossing points at intervals (especially in areas identified as wildlife corridors)
- retaining a ground layer or understorey of native vegetation
- minimising the size of any vehicle tracks along it and minimising the traffic on them
- providing aerial walkways for arboreal mammals if necessary
- ensuring that stream crossings do not result in bed changes that inhibit movement of aquatic species.

Introduction or Spread of Pest Plants and Pathogens

Pest Plants

Pest plants are either environmental weeds or agricultural weeds. Environmental weeds are plants that invade native vegetation, usually adversely affecting the regeneration and survival of native flora and fauna (Carr *et al.* 1992). Agricultural weeds are problems in farming situations, and many of these are proclaimed noxious weeds. While some pest plants are capable of invading undisturbed vegetation (Carr 1993), disturbance generally plays a significant role in weed invasion (Fox and Fox 1986, Hobbs 1991).

Construction of the proposed pipeline would result in significant soil disturbance and provide an opportunity for weeds to colonise. The potential for weed invasion is largely a function of the availability of weed propagules (seeds, fragments). Construction activities in remote forest areas where sources of weed propagules are equally remote are generally less problematic. Disturbance of the interface between weedy sites such as pastures or roadsides and native vegetation is, however, a threat to native vegetation. Once weeds become established their spread into surrounding vegetation after natural disturbances (eg fire) is more likely. However, much of the increase in weed levels is likely to be confined to the easement, at least in the short term.

Environmental weed invasion is an important issue, but it is noted that weeds already dominate the understoreys of forest and woodland vegetation in many areas, particularly on private land. This pre-existing high level of weed cover is related to the small size of many vegetation remnants and their management history (primarily in terms of grazing). Weed invasion is not a major management issue in such areas, although care should be taken not to exacerbate weed problems. There are, however, many large areas of forest with intact understorey vegetation. These areas may undergo weed invasion unless measures are taken to minimise disturbance and control outbreaks.

Substantial effort may be required to minimise the spread of weeds into native vegetation. On the Monaro Plains, soil disturbance is a major cause of native grassland loss. Options for amelioration in native grassland are limited and to some extent experimental. These include restricting traffic between weedy and largely native sites, burning weedy sites adjacent to native vegetation to reduce the abundance of weed seed prior to disturbance, harvesting the vegetation and surface soil intact and re-laying it as a 'turf' after construction, and revegetation with the dominant indigenous grasses present before disturbance (eg Kangaroo Grass *Themeda triandra*, Common Tussock-grass *Poa labillardieri*, Grey Tussock-grass *Poa sieberiana* etc). Most of these options are expensive. Furthermore, virtually all these remnants are on private land where landowners may prefer revegetation with introduced pasture, although such actions must be consistent with any vegetation management plan associated with the planning guidelines for native vegetation protection and management (SEPP 46).

Within native vegetation, away from edges, there is little opportunity for weed colonisation unless weed propagules are brought in. Indigenous plants will otherwise establish on disturbed sites; indeed disturbed but weed-free sites frequently provide valuable habitat diversity, especially for species requiring open conditions, such as many orchid species. The pipeline easement may thus have environmental benefits under certain circumstances. Importation of weed-infested soil on machinery and equipment is a major means of weed introduction in these situations. Accordingly it is appropriate to wash down vehicles and machinery, at designated points, before entering sensitive areas as part of an overall program of managing pest plants.

Besides direct soil disturbance, altered drainage can stimulate weed invasion. Native vegetation adjacent to the pipeline easement should not receive increased runoff.

There are several hundred weed species known to establish in native vegetation (Carr *et al.* 1992). Weed species of most concern include:

Pampas Grass	*Cortaderia selloana*
English Broom	*Cytisus scoparius*
Cape Ivy	*Delairea odorata*
Dolichos Pea	*Dipogon lignosus*
African Love-grass	*Eragrostis curvula*
Cape Broom	*Genista monspessulana*
English Ivy	*Hedera helix*
One-leaf Cape Tulip	*Homeria flaccida*
St Johns Wort	*Hypericum perforatum*
Bridal Creeper	*Myrsiphyllum asparagoides*
Serrated Tussock	*Nassella trichotoma*
Kikuyu	*Pennisetum clandestinum*
Monterey Pine	*Pinus radiata*
Wandering Jew	*Tradescantia albiflora*
Blue Periwinkle	*Vinca major.*
Willow	*Salix* spp.

Other weeds of concern may be identified in consultation with relevant land management agencies.

Monitoring and management of pest plants is integral to sound land management. Pre-construction monitoring is essential to obtain information on pre-existing weed levels, otherwise rehabilitation standards cannot be defined. It need not be a requirement to restore native vegetation on a site that was already weedy. Post-construction monitoring is essential in order to control outbreaks and meet rehabilitation standards. The overall aim should be to minimise weed invasion wherever possible. It is impracticable to completely prevent weed invasion, however, and some increase in weed levels, at least along the easement itself, is considered to be inevitable, as it is when any road or easement is constructed through native vegetation.

Regulatory Requirements:

At least two areas in New South Wales are designated as control zones for specific weeds:

- south of Cooma around Rock Flat (KP 375-385) - Serrated Tussock *Nassella trichotoma*
- Michelago south to Chakola (KP 410-455) - African Love-grass *Eragrostis curvula.*

In these control areas, vehicles are required to be washed down before leaving the Shire of Cooma. This technique may control the broad geographic spread of weeds but is unlikely to be effective in controlling weed invasion of particular sites disturbed during pipeline construction.

Amelioration Guidelines:

- Designate weed control areas, in consultation with relevant land management agencies and landowners. Prevent or minimise weed invasion within these defined sensitive areas.
- Mark the easement boundary within designated weed control areas to prevent entry of vehicles and personnel during construction works.
- Prevent the importation of soil into designated weed control areas from outside, and wash down vehicles and machinery before entering such areas, at designated points.
- Monitor weeds in weed control areas before and after pipeline construction (for two years after completion of works, due to the possible need for follow-up control). Monitoring should take place in spring and summer and should be conducted by an experienced field botanist.
- Manage weeds in designated control areas after pipeline construction (for two years after completion of works, due to the possible need for follow-up control). Management should take place in spring and summer, with works undertaken by trained works crews. It is necessary that weed outbreaks are controlled *prior* to seed production. The aim should be to return weed levels to the pre-existing levels, as determined by pre-construction monitoring.
- Avoid placing the pipeline in native vegetation wherever possible in order to prevent weed problems.
- Minimise physical disturbance of soils and vegetation within native vegetation generally.
- Minimise alterations in drainage within native vegetation generally.
- Follow existing regulatory guidelines on pest plant control (see above).
- Revegetate areas of native vegetation disturbed by pipeline construction with locally indigenous species (utilising natural regeneration as much as possible).
- All stream crossings should also be as narrow as practicable and where Soft Tree-ferns *Dicksonia antarctica* are present, they should be harvested, stockpiled and replanted after construction.

Cinnamon Fungus

Cinnamon Fungus *Phytophthora cinnamoni* is a primary cause of dieback in the coastal forests of Victoria and New South Wales. It a soil-borne fungal pathogen that has probably been introduced to Australia since European settlement, and is readily spread by infested soil adhering to vehicles. Many native plant species are susceptible, including a large number of trees. It is considered to be a major threat to native vegetation. The fungus is rarely found in cooler mountain forests, and even if accidentally introduced into these locations, is unlikely to cause problems (Marks and Smith 1991).

Cinnamon Fungus is likely to occur intermittently along the pipeline corridor, in both Victoria and New South Wales. The disease is particularly prevalent in lowland East Gippsland. However only one specific infested site is currently known: between Nowa Nowa and Orbost (KP 129) - site 802/08 in the East Gippsland Area Proposed Management Plan (DCNR 1995). Other dieback sites possibly carrying Cinnamon Fungus are likely to be known by land management agencies.

Construction and maintenance of the proposed pipeline has the potential to accelerate the spread of Cinnamon Fungus. This is regarded as a potentially major impact, although one which could be minimised or prevented using appropriate operational procedures. Due to the ability of this disease to spread by water-borne spores carried in runoff, the impact of the pipeline construction could extend considerable distances from the initial point of establishment.

In order to minimise this potential impact, the distribution of the disease requires survey. Soil tests can be undertaken in the warmer seasons when the fungus is active.

Cinnamon Fungus is readily spread by infested soil adhering to vehicles. Land hygiene measures can be applied to minimise spread into new uninfected areas once identified. These involve washing down, at designated sites that cannot lead to further infection, vehicles, machinery and plant before leaving known infested areas, as well as the safe disposal of infested soil.

However it is not considered practicable to apply land hygiene measures in areas with existing tracks carrying vehicular traffic including fire fighting and management vehicles, as vehicles are likely to disperse the pathogen in the long run. Most of the pipeline route is accordingly unsuitable for the application of hygiene measures. It is noted that no government agency is currently applying or proposing to apply land hygiene measures in the vicinity of the pipeline corridor. Furthermore it would be pointless to implement measures without the co-operation of all relevant agencies.

Amelioration Guidelines:

- Designate Cinnamon Fungus control areas, in consultation with relevant land management agencies. Prevent or minimise the spread of infection within these defined sensitive areas.
- Develop and apply land hygiene practices (see above), in consultation with relevant land management agencies, in any such designated areas. It not clear at this stage whether land hygiene measures can be effectively applied to any area (for reasons outlined above).

Fire

Fire is an important ecological factor in many of the native vegetation types along the pipeline route. Fire is a natural component of ecosystems in south east Australia, but fire can also be damaging if the nature of the fire *regime* changes: it becomes too frequent or, in some instances, too infrequent, or more or less intense.

For the pipeline to have any impact on the fire regimes in the vegetation through which it passes, it would have to cause a change in fire regime. This seems unlikely, as the pipeline is not expected to be a source of fires during operation, nor is it creating new access (and therefore people who may start fires) to previously inaccessible areas. The pipeline easement may play a minor role as a firebreak, but this will be a similar level of effect to the many existing roads, tracks or easements that are close to the route.

The main period where fire hazard could be increased is during construction. Construction teams should be trained in fire safety and all vehicles and heavy equipment should carry appropriate fire fighting equipment.

Impacts of Disturbance on Fauna

Noise

Most animals are highly tolerant of noise, as long as it is not associated with actual danger. They habituate rapidly to noise sources, especially where the noise is relatively constant. The temporal pattern of noise is as important as its volume. Animals seem to habituate readily to continuous noise; whereas sounds with a sharp onset time elicit an escape response, birds are able to adjust to slow onset times (Boudreau 1968, Brough 1968). Thus the noise from engines is less disruptive than the noise from blasting.

While an animal's first reaction to a new noise is initially one of fear and avoidance, it will generally learn to ignore the noise if other sensory systems (eg visual, chemical) are not stimulated. The time required to habituate completely varies with the species but is related to the time interval between each exposure to a certain noise and the animals' previous behaviour. Most studies which have examined the effectiveness of acoustical scaring devices on birds have concluded that birds habituate to sounds unless they are accompanied by some other aversive stimulus.

Lighting

Very little is known about the effects of artificial lighting on wildlife. It is likely to have little effect on most birds and mammals, as they generally have good night vision and perceive little difference between night and day. However in desert habitats strong light at night is known to elicit a predator avoidance response and curtail the movement of nocturnal mammals.

Above-ground Structures

The Eastern Gas Pipeline requires the construction of a number of above-ground structures to assist in its successful operation. These vary in size from the small Meter Stations and Sales Taps to the larger Compressor Stations. At the level of capacity expected at the commencement of operation of the pipeline there are plans for only one compressor station at Longford. However, as capacity in the pipeline is used up there will be a necessity for the construction of compressor stations at Cann River and near Michelago. These are considered in the Table below in addition to all the other above ground structures required for the pipeline's operation. Because they are permanent structures it is essential that they be located on land already cleared of any native vegetation as there is no potential for regeneration. The above ground structures are listed below.

Station Number	Station Type	km from Longford	Notes
1	Longford Compressor Station	0	Cleared Land
2	Stratford Sales Tap	26	Cleared Land
3	Paynesville/Bairnsdale Sales Tap	63	Cleared Land
4	Bruthen Sales Tap	94	Cleared Land
5	Lakes Entrance, Nowa Nowa Sales Tap	117	Cleared Land
6	Orbost Sales Tap	156	Cleared Land
7		190	Easement
8	Cann River Compression Station	234	Private Land, no identifiable constraints
9	Bombala Sales Tap	312	Farmland
10	Nimmitabel Sales Tap	360	Rare plants along roadside but otherwise cleared land
11	Cooma Sales Tap	392	Good quality tussock grassland on hill, move 0.5 km north.
12	Michelago Compressor Station & Bredbo Sales Tap	450	Cleared land, further investigation before determine exact site.
13	Bungendore, Braidwood, Queanbeyan and Canberra Sales Tap	502	Cleared Land
14	South Nowra Sales Tap	636	Forest
15	North Nowra Sales Tap	643	Cleared Land
16	Berry Sales Tap	655	Cleared Land

17	Gerringong Sales Tap	664	Cleared Land
18	Kiama, Jamberro Sales Tap	673	Cleared Land
19	Albion Park, Tallawarra Sales Tap	683	Cleared Land
20	Meter Station	694	Cleared Land
21	Port Kembla Wollongong sales Tap	701	Cleared Land
22	Wilton	731	Cleared Land

Significant Species

Significant Flora

Significant flora can be affected by pipeline construction where they are directly lost through clearing or excavation, or where they are affected by indirect effects such as weed invasion, soil erosion or altered light or microclimatic conditions.

As significant plants are usually highly localised, avoidance of direct impacts by minor changes to the pipeline route will often be feasible. In some cases, plants not affected by the actual pipeline trench but which are within the 20 m construction easement will be able to be conserved by excluding machinery from an area around the site at which they occur.

Amelioration of indirect effects is best achieved through good design, construction and easement management, as discussed in previous sections.

Few rare plants can be propagated successfully or relocated to other sites; attempts to do so should only be made when no other options are available.

Site-specific recommendations for ameliorating impacts on significant flora are made later in this chapter.

Significant Fauna

Although a large number of significant fauna species have been recorded in the study corridor, only a few may be significantly affected by the pipeline. This section divides the significant species into "guilds" (groups of species with similar ecological requirements) and discusses potential impacts on these guilds. Appendix 2 contains species-specific discussions.

Critical Weight Range Mammals

The critical weight range (CWR) mammals are a group of small to medium-sized mammals that are highly prone to extinction. It is believed that the key factor with CWR species is predation by introduced predators, especially the fox. Introduced predators may preferentially move along cleared corridors when hunting and native fauna may be more prone to predation when moving away from dense cover. Thus, where the pipeline easement creates a new clearing within unroaded forest, CWR species may be affected. Where the easement follows existing cleared areas, no significant effect is expected.

Arboreal Mammals

Most species of arboreal mammals would be able to cross the easement, either by walking or gliding. As for CWR species, this may expose them to predators. Thus, where the pipeline easement creates a new clearing within unroaded forest, arboreal mammals may be affected locally, but where the easement follows existing cleared areas, no significant effect is expected. Removal of mature trees with hollows would also affect arboreal mammals and should be minimised.

Bats

As flying species, bats should not be significantly affected by the pipeline, although there may be local changes to foraging patterns where new areas are cleared. No known roosting or maternity caves are directly affected by the proposed pipeline.

Small Terrestrial Mammals

As ground-dwelling species, small terrestrial mammals may find the pipeline a barrier to movement. This is likely to be a local effect, and enough individuals would be able to cross to prevent isolation of populations. The retention of the ground flora on the easement and the provision of narrowed or connected areas will minimise barrier effects.

Aquatic Mammals

Aquatic mammals could be affected by the pipeline if stream crossings resulted in major impacts on streams. Amelioration measures for stream crossings are dealt with in the Stream Ecology section.

Waterbirds

The pipeline is not expected to affect the habitat values of any major wetland and does not affect any breeding colonies of waterbirds, so impacts on this guild are minimal.

Raptors

Raptors are highly aerial birds and are not likely to be affected by the pipeline. Any raptor nest trees should be identified and avoided during construction.

Parrots

As hollow-nesting species, parrots could be affected where hollow-bearing trees are removed. The loss of feed trees (eg *Allocasuarina* for Glossy Black Cockatoos) could also affect them. Both these impacts will be minimal where the pipeline follows existing cleared areas and easements; they should be minimised elsewhere by careful pipeline location.

Owls

Owls are not expected to be affected by the pipeline, but minimising the removal of mature trees (in which they may nest and roost) will reduce any impacts.

Passerines

The passerines (small "bush" birds) includes a number of significant species that occur along the pipeline route which are sedentary and susceptible to local habitat loss or fragmentation (eg Striated Fieldwren, Eastern Bristlebird, Olive Whistler). In areas containing habitat for these species, it will be important to ensure that vegetation removal is minimised or avoided.

Reptiles

As mostly ground-dwelling species, small reptiles may find the pipeline a barrier to movement. This is likely to be a local effect, and enough individuals would be able to cross to prevent isolation of populations. The retention of the ground flora on the easement and the provision of narrowed or connected areas will minimise barrier effects. Larger reptiles should not be affected.

Frogs

The pipeline is not expected to affect the habitat values of any major wetland and populations of frogs in such areas should not be impacted. However, frogs utilise many other areas, including small wetlands (which could be identified), temporary pools and even damp litter. The pipeline route largely avoids identifiable wetlands of any size, but minor deviations within the easement may be required to minimise impacts on very small sites.

Species listed under International Treaties

The following species recorded within or adjacent to the study area are listed under the Japan-Australia Migratory Birds Agreement (JAMBA): Short-tailed Shearwater, Great Egret, Cattle Egret, and White-winged Black Tern. Species listed under the China-Australia Migratory Birds Agreement (CAMBA) recorded within or adjacent to the study area are: Great Egret, Cattle Egret, Glossy Ibis and White-bellied Sea-Eagle.

Although the study area may provide habitat for small numbers of these species during part of the year, it is marginal to their conservation in Victoria or New South Wales. The pipeline will not negatively impact on these species or violate Australia's treaty obligations.

Species listed under the Flora and Fauna Guarantee Act

One of the plant species (Purple Diuris *Diurus punctata*), two vegetation communities (Forest Red Gum Grassy Woodland and Central Gippsland Plains Grassland) and ten of the fauna species recorded in Victoria (Spot-tailed Quoll, Brush-tailed Phascogale, Long-footed Potoroo, Eastern Horseshoe Bat, Great Egret, White-bellied Sea-Eagle, Glossy Black Cockatoo, Swift Parrot, Turquoise Parrot, and Giant Burrowing Frog) are listed in Victoria under the Flora and Fauna Guarantee (FFG) Act 1988.

Special Management Areas (Saxon *et al.* 1994) have been defined for the protection of the Long Footed Potoroo in Victoria. These overlap the Special Protection and Special Management Zones defined for this species by CNR (1995). Between KP 178 - 188.5 the pipeline corridor passes near or close to some of these areas and enters a Core Area (Saxon *et al.* 1994) or Special Protection Zone (CNR 1995) between KP 181.7 - 187.5. This latter area includes the Bellbird Creek site of significance. In these areas the pipeline route follows existing SEC easement which is cleared except for riparian areas which are important wildlife corridors linking the two forest sections.

One relevant threatening process is also listed under the FFG Act; it relates to streams and is dealt with in the Stream Ecology section. The FFG Act aims to conserve flora and fauna at the state level. The pipeline is not expected to have significant impacts on any of the listed species or communities and thus would not affect their conservation status.

If any plants of Purple Diuris are to be removed by construction, a permit to take may be required under the FFG Act.

Schedule 13 of the National Parks and Wildlife Act

Twenty eight of the vascular plant species listed under Schedule 13 of the New South Wales National Parks and Wildlife Act were recorded along the proposed pipeline route. These species and the section of pipeline from which they were recorded are listed in Table 7.

Table 7. The distribution of vascular plants listed in Schedule 13 of the National Parks and Wildlife Act (1974) along the proposed pipeline route. Route segment abbreviations are as follows: Monaro Plains (MP), Mountain Valleys (MV), Hoskinstown-Nerriga Hills (HNH), Morton Plateau (Mor), Illawarra Coast (IC) and Wilton Tableland (WT).

Spec. No.	Species	MP	MV	HNH	Mor	IC	WT
112	*Actinotus helianthi*						+
7	*Adiantum aethiopicum*			+	+	+	+
9	*Adiantum formosum*					+	
10	*Adiantum hispidulum*					+	
3964	*Boronia floribunda*						+
3966	*Boronia ledifolia*						+
3971	*Boronia parviflora*				+		
3978	*Boronia subulifolia*				+		
835	*Casuarina cunninghamiana* ssp. *cun.*			+		+	+
1004	*Caustis flexuosa*			+	+		+
1005	*Caustis pentandra*						+
1008	*Caustis recurvata*						+
3989	*Crowea exalata*				+		
959	*Cyathea australis* s.l.					+	+
961	*Cyathea leichhardtiana* s.l.					+	
2763	*Cymbidium suave*				+	+	
1163	*Davallia pyxidata*					+	
2769	*Dendrobium linguiforme*				+		
1173	*Dicksonia antarctica*					+	
3991	*Eriostemon australasius* ssp. *aust.*						+
4002	*Eriostemon scaber*				+		
2830	*Liparis reflexa*				+		
205	*Livistona australis*					+	+
3694	*Lomatia silaifolia*						+
2107	*Lycopodium deuterodensum*				+		+
3737	*Persoonia pinifolia*						+
1303	*Sprengelia incarnata*						+

A number of these species (eg *Caustis flexuosa*) are common along the proposed pipeline route and the destruction of many individuals is unavoidable. Large, less common species, such as *Livistona australis,* should generally be easily avoided. The New South Wales National Parks and Wildlife Service should be informed of the presence of these species before construction begins and a permit sought to allow the indirect taking of these species.

The Environmental Planning and Assessment (EPA) Act

The NSW Environmental Planning and Assessment (EPA) Act 1979 requires that a Fauna Impact Statement must be prepared if it is demonstrated that "a development or activity is likely to significantly affect the environment of endangered fauna." A number of Schedule 12 species are known to occur or may potentially occur along the pipeline route and an FIS will need to be prepared. However, further survey work is required as some of the species are only active in warmer weather or will require specific focussed surveys. The FIS will be produced after the Spring surveys. A 30 day public comment period is required; this will occur during the EIS/EES public display period, allowing final review of both documents together.

Table 5 lists the Schedule 12 species known from the route corridor (those associated with the coastal or marine environment are not considered as the route will not impact upon them). Some species such as the Regent Honeyeater, Pink Robin and Swift Parrot are vagrants within the area. Bats and most of the other listed bird species (Square-tailed Kite, Turquoise Parrot, Ground Parrot, Powerful Owl and Sooty Owl) are mobile species which range widely. Consequently, neither of these groups will probably be affected by the proposed development.

The species which are likely to be impacted upon are those associated with specific habitats, are sedentary or have reproductive or other requirements that may be impacted upon by the removal of vegetation and subsequent earthworks associated with the laying of the pipeline. Each of these factors will be considered for the Schedule 12 species listed below:

Spot-tailed Quoll	*Dasyurus maculata*
Yellow-bellied Glider	*Petaurus australis*
Glossy Black Cockatoo	*Calyptorhynchus lathami*
Striated Fieldwren	*Calamanthus fuliginosus*
Eastern Bristlebird	*Dasyornis brachypterus*
Striated Fieldwren	*Calamanthus fuliginosus*
Olive Whistler	*Pachycephala olivacea*
Striped Legless Lizard	*Delma impar*
Heath Monitor	*Varanus rosenbergi*
Broad-headed Snake	*Hoplocephalus bungeroides*
Little Whip Snake	*Suta flagellum*
Growling Grass Frog	*Litoria raniformis*
Giant Burrowing Frog	*Heleioporus australiacus*
Red Crowned Toadlet	*Pseudophryne australis*

1. "the extent of modification or removal of habitat, in relation to the same habitat type in the locality"

It is the objective of BHPP to minimise damage to native vegetation. The proposed route has been selected and may be modified to take into account the sensitive nature of certain habitats. The majority of the route will traverse land that has been previously cleared of native vegetation (Figure 1). In naturally vegetated areas the pipeline will primarily follow existing easements. The only areas in New South Wales that will have a significant amount of vegetation removed are the Shoalhaven crossing and Saddleback Mountain.

2. "the sensitivity of the species of fauna to removal or modification of its habitat"

All Schedule 12 species considered here are either forest or native grassland dependant species that require areas of native vegetation that are of suitable size to maintain viable populations (personal observations). Such vegetation may also be necessary as dispersal corridors that link areas of core habitat where populations of animals reside.

The Spot-tailed Quoll is rarely detected in fauna surveys (QEM 1994, Tanton 1994, Smith *et al.* 1994). In the Illawarra/Shoalhaven the species is associated with closed forests along the escarpment (Daly and Murphy 1995). The Spot-tailed Quoll can forage over cleared land in areas adjacent to riparian vegetation and or contiguous bush (Daly, personal observations).

The population of Koalas has been severely reduced during this century. The species was previously known from several areas in the Shoalhaven such as west Cambewarra, Kangaroo Valley and behind Seven Mile Beach National Park (B. Wilson pers. comm., Robinson 1987). Shooting in the earlier part of this century, the 1968 wild-fire and habitat removal appear to be the main reasons for the reduced population of Koalas in the Shoalhaven City (pers. obs.).

The Yellow-Bellied Glider is a forest dependant species and removal or modification of its forest habitat may lead to local extinction (Goldingay and Kavanagh 1991). This may also apply to vegetated areas that may provide a corridor linking areas of preferred habitat (Goldingay 1994).

The response of the Glossy-Black Cockatoo to habitat disturbance/removal has not been documented. The Glossy-Black Cockatoo has a very large home range (Daly personal observations). The animals located at north Nowra were observed feeding on casuarinas. In the Shoalhaven this species feeds on the seeds of the Black She-oak *(Allocasuarina littoralis)* (Daly, personal observations). The study site at north Nowra has a large number of Black She-oaks.

The Striated Fieldwren and Eastern Bristlebird are species that are highly associated with heath/woodland ecotone (Bramwell *et al.* 1992, personal observations). Both species have had recent declines in their former range. Habitat removal is one possible cause for this decline but other factors appear to be affecting these species as they have disappeared from areas where their preferred habitat is intact (Morris *et al.* 1981).

The Olive Whistler in New South Wales is a species which occurs in montane areas in a variety of habitat types from *Northofagus* forest to stunted snow gum *E. pauciflora* forest which has a dense understorey (pers. obs.). The Olive Whistler will use logged areas but the retention of areas of unlogged moist forest which has a dense understorey may be important to its survival (QEM 1994).

The Striped Legless Lizard requires a continuous cover of perennial grasses and uses surface rocks and underground burrows for shelter. Bare ground may result in a decline in activity and temporary habitat fragmentation. In the A.C.T. soil disturbance resulting from ploughing is believed to cause population fragmentation and extinction (Dorrough 1995), while rock removal may lead to localised population decline (Cogger *et. al.* 1993).

The Heath Monitor is a species which utilises termitaria (usually *Nasuititermes* spp.) as oviposition sites (Ehmann *et al.* 1991, Green and King 1993). Juvenile animals spend most of their time in trees while adults utilise burrows as refuge sites (Green and King 1992).

Like most animal species Heath Monitors require several components of habitat for survival.

The Broad-headed Snake is restricted to north-facing sandstone escarpments in the Sydney Sandstone area which are topped by woodland. Individuals shelter under flat slabs of tight fitting sandstone and prefer those that are devoid of organic debris. This species will be sensitive to further damage to this habitat.

The habitat requirements of the Little Whip Snake are poorly documented. The species appears to need rock outcrops and fallen timber for daylight shelter. Removal or disturbance to these habitat features may result in localised extinction and/or population decline.

Disturbance to wetland areas and riparian vegetation may impact on local populations of the Growling Grass Frog. This species is believed to be in decline (Sadlier, 1994), possibly due to habitat disturbance.

No studies have been done on the sensitivity of the Giant Burrowing Frog to habitat disturbance but no animals have been found in pasture or cleared land which indicates that this is a forest dependant species (Daly in press; Gillespie 1990). Cogger (1995) states that the Giant Burrowing Frog has been extirpated from all urban areas and from much of the remnant native bushland remaining in the Sydney region.

The Red-crowned Toadlet would be sensitive to habitat removal as they are slow moving, nocturnal animals that could not escape an area when it was being developed (personal observations).

3. "the time required to regenerate critical habitat, namely, the whole or any part of the habitat which is essential for the survival of that species of fauna"

Only a small area of bushland that will be removed for the laying of the gas pipeline will be regenerated. The habitat removed for the easement will be kept clear of vegetation as required for maintenance.

The time to regenerate habitat that is suitable for the species of fauna considered here to use as a habitat corridor may be as little as 10-15 years (Goldingay 1994, personal observations). The time to regenerate gums that are suitable for Yellow-bellied Gliders to sap feed may be in the order of 30 years (Daly, personal observations).

We are unaware of any studies that indicate time taken for Striated Fieldwrens and Eastern Bristlebirds to recolonise an area after habitat has been removed. However, studies on Bristlebirds and fire indicate that they can recolonise an area which has been burnt after one year (Jordon 1984). In logging areas Olive Whistlers may be catered for by retaining unlogged reserves (QEM 1994).

Regeneration of suitable habitat for the Striped Legless Lizard may be rapid (<5 years) (Dorrough, personal observations), but recolonisation of this habitat may be slow due to slow rates of population increase a nd barriers to movement.

We are unaware of any quantitative study of the time taken for termites to construct a termitaria which is of suitable size for a Heath Monitor to utilise as a oviposition site. Likewise, we are also unaware of any studies of how long it would take for suitable rock crevices for Broad-headed Snakes to re-form after disturbance.

The time required for the regeneration of critical habitat for the Little Whip Snake or the Growling Grass Frog is unknown.

There is one site in Sydney where Red-crowned Toadlets colonised an area which had been modified by humans (Daly personal observations). The cut rock associated with drainage culverts in this area suggest that disturbance occurred some forty years previously, however we do not know how extensive the original impact was.

4. "the effect on the ability of the fauna population to recover, including interactions between the subject land and adjacent habitat that may influence the population beyond the area proposed for development or activities"

Populations of fauna that will be impacted on by the proposed development will only be able to recover if their requisite habitat is maintained either side of the pipeline route. In areas such as Morton National Park, State Forests and Sydney Water there is a conscious effort as part of the management of these areas to maintain habitat by a variety of management methods. Outside these areas the responsibility of habitat management relies on the appropriate zoning of significant habitat by Local Government. The three local government areas considered here as having habitat which is significant for endangered fauna are the Kiama, Shoalhaven and Wollongong Municipalities.

In the Kiama Shire environmentally sensitive areas have been mapped and zoned accordingly in a recent Local Environmental Plan (LEP) (1995). The situation in the Shoalhaven is quite different. Although a series of reports have documented the significance of habitat adjacent to the Shoalhaven River there has been no zoning to adequately protect such areas in the recent LEP (Daly 1994a,b; LSCMC 1994). The status of the Shoalhaven LEP is currently under review. In the Wollongong Shire there has been an effort in recent years to incorporate escarpment lands into lands zoned as State Recreation. This zoning aims to protect the escarpment forests. BHP has been a significant contributor to this process.

5. "any proposal to ameliorate the impact"

This EIS/EES sets out the proposals to ameliorate the impacts of the pipeline.

6. "whether the land is currently being assessed for wilderness by the Director of National Parks and Wildlife under the Wilderness Act 1987"

Portions of the subject land are existing wilderness and portions are being considered fro wilderness (NPWS 1993). The portion of Morton National Park north of the Braidwood Road between freehold land of Sassafras and Bulee Gap and between Sassafras and west of Tianjara Falls is existing wilderness (NPWS 1993). The amended proposed pipeline route will be under Braidwood (Turpentine) Road for these sections and hence shall not cross a dedicated wilderness area. To the east of Tianjara Falls the proposed pipeline will deviate from the road alignment and cross an area which is currently being assessed for wilderness.

7. "any adverse effect on the survival of that species of endangered fauna or populations of that fauna".

The present route will remove rainforest and tall eucalypt forest on Saddleback Mountain. These habitats are utilised by Spot-tailed Quolls (pers. obs.).

On the northern and southern side of the Shoalhaven River, Yellow-bellied Gliders will be affected because feed trees will be removed during the laying of the pipe. Den trees may also be removed during this process. The population of Yellow-bellied Gliders detected at Wilton will not be affected by this proposed development because the route of the pipeline will not remove trees within that area.

The Koala has been found close to Bulee Gap and Sassafras but the proposed route will only have minimal impact on this species if the option is taken to place the alignment of the pipeline under the existing roadway.

On the northern side of the Shoalhaven River the proposed route will remove Black She-oaks. This will impact upon Glossy Black Cockatoos because some of these trees are utilised by these cockatoos as food.

The Striated Fieldwren and Olive Whistler were detected in the Tianjara Falls area of Morton National Park. If the pipeline takes the existing road easement as the route of the pipeline then these species will not be directly impacted upon by the removal of habitat.

The Heath Monitor was detected at Bulee Gap and has previously been found close to Tianjara Falls (AM record). It can be assumed that most of the area which the pipeline traverses in the Morton Plateau is potential Heath Monitor habitat. Unless the pipeline is placed under the existing road then it can be assumed that the development will impact on individual monitors directly and indirectly be the removal of nesting sites (termitaria). Although no Heath Monitors were detected in Sydney Water, based on habitat preference and distribution, it can be assumed that this area is inhabited by this species. If the existing AGL gas pipeline was upgraded so that no additional bushland was removed then there would be no effect on the survival of this species in this area.

The pipeline will result in soil disturbance, disturbance to surface rocks and removal of native grassland, creating bare ground. These actions will cause the temporary loss of habitat and hence fragmentation of populations of the Striped Legless Lizard.

Bulee Gap, Tianjara Falls and the area adjacent to the Shoalhaven River are areas crossed by the proposed route that support Broad-headed Snake habitat. The construction of the proposed pipeline will remove habitat in these areas and directly and negatively affect individuals living on the route. The pipeline is unlikely to be a barrier to movement between populations as this is a large, mobile species.

Only one Little Whip Snake was detected in this survey and the size of the population is unknown. The pipeline may disturb or remove surface rocks, rock outcrops and fallen timber. This may cause the decline of local populations.

Disturbance to wetland areas within the range of the Growling Grass Frogs may result in the direct removal of individuals of this species or in decline of local populations through habitat removal.

The Giant Burrowing Frog was detected at one site in Sydney Water, however it is known from Morton National Park and the Nowra area (Daly, personal observations). The proposed development may impact upon Burrowing Frogs in Sydney Water by directly removing habitat and/or frogs.

Recommendations

1. The following species of vertebrates listed on Schedule 12 are likely to be affected by the proposed route of the pipeline: Yellow-bellied Glider, Eastern Bristlebird, Striated Fieldwren, Glossy Black Cockatoo, Striped Legless Lizard, Heath Monitor, Giant Burrowing Frog and Red-crowned Toadlet. A Fauna Impact Statement will be required to ascertain if any of the above species will be "taken" by the clearing and associated earthworks of the pipeline.

2. That BHPP realign the proposed pipeline route east of Tianjara Falls so that it does not cross the area that is currently being assessed for wilderness.

3. BHPP should liaise with AGL so that the existing gas pipeline that traverses Sydney Water (Wilton section and the northern Illawarra) and the Illawarra escarpment is upgraded and both companies share the utility. If such an arrangement can be agreed then the impact on fauna in this section of the pipeline route would be minimised. If such an agreement could be reached then it is possible that the Giant Burrowing Frog and the Red-crowned Toadlet would not be impacted upon.

SEPP 44 Koala Habitat

The Koala has lost such a significant amount of its habitat in NSW that in 1995 a separate State Environmental Planning Policy (SEPP) was introduced to aid the conservation of the species. The aim of this policy is for Local Government to identify "Core Koala Habitat" and to encourage these areas to be included in environment protection zones (Department of Planning Circular No. B35).

Pivotal to this provision is the definition of "Core Koala Habitat". SEPP 44 defines this as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is females with young) and recent sightings, and historical records of a population. This is distinct from "Potential Koala Habitat" which describes areas of native vegetation where the tree species types listed in Schedule 2 (of SEPP 44) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

SEPP 44 lists the Local Governments within NSW in which the Policy is applicable. In the northern section of the proposed pipeline the following Local Governments are involved: Shellharbour, Shoalhaven and Wollongong.

The stated Local Governments are required to produce a "Plan of Management". This plan can be for a part of or the whole of the Local Government area. The guidelines for such a plan which covers the entire local Government area must be developed in consultation with the Director-General of the National Parks and Wildlife Service. A plan of management that has been prepared by a single person has no effect unless approved by the Director and the council.

The proposed pipeline route covers such a small linear strip of each Local Government area that it would be inappropriate to attempt to provide a plan of management for each of the above areas. What is necessary is an examination of the areas that are considered core and potential Koala habitat, and to address the current proposed development in respect to its impact on these areas. Such an examination will be beneficial for the above Local Governments in the process of formulating their Plan of Management because it is intended to provide standard parameters that may be adopted in the Plan.

One site (Sassafras High Forest, KP 589-593) in Spread III was identified as a site of biological significance for koalas. The route has been altered to preserve mature trees in this area. The resultant impact on koalas would be minimal.

Corridor Maintenance

After pipeline construction it is important to regenerate vegetation cover as soon as possible to avoid adverse effects such as large scale erosion and weed invasion. All existing pest quarantine procedures should be adhered to. Options for corridor rehabilitation and ongoing maintenance largely depend on the surrounding environment and management recommendations for the range of natural habitats traversed by the corridor are presented in Table 8. A specific management plan should be prepared where sites of biological significance are to be disturbed.

Table 8. Post construction and operational easement management recommendations for different habitat types.

Habitat Type	Post Construction	Operational Management
Existing Easement (through native vegetation)	Ensure rapid recovery of locally indigenous ground cover (even in areas where this is currently absent). Where possible, taper the easement edges using local shrubs and small trees.	Negotiate a management agreement with other easement users. Minimise use of herbicides. Monitor for weed outbreaks regularly and attempt to control weeds before they set seed. Slash vegetation as required. Minimise vehicle traffic. Perform maintenance activities during dry periods.
New Easement (Forest, woodland or shrubland)	Re-establish indigenous vegetation cleared greater than three metres away from above the actual pipeline. Ensure rapid recovery of locally indigenous ground cover over the remaining 6 m width.	Monitor and control weeds. Minimise use of herbicides. Minimise vehicle traffic. Perform maintenance activities during dry periods.
Native Grassland	Re-establish the native vegetation community as soon as possible over the entire area disturbed. Do not leave a maintenance track. Control weed invasions quickly and minimise subsequent soil disturbance.	Monitor and control weeds. Minimise vehicle traffic. No slashing or mowing required.
Riparian	Re-establish the native vegetation community as soon as possible, preferably over the entire area disturbed. Where access is required across a perennial stream establish an appropriate, stable crossing for a single vehicle. Replant tree ferns or other species harvested from the site.	Monitor and control weeds. Minimise disturbance to regenerated vegetation. No slashing or mowing required.
Wetland	Re-establish the native vegetation community as soon as possible over the entire area disturbed. Utilise existing access tracks rather than creating new tracks.	Monitor and control weeds. Minimise disturbance to regenerated vegetation. No slashing or mowing required.

POTENTIAL SITE-SPECIFIC IMPACTS

Potential Impacts on Sites of Biological Significance

The proposed pipeline has the potential to impact on areas identified as sites of biological significance in several different ways. Options to minimise the potential short and long term effects of these impacts are provided.

Perry River (KP 33-34)

The impact of pipeline construction on the biological values of this nationally significant remnant of Coastal Grassy Forest would be substantial. The total area supporting this endangered community would be reduced and this isolate would be fragmented, subject to weed invasion and significant species would be lost. Old-growth features could also be lost as clearing is likely to remove veteran trees and shrubs, in particular the ancient banksias which grow here. From a conservation perspective the most appropriate form of amelioration is to divert the proposed route to the north, utilising the existing powerline easement and farmland. In utilising the existing easement construction should ensure the easement is not expanded.

Bridle Creek (KP 95-98.5) and Stony Creek (KP 109-111.5)

The Gallery Rainforest present within Bridle Creek and riparian vegetation associated with the Stony Creek Special Protection Zone are vulnerable to disturbance associated with construction. As with most riparian communities this type of disturbance could result in substantial weed invasion, soil erosion and the loss of old-growth features. At Stony Creek there is also the potential for loss of habitat or possibly individuals of the endangered species Slender Mud Grass *Pseudoraphis paradoxa*. Both these creek crossings require careful location of the exact crossing point and minimum impact construction techniques.

Colquhoun State Forest (KP 95.5-115)

The Colquhoun State Forest is one of the few areas of native vegetation where substantial lengths of the proposed pipeline route do not fully utilise existing easements or roads. Two potentially lower impact options are available for the proposed route. Firstly the pipeline could follow the existing railway easement, which it already does for approximately four kilometres west of Nowa Nowa. This option, however, would still carry the disadvantages of impacts on the Stony Creek Special Protection Zone and probably impacts related to easement widening. The second option is to utilise the existing, maintained powerline easement which follows the Bruthen Buchan Road and the Nowa Nowa Road (this easement was not inspected during this assessment).

Lake Tyers (KP 119.9-122) to Newmerella (KP 142-143.5)

The following comments apply to the five sites of significance identified between Nowa Nowa and Newmerella including Lake Tyers State Park, the Tostaree Dieback Monitoring Site, Hartland River, Simpsons Creek and Newmerella sites. The area supporting significant species and communities in these sites would be reduced by pipeline construction through native vegetation and it is possible that these communities would not recover their original floristic composition. Given the state significance of the biological values present, the presence of special management zones, special protection zones, a conservation reserve and an existing easement along the Princes Highway, it is recommended that the proposed route be aligned with the existing easement as closely as possible. This is already proposed for the Hartland River, Simpsons Creek and Newmerella sites and given construction would remain within the existing easement, impacts on these sites will be minimal. While weed species were observed along the easement none of the high management priority, invasive environmental weeds identified by DCNR (1995) were observed. The riparian vegetation along the Princes Highway between Nowa Nowa and Newmerella is already significantly disturbed and supports numerous weed species. Riparian crossings, however, should still be kept as narrow as possible to avoid exacerbating this situation. The easement should be narrowed as far as possible at the crossing of Simpsons Creek as this area is considered to be a significant wildlife corridor.

Mount Raymond Regional Park (KP 161.3-164) to Lind National Park (KP 206.8-212.4)

The following comments apply to the five sites of significance identified between Orbost and Tonghi Creek, including the Mount Raymond Regional Park, Yeerung River (west branch), Bellbird Creek, Bemm River and Lind National Park sites. All of the proposed pipeline route in this section follows an existing, approximately 20 m wide, cleared and maintained powerline easement. No significant values were detected within the boundaries of this existing easement, and pipeline construction impacts would be low.

Streams crossing the easement in these areas were generally deeply incised into the landscape and had steep banks. Riparian vegetation was often largely intact except for the removal of tall trees and shrubs and an occasional narrow four-wheel drive track. Few weed species were present, generally in low abundance (except adjacent to agricultural land). Where construction proceeds from agricultural land into relatively weed free areas of easement surrounded by forest, vehicles should be washed down within the first 20 metres and again after a further 200 m to minimise weed spread.

All stream crossings should also be as narrow as practicable and where Soft Tree-ferns *Dicksonia antarctica* are present, they should be harvested, stockpiled and replanted after construction.

Reed Bed Creek (KP 220-226)

The proposed pipeline route bisects this site of biological significance and would have a significant impact. Substantial areas of Riparian Scrub Complex and Wet Heathland would be disturbed and populations of significant species would probably be lost. Pipeline construction would provide a significant opportunity for weed invasion, fragment fauna habitat, result in the loss of old-growth and generally compromise its value as a special protection zone. Potential alternative routes include aligning the route along Reed Bed Road and/or the Princes Highway. The least impact on flora and fauna would be for the pipeline to avoid the forest completely and utilise the existing powerline easement south of the Princess Highway or the Princess Highway itself and cleared farmland adjacent to the Cann River.

Combienbar Road (KP 230.5-231.1)

This is a special management zone for Powerful Owls. The loss of mature trees must be minimised.

Neilson Creek (KP 235.1)

Individuals of the rare species Giant Maidenhair *Adiantum formosum* are likely to be lost during pipeline construction over this creek. As the surrounding area is farmland the potential for increased weed invasion is also high. The proportion of the population of this species which may be effected is unknown and should be evaluated during the second phase of this assessment. The area disturbed in crossing Neilson Creek should be as narrow as practicable and, if possible, an area downstream of the fern population should be used for the crossing.

Chandler's Creek (KP 249-256)

The southern section of this site (KP 249-251) follows an existing telecommunications easement which is approximately 20 m wide. The easement appeared to be maintained by soil scalping using a bulldozer, but despite this intense soil disturbance the easement did not appear to support any significant weed species. The southern end of the easement was an exception to this as many introduced pasture species had colonised the easement, presumably invading from adjacent farmland. Vegetation along the easement was generally sparse and water erosion obvious. Disturbance to riparian vegetation appeared to be quite localised. Construction in this section should not widen the easement as it is surrounded by old-growth forest.

North of about KP 251 the proposed pipeline route leaves the existing easement to cross about 300 m of Heathy Dry Forest before emerging into cleared land and eventually being aligned with the Buldah Road. Fragmentation of the Heathy Dry Forest could be avoided by utilising the existing easement until it emerges into cleared land and then move west to the Buldah Road.

Once adjacent the Buldah Road, the pipeline passes through sites of biological significance described by Cherry *et al.* (1986). The alignment follows the road and would require a small widening of the road. This could result in the loss of old-growth features and impact on populations of significant plants. Construction in this area should disturb the least area possible and be undertaken with particular care. Areas where rare plants have been identified should be avoided.

An option to alter the proposed pipeline route from KP 251, to follow the telecommunication easement north for approximately 6 km, to near the intersection of the Cann Valley Highway and Fiddlers Green Track, would avoid any impact to this site of significance. This option would require a new ridge line easement of about 2 km to be constructed to rejoin Buldah Gap Road at KP 261. The resultant forest fragmentation and barrier effects could be reduced by minimising the width of the area disturbed by construction. The impact on any significant species requires further evaluation. Some old-growth features would probably be lost.

Kelly Creek (KP 260.8-262)

Particular care should be taken in constructing across this creek to minimise potential impacts on significant frogs.

Central Buldah (KP 264.5-265.5)

The pipeline roughly follows the alignment of Buldah Gap Road through this site. The proposed width of the construction zone would widen the existing road. Populations of two regionally significant plant species would probably be reduced. While the proposed route avoids mapped old-growth forest, widening the existing road would result in the loss of some unmapped old-growth trees. The alignment should follow the existing road as closely as possible.

Buldah Old-growth (KP 266.5-267.5)

This section of the pipeline route is well east of the alignment of the Buldah Gap Road and generally follows a ridge line. Pipeline construction would therefore result in the presence of a new easement and the barrier and habitat fragmentation effects associated with such a clearing. While much of the northern half of this section has been subject to timber harvesting, the southern half appears to support patches old-growth Damp Forest although these have not been mapped by Woodgate *et al.* (1994). Construction could result in the loss of a substantial number of old-growth trees. While the area is in part described as a site of biological significance by Cherry *et al.* (1986), CNR (1995) has reduced the protection for the rare species Pinkwood *Beyeria viscosa* to a narrow special protection zone and made the old-growth forest available for timber harvesting. If harvesting is to occur in the future, some old-growth trees will be retained as habitat trees, so pipeline construction should minimise the loss of such trees.

Mount Canterbury (KP 266.5-267.5)

The proposed pipeline route passes along the western edge of this site which, since its identification by Cherry *et al.* (1986) has been largely isolated from intact native vegetation by timber harvesting. The vegetation either side of Buldah Gap Road has been logged, degrading the biological significance of the site. Construction of the pipeline in this area should avoid remnant mature trees, but would otherwise have low impacts.

Rock Flat Travelling Stock Reserve and Adjoining Grasslands (KP 379-384.2)

Disturbance of Rock Flat travelling stock reserve must be avoided as development would dissect good quality tussock grassland. It is recommended that the significant grasslands surrounding the site also be avoided. Realignment of pipeline to the western side of the highway, or to the east and north of the Travelling Stock Route, may be required. An alternative (and preferred) option is to follow the road easement between the eastern side of the highway and fenceline from KP 379 to 384.2.

Cooma Grasslands (KP 390-392)

Development of this site would fragment the large areas of high quality grassland and seriously damage reptile habitat. This extensive grassland should be avoided as it contains reptile fauna and grassland of national significance. Original recommendations made to follow the fenceline have been reconsidered due to *Delma impar* being found to inhabit this area. To maintain high biological values of the site, a preferred pipeline realignment option would be to deviate slightly east of north from KP 389.5, maintaining this bearing until clear of the most significant areas.

North Cooma Tussock Grasslands (KP 397.7-401.5)

This site should be avoided as the site supports an extensive area of good quality tussock grassland - a community which has become severely depleted and modified throughout the Monaro Tablelands. Proposed amelioration would be to realign pipeline to utilise roadside easement beside the Monaro Highway from KP 398 to KP 402.

Bredbo Grasslands (KP 413.7-414.1)

The pipeline route currently avoids the site.

South Michelago Grassland (KP 449.8-450.6)

Development of this site would destroy a significant part of this already much-reduced grassland. This area may be avoided by a minor realignment to the east of the site.

East Michelago Grassland (KP 455-455.9)

Current pipeline route has minimal impact on this site.

Themeda *Grassland/Grassy Woodland (KP 464-467)*

Development of this site will have direct impact upon populations of the endangered plant *Thesium australe* and will also damage valuable reptile habitat. The grassland areas should be avoided completely. Realignment of pipeline to follow the road as closely as possible is recommended.

Dry Woodland (KP 507.1-508.1)

Pipeline construction will destroy high quality vegetation and valuable habitat. Route 8.1 offers a slightly improved option by utilising an area affected by logging. However, this area may be suitable habitat for the Little Whip Snake found at this site. Realignment of the pipeline to 200 metres to the north would avoid the highest quality vegetation. Rocky outcrops must be avoided as these provide potential habitat for the snake.

Massey Creek Tributaries, Wetland and Associated Forest (KP 511-513.2)

Development may alter the hydrology and water quality of this site, as well as fragment good quality riparian forests and associated vegetation. It is recommended that route realignment suggestions made during Phase 1 survey be reconsidered with one exception. During Phase 2, the landholder indicated a further possibility which was suited to the original recommendations made. If the pipeline were to follow the western side of Massey creek and tributaries, then to deviate slightly north from KP 512 to utilise an existing fenceline easement to the west of the entire forested area, there would be minimal tree removal and a much-reduced impact on site hydrology.

Water Board Proteaceous Forest (KP 543-545.3)

Pipeline construction within this community could have a significant impact on stands of *Isopogon prostrata* and by fragmenting portions of the vegetation. Avoidance or careful construction on a narrowed easement utilising existing minor tracks and easements is recommended. A Telstra easement located to the east of the area may be considered.

Waterboard Proteaceous Forest with Wet Heaths (579.6-589)

Development of this site will fragment high-quality vegetation. Wet heaths on this site are often very localised and some may be severely damaged by pipeline construction. It is recommended that the pipeline be realigned to avoid this site completely, utilising cleared areas to the south.

Bulee Gap (KP 577.5-579.6)

It is proposed to lay the pipeline along the edge of the road in this highly sensitive area. This is strongly supported. Road widening should be minimised and work crews should not enter adjacent native vegetation.

Morton National Park West (KP 579.6-589)

Construction of the pipeline in the road verge would avoid all significant species.

Sassafras High Forests (KP 589-593)

The mature trees and koala feed trees should be conserved in this area by keeping the pipeline away from them, preferably in the pasture areas.

Sassafras West (KP 593-594)

Construction of the pipeline in the road verge would avoid all significant species. The possible exception to this is at Tianjara Falls; consideration should be given to placing the pipe actually under the road for this short distance.

Yerriyong and Colymea Forests (KP 594-624, 625.5-631)

Construction of the pipeline in the road verge would avoid all significant species.

Yerriyong (KP 624-625.5)

This is a highly sensitive area and construction in the road verge would remove some nationally significant plants. Consideration should be given to placing the pipe actually under the road for this short distance.

Shoalhaven River Forests (KP 635-639.5)

Some vegetation removal will be inevitable in this area. Given its regional values for (mainly) fauna, the easement should be kept as narrow as possible, with minimal removal of mature trees, and revegetation of the ground layer.

Saddleback Mountain (KP 666-670)

The values of this area for fauna, for regionally significant vegetation and as a wildlife corridor will be reduced by the pipeline easement. This area should either be avoided by a route to the east or constructed with a narrowed easement which maintains cross-connected vegetation at several points.

Mount Kembla (KP 702-704)

Impacts on this area would be reduced by careful construction in a narrowed easement which maintains cross-connected vegetation at several points.

Illawarra Escarpment (KP 705.3-708)

Impacts on this area would be reduced by careful construction in a narrowed easement which maintains cross-connected vegetation at several points.

Sydney Water Catchments (KP 708-726)

This is the longest area of high sensitivity along the route. The existing track and easements have caused considerable disturbance; pipeline construction that remained within these areas would have minimal impacts but any widening of these disturbed areas has the potential to impact on a range of significant species.

Potential Impacts on Other Areas

The proposed pipeline has the potential to have localised impacts on flora and fauna outside areas identified as sites of biological significance in several different ways. Generalised potential impacts and their ecological consequences are described below. Options to minimise the potential short and long term effects of these impacts are also provided.

KP	Potential Impact	Amelioration Measures
0.5-1.5	Potential loss of locally significant vegetation.	Keep construction in adjacent cleared farmland.
2.5	Corridor fragmentation. Potential loss of locally significant roadside woodland corridor dominated by native species.	Minimise construction width at road crossing and select already disturbed location. Do not remove any trees.
47-48	Proposed pipeline route parallels roadside vegetation. Potential loss of woodland corridor and regionally significant species (Forest Red Gum *Eucalyptus tereticornis*).	Construction to remain in adjoining pasture and the road to be crossed at existing disturbance adjacent powerlines.
50-60	Corridor fragmentation of roadside woodland corridors at the Princes Highway, Andersons Lane and a fire access track further west. Potential loss of regionally significant species (Forest Red Gum *Eucalyptus tereticornis*).	Choose crossing site carefully to avoid disturbing mature trees and minimise the width of construction activities.
73.5-76	Fragmentation of forest remnants on private land in a largely cleared landscape.	Avoidable by re-routing through cleared land to the south.
77-78	Fragmentation of Lowland Forest remnant. Current route through narrowest section is the best possible.	Minimise the width of construction activities.
87.5-88.5	Corridor fragmentation. Corridors along private roads and largely dominated by native species.	Minimise the width of construction activities at corridor crossings.
98.5-109	Construction of a new easement through state forest. This would result in the fragmentation of forest and increased barrier effects. There would also be an impact on relatively weed free riparian vegetation and a loss of regionally significant species (Apple-topped Box *Eucalyptus angophoroides* and Brittle Gum *Eucalyptus mannifera*), old-growth features and individuals of Red Ironbark.	Possibilities for amelioration include moving the pipeline route to the existing railway or road easements.

111.5-116	Widening of an existing easement. The proposed route follows old railway easement to Nowa Nowa which has not yet been surveyed. The edges are likely to support at least some high quality fauna habitat. Mature, old growth trees will remain along existing road and railway easement	Avoid Easement widening or damage to mature trees.
131.7-132.2	Fragmentation of forest habitat.	Utilise existing easement and cleared agricultural land.
146-146.5	Fragmentation of remnant forest. Potential loss of locally significant vegetation and of regionally significant species (Apple-topped Box *Eucalyptus angophoroides* and Spurred Helmet-orchid *Corybas acontiflorus*), old-growth features and individuals of Red Ironbark. This remnant forms part of a link between large areas of state forest to the south and native forest patches further north.	Avoidable by either joining the existing Princes Highway/SEC easement closer to Newmerella (ie north) or by re-routing further south and staying in cleared farmland.
219-220	Potential loss of remaining habitat trees in clear-felled areas and individuals of Red Ironbark.	Avoid any damage to these individual trees.
223-228.8	Widening of existing road alignments and fragmentation of forest habitat. Roadside vegetation in varying condition. Some areas recently burnt, others selectively logged. Potential loss of old-growth features including mature Coast Grey Box.	Amelioration options include that described under the potential impacts on the Reed Bed Creek site of significance or minimising the construction corridor and strictly following the existing road.
228.8-231.2	Fragmentation of forest habitat and loss of old-growth features. Potential impact on significant species (Masked Owl). Sections of this area recently burnt and otherwise available for clearfelling.	The impact could be reduced by utilising all existing roads and clearings (on and adjacent private land), however, if the route further south is diverted into cleared farmland to the east, this area would also be avoided.
242.4-242.9	Corridor Fragmentation and disturbance of a small patch of Warm Temperate Rainforest.	Avoid by realigning to beside the Cann Highway.
256.5-257.6	Widening of existing narrow telecommunications easement, erosion and fragmentation of forest habitat.	Avoid by realigning to existing road.
257.6-261.3	Widening of existing narrow telecommunications easement, erosion and fragmentation of forest habitat.	Easement widening, if required, should occur on eastern side only to minimise disturbance of catchment head-waters.
261.3-273	Forest fragmentation, increased barrier effects, easement widening and loss of mature trees.	Minimise by following existing road alignment with any additional clearing to utilise existing clearfelled areas
KP 285-290 Jacksons Bog	May affect hydrology of these sensitive wetland areas. Although grazed, water quality is excellent and native flora and fauna species likely to be significant. Pipeline (5.1) will destroy stand of *Discaria pubescens* at KP 286.5-286.7. Square-tailed Kite. *Litoria raniformis* recorded in pasture and bog.	Route revision 5.2 and 8.1 avoids Jacksons Bog entirely. However, alternative route requires assessment before its suitability can be confirmed.
KP 289	May cause siltation and affect hydrology of Jacksons Bog.	Minimise disturbance. Avoid major tributaries where possible.
KP 292	"Crown Reserve"- many old trees considered valuable bird habitat, understorey grazed.	A slight realignment to the north would avoid this entirely. Tree removal should be minimised.
KP 297	Crossing tributary to good quality wetland. May affect hydrology and cause siltation.	Avoid crossing creek line too far south on the Hoods property ie. divert to south-east at KP 297.8.

KP 299-300.4	Moderate quality native vegetation will be disturbed. Weed invasion likely. Good quality native vegetation along roadside will be dissected.	Minimise easement width, particularly across roadside easement. Weed control methods should be employed following development.
KP 304.4	Crossing Saucy Ck will affect water quality and may sever a minor habitat corridor along the creek.	Chosen crossing appears to be the most suitable option as supports less indigenous vegetation and is less steep and stony. Minimise disturbance when making actual river crossing.
KP 308.8-309.2	Very stony, treed, grazed. Likely reptile habitat will be affected by development.	Avoid stoniest areas and trees and shrubs where possible and/or move pipeline slightly east or west where less will be affected.
KP 310-310.5 Bombala River crossing (south)	River banks very steep and rocky in parts. Rocky areas appear well vegetated. Pipeline development will affect habitat corridor along river.	Pipeline development should minimise disturbance to water quality. Steep, rocky sites should be avoided where possible. Current crossing appears reasonably well placed as indigenous vegetation is reduced and willows infest the banks close to the river. Care must be taken to avoid excessive limb-loss when removing willows (see weeds recommendations).
KP 314 Bombala River crossing (central)	Potential disturbance of Eucalypt regrowth and/or Burgan scrub on the north banks of Bombala River.	Current route seems most suitable as major stands of native vegetation appear to be avoided.
KP 313.8-314.3	Patchy *Themeda* grassland will be disturbed.	No amelioration options evident at this stage.
KP 314-314.3	On advice from local land holder, this area usually infested with serrated tussock.	Machinery cleansing must be undertaken before leaving the site to avoid spread of this noxious weed.
Roadsides between KP 314.5-315.4	Development will fragment high-quality remnant vegetation along roadsides.	Keep pipeline development within pasture to east. Deviate further east into pasture from KP 314.3 to avoid two (KP 314.6 & 314.8) of three potential roadside crossings (inc. KP 315.5).
KP 317.1-320.5	Very grazed native pasture. Highest quality between KP 318.5-319.2. Pipeline development will increase possibility of weed invasion.	Minimise disturbance by remaining alongside existing transmission easement. Precautions must be taken to avoid introduction of weeds, particularly thistle and serrated tussock. Site should be re-sown with local native grasses.
KP 323.1-323.4 and 324-324.2	Removal of mature trees. Soil disturbance may result in erosion on steep bank to Bombala River. Two rare plants recorded from this general area.	Continue to follow existing transmission easement. Minimise removal of mature trees. Pre- and post-development erosion controls essential.
KP 336.6-337.7	Very grazed, possibly valuable, tussock grassland will be affected by soil disturbance.	Possible realignment to move closer to the western boundary near the highway.
KP 340.8-342	Gross widening of existing easement (or creation of a new easement) will further fragment remnant Manna Gum forest.	Tree removal and soil disturbance should be kept to a minimum. Rapid regeneration of the site should be encouraged. Route realignment would be difficult without major redirection ie. from KP 341, re-route to the north-east into pasture. Reconnection with existing route would then be difficult.
KP 343.5-344.3	Further fragmentation of grassy woodland.	Keep easement requirement to a minimum. Possible realignment option to east side of highway.
KP 348-349.5	Disturbance of tussock grassland (grazed). Weed invasion likely.	Minimise disturbance.
KP 352.3-353.1 and through to 355	Reasonably good quality *Poa* tussock and/or *Themeda* grassland will be disturbed. Railway easement at KP 351.7-352.3 is of good floristic quality.	Difficult to avoid without major realignment. Route 8.1 utilises railway easement. However, to avoid fragmentation of grassland, it is recommended to keep as close to roadside/property boundary as possible. Minimise disturbance. Weed control necessary.
KP 353.7 Maclaughlin River	Damage to river banks.	Avoid indigenous trees where possible. Replanting local tree species to stabilise banks. Current route appears most suitable.

KP 360.1 (and 359.5) roadside(s)	Roadside habitat corridor(s) in good (and fair) condition will be severed.	Minimise width of easement. Re-establish local grassland flora following development.
KP 366.1-367.1	Lightly-grazed *Acacia*/Yellow Box/Tree Violet open woodland and grazed (yet seemingly intact) tussock grassland may be affected.	Remain within pasture to west of railway. Avoid removal of mature trees. Minimise disturbance of remnant tussock grassland.
KP 372.8-375	Grazed native tussock grassland will be dissected. Disturbance of stony rises may result loss of refugia for native species	Avoid or minimise disturbance to stony rises.
KP 379.6-380.1	Disturbance of good condition (but grazed) tussock grassland. Loss of local flora species. Weed invasion likely.	Realign pipeline to follow roadside more closely. Minimise disturbance by keeping easement width to a minimum. Weed control necessary, including cleaning of machinery before entering property.
KP 382-384.2	Good quality tussock grassland on hillsides and ridges. Pipeline development will dissect vegetation and increase likelihood of weed invasion. African Love Grass prolific along flats closer to highway. *Dodonea procumbens* found.	Realignment of route to follow roadside as closely as possible is recommended. Spread of African Love Grass must be avoided by regular wash-down of machinery.
KP 390-392	As for KP 382-383.7, without *D. procumbens*. Site harbours nationally significant reptile species.	Site should be completely avoided by realignment of route to the east of the property. Machinery must be cleaned before entering the property to avoid spread of African Love Grass.
KP 394.5-398 1.1	Grazed native grasslands.	No recommendations available at this stage. Often infested with African Love Grass. Precautions against spread of the noxious weed essential.
KP 398-401.5	High-quality tussock grassland will be dissected. Weed invasion possible.	Move pipeline to utilise the roadside easement between highway and fenceline. Clean vehicles before entering property to minimise weed invasion.
KP 430.6-433	Intermittent patches of native grassland, variously grazed/weed-invaded.	No recommendations at this stage except pipeline should stay as close to roadside or within damaged areas of existing easement.
KP 432.5-435	Grazed grassland and grassy woodland. Development will widen easement through remnants, possibly destroying some White Cypress. Orchid species present.	Keep pipeline within damaged areas of existing easement. In parts, keep easement width and tree removal to a minimum.
KP 437.8-439.1	Pipeline will fragment *Aristida/Poa* grasslands. Soil erosion may occur. Post-development weed invasion likely.	No recommendations at this stage. Soil stabilisation necessary. Replant/re-sow with local native species. Weed controls necessary.
KP 439.2-441	Patchy *Themeda* grasslands. As for KP 437.8-439.1.	As for KP 437.8-439.1.
KP 444.2-445.1	As for KP 437.8-439.1.	As for KP 437.8-439.1.
KP 457.4-457.4	*Aristida/Stipa/Danthonia* grassland will be fragmented by pipeline construction. Post-construction weed invasion likely. Erosion occurs readily on these soils.	Realign pipeline nearer to road to minimise fragmentation. Avoid spread of noxious weeds and post-construction weed control recommended. Soil stabilisation required.
KP 457.5-460.5	Scattered remnant trees in pasture.	Damage to/loss of trees should be avoided where possible.
KP 461.2-461.8	Widening of existing transmission line easement further fragments forest habitat. This area is the western edge of an extensive tract of forest.	Revision 5.2 has moved pipeline closer to road edge, which avoids fragmentation. However, many mature trees will need to be removed. Realignment to the western side of Burra Road from KP 461.2 would alleviate the need for forest removal.
KP 473.8-474.4	Development utilises damaged vegetation. However, proposed 8.1 route will fragment high-quality forest vegetation.	Route 5.1 is recommended for this portion or the route.

KP 474.5-475	Widening of existing transmission line easement further fragments forest habitat. Option 8.1 utilises roadside verge.	Minimise width of easement. Realign pipeline as close to road as possible to minimise fragmentation. Route 5.1 is a better option biologically, as drainage line vegetation will be affected along route 8.1.
KP 476-476.4	Fragments good quality forest vegetation.	Follow roadside verge to KP 475.7 then realign with original route. Route 8.1 also dissects good native vegetation.
KP 479-479.6	Scattered trees and tree clumps (the latter especially on ridges, where very rocky) - not assessed on foot, quality uncertain.	Trees and rocky areas should be avoided where possible.
KP 479.6-480	Urialla Creek supports an intact remnant of shrubby woodland on a rocky west-facing slope.	Avoid treed and rocky areas.
KP 481-481.3	Queanbeyan River supports intact riparian scrub and forest, with little grazing. Important habitat link between large forested areas to the north and south.	Realignment to follow open ridge line on west side in vicinity of proposed route would minimise disturbance of corridor vegetation. Attempts should also be made to avoid rocky outcrops which may provide reptile habitat. Minimise easement width.
KP 481.4-482	Scattered trees in pasture.	Avoid damage to/loss of trees.
KP 485.5-487	Scattered scrub on stony/rocky soils. Area grazed, many trees senescing. Full assessment of habitat quality not made due to constant supervision by landholder	Avoid rocky sites. Realign to follow pasture extending north from KP 485.6 along the west side of Woolcara Lane. Route 8.1 will damage regenerating scrub between (5.1) KP 86-487.
KP 491.7-493	Grazed tall wet tussock soaks. Old trees at KP 492.2 used as nest sites by Sulphur-crested Cockatoos.	Avoid trees. No further ameliorations at this stage.
KP 496.5-497.2	Molonglo River flood plains and associated wetlands. Water quality very good despite stock being present. Very grazed between *Poa* tussocks.	Cannot avoid along current route. Reduce impact by minimising easement width. Turnaround points should be avoided in this area.
KP 505.7-506.5	Forests and woodland along Turallo Range will be fragmented. Western side is extensively grazed under. Eastern side slightly grazed. Access denied for most of this area.	Difficult to avoid. Follow tracks where possible. Minimise easement width to reduce fragmentation effect.
KP 507.1-507.7	Cuts through, and fragments an extensive tract of woodland. Vegetation in good condition with little selective logging. Logging more extensive to the west (506.5-507.1).	Difficult to avoid. Follow tracks where possible. Minimise easement width. Turnaround points should be kept within area between KP 506.5-507.1 or beyond 508.1
KP 507.7-508.1	Dissects high-quality woodland with ungrazed grassy and shrubby groundcover.	Realign to 200m north of KP 507.7 to avoid the high-quality vegetation.
KP 508.7	Tributary to creek and associated riparian vegetation will be affected by development.	Revision 5.2 avoids this site and is recommended.
KP 509.8-511.6	Cuts through Burgan scrub, *Banksia* Riparian woodland and Open Forest edges.	Reroute to the north at 509.3 into mostly-cleared area, cross the creek line then approximately north-east to align with a recommendation made in the Significant Sites section. This realignment would avoid most significant habitat likely to be affected.
KP 510.8-513.3	Massey Creek tributaries and associated wetlands. Considered significant. Refer to Significant Sites section.	Realignment recommended as per Significant Sites section.
KP 510.8-515	Dry Shrubby Forest will be dissected by pipeline development. Sensitive riparian vegetation may be affected	Realignment as per recommended in Significant Sites section.

KP 522.3-525	Forest will be fragmented. Vegetation in very good to excellent condition. Some selective logging in the north-east corner.	Recommendation made in Significant Sites section. Route Revision 7.0 shows realignment to southern portion of property. Although likely to be a better option, assessment of new route is essential.
KP 528.5-529	Forest remnant (Doughboy Hills), mostly grazed under.	Proposed route appears to follow more open area - may require further ground inspection.
KP 530-530.5	Scattered trees and pasture.	Avoid mature trees where possible.
KP 530.6-532.3	Patchy scrub and woodland, often rocky. Some excellent burgan scrubs with many orchid species will be dissected. Riparian vegetation in fair to good condition.	Rocky areas, scrub and drainage lines should be avoided where possible. Existing tracks should be utilised. Site should be stabilised and allowed regenerate naturally.
KP 533.1-534	Dry woodland will be fragmented. Vegetation in fair to good condition, with many geophytic species (orchids, lilies, sundews) evident.	A very old and overgrown track exists (east-west) over the saddle of the two ridges. This should be utilised.
KP 549-552	Very good quality forest will be fragmented by development.	Realignment slightly to the south will pass the route through some more cleared country. Otherwise, remnant size and easement width should be minimised. Erosion controls essential.
KP 553.2-554.8	Fragmentation of good quality forest.	As for KP 549-552. Complete avoidance is recommended.
KP 557-557.9	Shoalhaven River area. Very rocky. Vegetation in fair condition, with little ground cover. Evidence of fire (2-3 years ago?). Riparian vegetation in very good condition.	Assess for possible realignment to cleared area 1.5 km south of present route [Revision 5.2 shows this option - this is supported].
KP 557.9-558.8	Will fragment riparian forest. Some cleared areas (nearer 555.6) evident. Access permission not granted.	No ameliorations at this stage (except as recommended for KP 557-557.9).
KP 558.8-560.6	May affect forest patches within pasture.	Avoid mature trees and intact stands where possible. Where possible, utilise cleared areas following slight gully to the north-west.
KP 560.6-561.3	Forest remnants - difficult to assess. Some grazed, others invaded by pines.	No ameliorations at this stage.
KP 562.5-565.5	Development will fragment pine plantation interspersed with regrowth forest patches occurring (mostly) along drainage lines. Regrowth is good refugia for birds. Flora values difficult to assess.	Care should be taken when crossing any riparian strips / drainage lines. Easement width must be minimised to reduce fragmenting of habitat corridors.
KP 566.1-566.8	Pipeline fragments good quality dry heathy woodland.	Route 8.1 utilises an existing easement. This option is recommended, with care taken to avoid further damage to *Isopogon prostrata* found along easement edges.
KP 566.8-568	Fragmentation of shrubby woodland patch. Good quality vegetation and habitat.	Realignment as per Revision 5.2 would avoid this.
KP 568.5-577	Pasture with scattered trees.(Regent Honeyeater record from vicinity of KP 573).	Damage to / loss of trees should be avoided.
KP 573.4	Fragmentation of creek line vegetation.	Route should pass through least treed part of creek, e.g. 0.7 km to the south-east of present route.
574.2-574.9	Development is alongside damaged open forest. Rare plant *Eucalyptus triflora* recorded for this site.	Avoid tree removal.
KP 577	Riparian forest may be affected.	Keep development to existing roadside easement. Avoid a large Eucalypt at KP 576.9.

STREAM ECOLOGY

Sensitivity

There are a number of key areas of sensitivity in relation to effects on stream ecology of pipeline construction and operation.

Sensitivity of High Value Streams

There is a higher chance of negative impacts on streams with higher values as such streams are uncommon and their high values generally reflect a lack of existing degradation.

Sensitivity to Pipeline Construction

The construction phase is the period in which any impacts on streams are most likely. The potential for impacts on streams during construction relates to a range of factors, including erosion hazard, presence of acid sulphate soils, high intensity rainfall events and construction techniques. A series of indices were calculated to assess the potential for impacts associated with pipeline construction. Separate indices were calculated for both the sensitivity of the environment surrounding the stream (approach hazards) and the sensitivity of the stream itself (within-stream hazards). The results of these analyses are provided in Appendix 3.

Sensitivity to Pipeline Operation

The most sensitive period of pipeline operation will be in the initial stages when revegetation is not yet fully established and when extra short term erosion mitigation measures may be necessary. In the medium to long term, key factors are the continuing effectiveness of erosion mitigation measures and the effectiveness of systems to contain and handle potentially hazardous materials associated with pipeline maintenance.

Sensitivity of Estuaries

Estuaries are sensitive to a similar range of factors as streams, but their relative importance is different. Bank destabilisation is generally less important while disturbance to the sediments on the floor of the estuary and the associated benthic communities is more important. The crossing of estuaries may require dredging which, as well as disturbing sediments, may raise issues of dredge spoil disposal.

Potential Impacts

There is only a very limited amount of information available from overseas on the potential environmental impacts of pipeline construction and operation activities on streams and no such information is available for Australia. There is however considerable relevant information relating to the impacts of vegetation clearance and the construction of linear developments such as roads. The key potential impacts are discussed below.

Sediment Input into Streams

Sediment input into streams is the single most important potential impact on streams. In Victoria, increased sediment input into streams due to human activities is listed in the FFG Act 1988 (Schedule 3) as a potentially threatening process.

Sediments are usually delivered to streams by rainwater runoff, stream bank collapse or disposal of turbid waters from trenches. Rainwater runoff is by far the most important factor and usually results from high intensity rainfall events. These events are likely to be most intense within Spread III and least intense in Spread I. Bank stability is primarily dependent on the retention of riparian vegetation. Erosion following vegetation removal and soil exposure is recognised to be the major cause of elevated levels of suspended solids. Riparian vegetation is also a critical component of stream ecosystems, providing nutrients and habitat, and stabilising water temperatures.

Streams in the Victorian section of the route carry greater sediment loads in flow spates than do streams in NSW. Therefore, stream biota in NSW streams would appear to be more susceptible to increased sediment loads than those in Victoria. However, in some cases (eg Cann River), existing high levels of sedimentation may make certain streams more sensitive to cumulative increases.

The major cause of elevated levels of suspended solids is recognised to be vegetation removal and soil exposure leading to erosion (Bek and Robinson 1991). Burchmore (1993) indicated that fish habitat is degraded by:

- activities near streams such as clearing of vegetation, road construction, tilling of soil and riparian vegetation damage and associated bank destabilisation, all of which lead to increased silt loads
- activities within streams such as dredging, which can lead to increased turbidity with the result that productive areas downstream such as weedbeds and riffle areas can be destroyed by smothering with silt. Important refuges such as deep holes may additionally be filled in.

Burchmore (1993) noted that forestry operations such as logging and associated road construction can cause erosion and bank collapse, leading to sedimentation which prevents fish passage. Impacts caused on streams by forestry operations, particularly roading, have been the subject of a number of litigations and associated investigations (e.g. Nanson 1992). In 1992 such actions made it necessary for the NSW Forestry Commission to apply for pollution control licenses (under section 17D of the Pollution Control Act 1970) for the continuation of their operations statewide.

While controls to minimise sediment inputs into streams have become more sophisticated in recent years, particularly in NSW where slope and soil erodibility factors now can dictate the nature of activities allowed (e.g. Anon. 1994), they are still primarily theoretically based. As Campbell and Doeg (1989) noted in relation to effectiveness of buffer strips around streams, there exists an urgent need for empirical testing of these measures, i.e. detailed scientifically-based monitoring of environmental performance. As impacts are often more intense in streams, within-stream monitoring of both physical and biological features is essential.

Acid Soils

Acid soils exist around the Illawarra coastal streams and streams entering the Shoalhaven River estuary in NSW. Toxic leachates from these soils could reach streams through the disposal of trench water, rainwater percolating through material excavated from trenches and the filled-in trench, providing a conduit for groundwater to move towards streams.

Within-stream Factors

The main within-stream hazards are the creation of a plume of suspended sediment, and the destabilisation of the stream bed. The magnitude of a plume of suspended sediments is related to the substrate type and water velocities at the time of construction. The most sensitive substrates are deep pools, where fine sediments accumulate. Not only may downstream turbidity be increased, but, if contamination sources (land use or natural origin) exist upstream, it is possible pollutants associated with the pool sediments could be mobilised. Hazards may be elevated in situations where valuable stream features, such as productive riffles or beds of aquatic plants, are a short distance downstream of crossing points.

Key hazards associated with the destabilisation of stream beds are the destabilisation of bars which maintain water levels in major refuge pools and the creation of barriers to fish movement (eg a stream may become shallower and faster flowing and lose resting pools).

Handling and Storing Hazardous Chemicals.

A potential impact during the construction period is the input to streams of hazardous chemicals arising from spills of fuel or drilling fluid used near streams. A potential impact during the operational period is the input of hazardous chemicals arising from spills of residues from pipeline maintenance.

Mitigation Measures

Several methods can be used when crossing streams. The two main methods are "wet crossings" and "stream-flow diversion crossings". WEAE have indicated (A. Bowes and K. Berry, pers. comm.) that the simpler wet crossing method is preferred as it is believed that the resultant impacts are similar:

- wet crossings: higher concentration of sediments for shorter periods
- stream diversion crossings: lower concentration of sediments for longer periods.

However, there appears to be no available data on these two crossing techniques, and so it is very difficult to make an effective assessment of either. The assumption that total "dose" of sediments is the key factor may be oversimplified, as it does not take account of threshold responses. These responses are typically behavioural, and Doeg and Milledge (1991) have tentatively identified such a response threshold (~ 130mg/l) for macroinvertebrates in one Victorian river (commencement of drift was taken to indicate avoidance).

Taking avoidance responses into account, it is clearly advisable to keep sediment concentrations to a minimum. Accordingly, stream-diversion stream crossings may be the least damaging.

A potential negative impact of stream diversion crossings is the creation of a temporary barrier to fish passage. This is considered to be of minor importance given that it will persist for only a few days per stream. Additionally, it is offset by the feature that water quality changes downstream will be minimised. A more significant potential negative impact is damage to sensitive riparian vegetation associated with the diversion. This factor would need to be considered on an individual stream basis during crossing design.

It is likely that there will be some streams where major impacts will result if any within-stream construction activities are undertaken and directional drilling may be the only acceptable method.

Factors that could indicate consideration of the directional drilling option are:

- stream of very high conservation value
- bank collapse highly likely if riparian vegetation is damaged
- sediments in stream suspected of being contaminated
- productive riffle and aquatic plant beds a short distance downstream
- stream bed destabilisation will lead to the draining of a major refuge pool, or creation of a barrier to fish passage.

As discussed previously, the significance of all such factors cannot be determined until the detailed design phase. It is important that an experienced stream ecologist and fluvial geomorphologist is involved in this phase to assess these factors. The conservation value index and the within-stream hazard indices described earlier will provide guidance on the first two factors listed above. A preliminary analysis provides an indication of the streams where directional drilling may be appropriate and Table 9 lists the 27 streams that appear to be most sensitive to within-stream disturbance. The Queanbeyan River may also be a candidate due to very steep unstable banks.

Table 9. List of highest conservation value streams.

Stream Name	KP	Rank	Conservation Value Index VI
Euchre Ck. (Bemm R.)	204.8	1	2.8703
Cooma Ck. (Numerella R.)	402.5	2	2.7592
Bemm River	199.7	3	2.6409
Numerella River	410.5	4	2.6008
Kate Ck. (Cann R.)	243.0	5	2.5975
Cann River (west branch)	247.8	6	2.3681
Neilson Ck. (Cann R.)	235.2	7	2.2793
Raymond Ck. (Brodribb R)	160.1	8	2.0505
Cann River	238.6	9	2.0499
Cann River	237.7	10	2.0499
Rock Flat Ck.(Numerella R.)	380.5	11	2.0472
Mitchell River	66.1	12	2.0376
Tonghi Ck. (Cann R.)	219.2	13	2.0318
Clifton Ck. (Mitchell R.)	71.9	14	1.9550
Bellbird Ck. (Bemm R.)	184.9	15	1.8980
Snowy River	152.5	16	1.8913
Brodribb River	158.6	17	1.7384
Tianjara Ck.(Shoalhaven R.)	598.6	18	1.6698

Mackenzie River (Bemm R.)	191.7	19	1.6686
Boulder Ck. (Bemm R.)	194.9	20	1.5985
Perry River	25.3	21	1.5285
Raymond Ck. (Brodribb R.)	161.3	22	1.5187
Ironstone Ck.(L. Tyers Trib.)	117.1	23	1.4983
Tambo River	92.8	24	1.4202
Old Tambo River	91.1	25	1.4202
Latrobe River	9.1	26	1.4002
Bredbo River	425.9	27	1.3810

The following general mitigation measures are recommended to minimise impacts on streams:

1. Each stream crossing should be assessed during final design and a crossing plan developed appropriate to the sensitivity of the stream and using appropriate technology (eg directional drilling, stream diversion, wet crossing, light-weight machinery, etc); terrestrial flora and fauna values of riparian areas should also be taken into account
2. Use best available technology and protocols to minimise the input of sediments and other hazardous materials
3. Ensure strict adherence to best-available erosion mitigation measures to minimise sediment inputs to the streams, using the guidelines developed by the NSW Department of Land and Water Conservation, and the Victorian Department of Conservation and Natural Resources as a basis
4. Erosion mitigation measures to be put into place as soon as possible during construction
5. Adhere to accepted protocols developed by the NSW Department of Land and Water Conservation for the handling and storage of acidic soils, particularly acid sulphate soils
6. Ensure that the pipeline trench does not cause drainage of acid sulphate soils and subsequent acidification problems
7. Guidelines should be developed to control the nature of construction activities under different rainfall conditions
8. Revegetate or otherwise stabilise all disturbed areas
9. Monitor and maintain erosion mitigation measures
10. Construction vehicles should only cross streams at a bridge or temporary crossing structure
11. Impacts on reference sites for the Commonwealth Government's Monitoring River Health Initiative should be minimised and the surveying groups should be contacted so that they can undertake specific monitoring of impacts
12. Turbid or acidic trench water should be disposed of away from streams in a location where it can be absorbed into the soil
13. Water used in any construction activities should not be disposed of into streams in a different catchment from that in which it was collected
14. All storage and distribution points of hazardous chemicals should be bunded to acceptable standards; mobile fuel storages should be kept well away from streams and drainage lines; drilling fluids should be collected at the site of use and be disposed of at a waste disposal/recycling depot
15. A statistically valid impact monitoring program should be put in place prior to construction commencing (to collect pre-impact data) and should continue for at least 5 years post-construction

Scheduling of pipeline construction activities in North America is frequently adjusted so as to avoid periods when stream biota may be susceptible to harsh conditions such as high concentrations of suspended sediment. Westcoast Energy Inc. (1992) refers to this adjustment as 'construction timing windows'. Conceptually, this approach has merits, but its overall effectiveness is questionable under the following situations:

- One component of the life cycle of a target species is protected, but the next equally critical stage is not. For example, construction could be delayed to avoid the period when fish lay eggs in gravel substrates, yet it occurs when the resulting larvae are searching for food. In this case the larvae could be severely affected, as could the invertebrate fauna comprising the food.
- Critical life-cycle stages of a target species is protected in a particular year, but due to the persistence of the impact in the stream, the stages in the subsequent years could be affected. Impacts resulting from the input of sediment has a great potential to act in this manner as sediment fills the interstitial spaces of substrates and may persist for years.
- Impacts occurring after construction activities have been completed. This situation is most likely in relation to sediment inputs, as they are primarily dependent on high intensity rainfall events, and construction will be timed to avoid these.

The breeding seasons, locality of eggs and migration season for high conservation and recreational-value fish taxa was reviewed. For the species which lay eggs in fresh waters amongst or on substrates, it is apparent that construction activities will occur during the following proportions of their breeding season:

100% - striped gudgeon and Coxs gudgeon
66% - pouched lamprey and Macquarie perch
50% - spotted galaxias, Australian grayling and brown trout
33% - trout cod.

For species known to make upstream migrations, i.e. those which are probably most at risk when faced with poor water quality, it is apparent that construction activities will occur in the following proportions of their migration seasons:

86% - Australian bass juveniles
66% - Australian grayling juveniles and Macquarie perch adults
50% - broad-finned galaxias juveniles, spotted galaxias juveniles and adult brown trout
33% - pouched lamprey.

The seasonality of fish spawning and other biological cycles is so varied in the study area that the scheduling of pipeline construction activities to minimise susceptible times for stream biota is of limited use and so is not recommended as a mitigation measure.

Resultant Impacts

Stream systems are extensive and dynamic, while the direct impacts associated with pipeline construction occur at localised crossing points. In general, these localised impacts will be minor in terms of the whole stream system. What is more important is the potential for indirect impacts to extend from the crossing site to other parts of the stream (usually downstream). As is clear from the assessment of potential impacts and mitigation measures, the potential for indirect impacts greatly depends on the manner in which a crossing is designed, constructed and maintained. Although both the sensitivity of streams to environmental impacts and the degree of hazard varies considerably in relation to a range of variables, even highly sensitive streams in areas of high erosion hazard can usually be crossed with minimal impacts given appropriate design and construction. The recommended mitigation measures recognise these by aiming to set out a series of approaches to design, construction and maintenance that are reactive to identified stream sensitivity and hazards.

Twenty-seven streams were identified as possible sites where the greatest environmental care would be required, in the Cann, Bemm and Yeerung River catchments in Victoria and in the Numeralla and Shoalhaven River catchments in NSW. No streams were identified that could not be crossed by the proposed pipeline while maintaining ecological impacts within reasonable limits, providing appropriate techniques were used and due care taken in design, construction and maintenance.

EFFECTS ON WILDERNESS, RESERVES, ETC

Impacts of the Eastern Gas Pipeline on Wilderness and World Heritage Values

The proposed route of the Eastern Gas Pipeline passes near to three areas identified as wilderness (LCC, 1991, NSW NPWS *pers. comm.*). These wilderness areas are the Genoa Wilderness in east Gippsland and the Budawang and Ettrema wilderness areas in the area of the Morton National Park. The indicators used to define the wilderness areas are several factors that influence remoteness and naturalness. These factors have been defined by Preece and Lesslie (1987) and Lesslie *et al.* (1993) and are:

> *Remoteness from Settlement* - remoteness from settled (cleared) land or, within natural areas, points of permanent occupation;
>
> *Remoteness from Access* - remoteness from constructed vehicle access routes;
>
> *Aesthetic Naturalness* - the degree to which the landscape is free from the presence of the permanent structures of modern technological society;
>
> *Biophysical Naturalness* - the degree to which the natural environment is free of biophysical disturbance caused by the influences of modern technological society.

Where the proposed pipeline route passes near to wilderness areas, the route either follows an existing easement or roadway or is further from the wilderness area than an existing roadway or other disturbance to the natural environment such as an easement. The pipeline route will therefore not diminish the wilderness quality of the Genoa, Budawang or Ettrema wilderness areas.

There are no areas listed as World Heritage areas along or near the route corridor, but there have been proposals to list both the Victorian Alps (Kirkpatrick 1994) and the Blue Mountains (James 1994). The impacts of the pipeline on these proposals are discussed below.

1. (Proposed) Australian Alps World Heritage Area: A contiguous set of reserves in Victoria and New South Wales which are managed under a co-operative Memorandum of Understanding form the backbone of this proposal. These reserves are a minimum of 5 km to the west of the proposed pipeline route in a separate catchment system and will not

be affected by it. Kirkpatrick (1994) suggested that the addition of other reserves including Croajingolong and Coopracambra National Parks may strengthen the case for World Heritage listing. The proposed pipeline route utilises existing easements and traverses the opposite side of the Cann River catchment and will not impact on Coopracambra National Park. While the pipeline route also traverses the headwaters of some streams which later flow into the Croajingolong National Park, impact on the National Park should be low.

2. (Proposed) Blue Mountains World Heritage Area: The southern section of this proposed area includes Morton and Budawang National Parks (James 1994). The pipeline route closely follows the existing road easement through this sensitive area. The expected impact on the proposed World Heritage area should be very low.

Areas on the Register of the National Estate

The proposed route of the Eastern Gas Pipeline encounters a number of areas listed on the Register of the National Estate by the Australian Heritage Commission (Table 10). These are areas considered to have a national importance because of certain features which are considered of importance to the Australian Community as a whole. Areas listed on the Register of the National Estate are not protected as such, however consideration must be given to any developments which are likely to compromise the values for which an area has been considered important. What the registration of these sites does mean is that they are considered to be important areas worthy of conservation by not only the nominator, which may be a local conservation group, a state or federal government body or other interested party, but also by the Federal Government. The criteria for a successful Registration are very strict, therefore these areas represent areas of high conservation significance. Areas on the Register of the National Estate should be avoided, if at all possible.

Please Note: Areas in east Gippsland have joint CNR/AHC team currently evaluating National Estate Values in the area.

Table 10: Areas on the Register of the National Estate that occur within the proposed route of the Eastern Gas Pipeline.

Area	Registration Number	Position on Pipeline Route (km post)	Notes
Dowd Morass State Game Reserve	*004774*	7-9	Large wetlands, nesting area for waterbirds. Many birds covered by JAMBA and CAMBA treaties. Pipeline corridor crosses northwest corner of this reserve with likely pipeline route outside reserve area. Care will be needed to avoid downstream affects from construction activities.
Gippsland Lakes Area	015528	south of 80	Appears to be well east of corridor, but boundaries of area unclear.

Lake Tyers State Park	*004788*	113-123	Contains areas of high significance from zoological aspect. Although registered as of Aboriginal significance this area has high natural values. Part lies within pipeline corridor.
Ewing Morass State Game Reserve	*004760*	126-147	Not in corridor, but tributary streams and catchments are. Care needs to be taken to avoid downstream effects.
Lind National Park	*?*	195.5-203.5	National Park. Pipeline route passes to the north.
Errinundra Plateau Area	*015226*	West of 265	Will not be affected by pipeline construction or operation. To the northwest and at higher altitude than the pipeline route corridor.
Coopracambra Extension Area	*015227*	242-273.5	Highly significant Park, high flora and fauna values, important geological and geomorphological sites, high wilderness values. Part of the Reserve is contained within the pipeline corridor. The actual route of the pipeline and any associated construction activities will avoid the Registered Area altogether.
Croajingolong Area	*004741*	174-224	Not likely to be directly affected by pipeline construction or operation. However, rivers which are crossed by the pipeline route flow through the Croajingolong Area. Care will need to be taken to avoid downstream affects such as an increase in the amount of particulate matter in the water of these rivers. Joint CNR/AHC study currently reviewing National Estate values in area.
Flat Rock Travelling Stock Reserve	*0019516*	380.1-380.3	*Poa sieberana* native grassland (32 ha) in good condition; rare species *Dodonaea procumbens* (see section on sites of state significance).
Tinderry Nature Reserve	*001052*	463-466	Nature Reserve containing a significant portion of the Tinderry Range in relatively natural condition. The five kilometre pipeline route corridor contains areas of the Nature Reserve. The actual route of the pipeline and any associated construction activities will avoid the Nature Reserve altogether.
Morton National Park	*001131*	578-592	Pipeline Route crosses National Park. See detailed discussion in impacts section of this report.
Barren Grounds Nature Reserve	*001605*	662-666	To the west of the pipeline and on higher ground. Will not be affected by any activities associated with construction or operation of the pipeline.
Illawarra Escarpment	*001526*	698-708	The forested sandstone escarpment which defines the western extent of the Illawarra coastal plain. Nominated by the National Trust, the aesthetic values of the landscape are considered as important as the natural values. Pipeline crosses the escarpment. Particular care needed.
Upper Nepean Water Catchment	*001476*	?-730	Large area containing the catchment of the Nepean River, part of Sydney's water supply. 90,000 ha of virtually untouched natural bushland which provides sanctuary for Koala, Parma Wallaby and Platypus.

Proposed Reserves and Other Significant Areas

The proposed route of the Eastern Gas Pipeline encounters a number of proposed reserves and community concerns over earlier corridor options led to areas somewhat distant from the existing proposed corridor to be listed within the scoping document. The location and potential impacts on these areas is documented in Table 11.

Table 11. Location and impact on other areas listed in the scoping document.

Area	Location	Notes
Genoa National Park (proposed)	≥ 10 km east of pipeline route (8.1) near Vic/NSW border.	Area in a different catchment system to pipeline route. Impact nil.
Tennyson Creek Flora Reserve	≥ 3 km west of pipeline route (8.1) near Vic/NSW border.	Impact low (5.1); impact even lower with route 8.1.
Boggy Creek Swamps	west of KP 290 (5.1).	Impact low (5.1, 8.1).
Googong Dam catchment	KP 465.5 - 485 (5.1), KP 466 - 484 (8.1)	Catchment area managed by ACT Parks & Wildlife as conservation reserve. Route runs through upper areas of catchment but potential for impacts on catchment appears low.
Timber Reserve 975225	east of KP 505 (8.1).	Northern end of reserve is within pipeline corridor. Impact low (5.1, 8.1).
Leasehold land north of Tallagandra State Forest	approx. KP 520 - 530 (8.1).	Impact low (5.1, 8.1).
Welcome Reef Nature Reserve (proposed)	KP 540 - 546 (ver. 5.1); KP 550 (ver. 8.1).	Encompasses Welcome Reef Dam catchment and impoundment. Boundaries unknown.
Parma Creek Nature Reserve (proposed)	East of KP 616 - 626 (approx.).	Route 8.1 follows existing road along the ridge in the headwaters of catchment. Impact low.
Foxground Valley	KP 664 - 670 (ver. 5.1); KP 672-678 (8.1)	The area surrounding Route 5.1 was described as a regional site of significance. Route 8.1, however, diverted the proposed pipeline to the east where it largely traverses agricultural land. Impact low.
Minamurra River Crossing	KP 673 (5.1)	Care needed crossing to avoid downstream effects on instream fauna. Damage to the corridor of native vegetation along the stream should be avoided. Clearing of casuarinas from riverbanks covered under Land Conservation Legislation, permission needed from the Minister to clear.

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MAPS

EASTERN GAS PIPELINE PROJECT

LEGEND - Ecological Vegetation Classes

VICTORIAN ECOLOGICAL VEGETATION CLASSES
Longford to Colquhoun

- Riparian Scrub Complex
- Coastal Grassy Forest
- Forest Red Gum Grassy Woodland
- Central Gippsland Plains Grassland
- Lowland Forest
- Shrubby Dry Forest
- Gallery Rainforest
- Unknown/Unclassified

WATER FEATURES

- Lakes
- Swamps
- Mangroves
- Subject to Inundation

ROADS

- Principal Road
- Secondary Road
- Minor Road
- Track
- Operational Railway
- Abandoned Railway
- Railway Under Construction

DRAINAGE

- Rivers
- Creeks

VICTORIAN ECOLOGICAL VEGETATION CLASSES
East Gippsland Area

- Coastal Banksia Woodland
- Clay Heathland
- Wet Heathland
- Banksia Woodland
- Limestone Box Forest
- Lowland Forest
- Riparian Scrub Complex
- Riparian Forest
- Heathy Dry Forest
- Shrubby Dry Forest
- Grassy Dry Forest
- Herb-Rich Forest
- Damp Forest
- Wet Forest
- Cool Temperate Forest
- Warm Temperate Forest
- Unknown / Unclassified

NSW ECOLOGICAL VEGETATION CLASSES
Spread II

- Pasture/Degraded Semi-Native
- Aristida/Danthonia/Stipa Grassland
- Medium Dry Tussock Grassland
- Themeda Grassland
- Tall Wet Tussock Grassland
- Wetland/Sedgeland
- Riparian Forest/Thicket
- Grassy Woodland
- Scrub/Regrowth(young)/Burgan Thickets
- Grassy/Shrubby Woodland
- Dry Shrub Forest/Shrubby Forest/Grassy Shrub
- Pine Plantation
- Unclassified/Unknown

NSW ECOLOGICAL VEGETATION CLASSES
Spread III

- Mallee/Heath
- Sassafras
- Scribbly Gum Woodland
- Heathland
- Tall Open Forest/Closed Forest
- Open Forest
- Spotted Gum/Grey Gum Forest
- Woodland/Scrubland
- Spotted Gum/Blackbutt
- Closed Forest
- Blackbutt - Bluegum
- River Flat
- Saddle Back High Forest
- Woodland
- Disturbed Woodland
- Disturbed River Flat
- Illawarra
- Heath
- Banksia Thicket
- SSRF Closed Scrub
- Sydney Sandstone Gully Forest
- Bargo Brush/Mittagong Shale
- Bargo Brush Forest
- Greybox/Ironbark Woodland
- Bulee Gap Woodland
- Bulee Gap Woodland/Forest
- Unclassified/Unknown
- Grassland
- Sydney Sandstone Ridgetop Woodland

BHP   Westcoast Energy

Australian Map Grid
Universal Transverse Mercator Projection
Data sourced from AUSLIG, NSW Land Information Centre,
Victorian OGDC and DCNR

MAP NUMBER: A3-44 (1 of 4)
MAP REVISION: 1.0
Prepared by BHP Engineering Pty Ltd
Date: November 23, 1995

Map 1

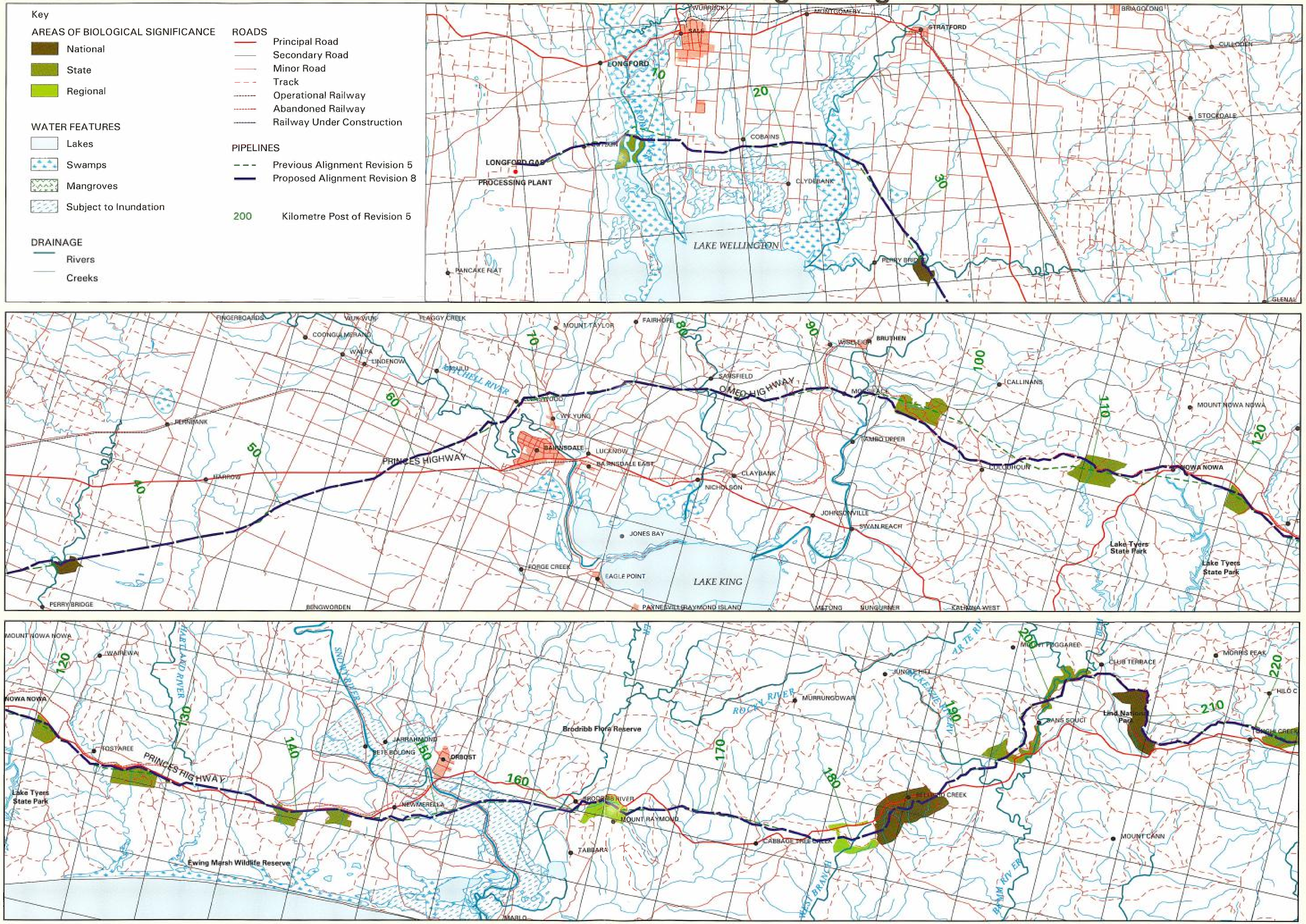
EASTERN GAS PIPELINE PROJECT

Sites of Biological Significance

Section 1

Section 2

Section 3



BHP

Westcoast Energy

Scale 1 : 250 000

0 5 10 15 20

Australian Map Grid
Universal Transverse Mercator Projection
Data sourced from AUSLIG, NSW Land Information Centre, Victorian OGDC and DCNR

MAP NUMBER: A3-47 (1 of 3)
MAP REVISION: 2.0
Prepared by BHP Engineering Pty Ltd
Date: November 23, 1995

Map 2

APPENDIX 1

FLORA

SITES SURVEYED

The focus of survey effort was on areas where the proposed route passed through or adjacent to relatively intact native vegetation. These areas were identified by examining the route using aerial photography and reconnaissance from a light aircraft. The aerial reconnaissance was particularly important for the identification of remnant native grasslands.

DATA COLLECTION

The proposed route was marked at relatively regular intervals on the ground with numbered star pickets and flagging tape. Plant species lists were compiled at regular intervals using these markers as reference points. In areas supporting relatively intact native vegetation the proposed pipeline route was walked along and active searching used to locate all visible vascular plants. In areas where the proposed pipeline route utilised an existing easement through otherwise native vegetation, the easement was assessed from a slow moving vehicle in association with regular stops (about every kilometre driven) lasting about 10 minutes for more intensive searching. Roadside vegetation was inspected and surveyed when considered to consist of largely native vegetation. Non-native vegetation (e.g. improved pasture, pine plantations etc.) was not surveyed.

Spring survey work targetted areas previously identified as having or considered to have conservation value. Areas in which ROTAP species were previously recorded were searched for additional individuals as well as for indications of responses to disturbance.

Notes were made on any features of biological interest including the presence (or lack) of disturbance, rocky outcrops and particularly well developed plant species (i.e. old-growth trees).

In Victoria, the Department of Conservation and Natural Resources maintains a substantial database on the state's flora. This includes a substantial amount of quadrat data. All quadrats within a two kilometre corridor of the proposed route were identified and collated into groups representing the three sections of the route in this state.

PLANT TAXONOMY

Plant nomenclature in this report follows that by Ross (1993) and Walsh and Entwisle (1994) in Victoria and Harden (1990, 1991, 1992 & 1993) in New South Wales. Variations from this format are only made subsequent to advice from the National Herbarium in each state.

Plant specimens were identified using a range of taxonomic texts and papers including Willis (1972), Walsh and Entwisle (1994) and Harden (1990, 1991, 1992 & 1993).

In some taxonomic groups specimens could not be identified to specific level, usually due to the lack of fertile material or because of taxonomic difficulty within a group.

Taxonomic Qualifications:

Grasses (Poaceae)

Many grasses were impossible to identify due to the lack of flowering stems. The optimum time for grass identification is late spring to early summer.

Geophytes/Annuals/Seasonal Perennials

Species such as terrestrial orchids and some lilies are geophytic seasonal perennials - that is, the above ground parts of the plant die off for part of the year and a viable root or tuber remains below the soil. The following winter and/or spring, the plant regrows. During the winter survey, orchid and lily leaves were often observed, however, few could be accurately identified using the few leaves that were present. Orchid and lily species often have a staggered flowering. *Diuris, Pterostylis, Caladenia* and *Arthropodium/Dichopogon* species were often identifiable from early spring, yet *Microtis/Prasophyllum, Chiloglottis, Thelymitra* and *Caesia* species have later flowering periods and thus were only evident as leaves at the time of the Phase 2 surveys. Most annual species, particularly native daisies and annual grasses, were not evident during winter, and species which had germinated after early spring rains were still immature and thus unidentifiable. Phase 2 surveys enabled accurate identification of many species that had since regenerated and flowered.

Microtis/Prasophyllum

During the survey period, specimens of *Microtis/Prasophyllum* (Leek and Onion Orchids) were identified. Specimens, however, were infertile due to a later flowering season. It was thus difficult to accurately identify specimens as either *Microtis* or *Prasophyllum.* Most such records have been placed within *Microtis* spp, thus these must be treated with caution.

Peas (Fabaceae)

Most native pea shrubs require flowers and/or pods for accurate identification. Winter surveys for this study were far too early in the flowering season for some pea flowers, and the previous seasons fruits had already been shed. Phase 2 (spring) surveys enabled accurate identification of many peas. However, the identities of a few late-spring flowering species may still remain unconfirmed.

Specimens of *Gompholobium* have been identified with a degree of confidence on the basis of vegetative characters alone. However, *G. uncinatum* has not been recorded for the southern tablelands region prior to this study. Attempts to obtain flowering material proved unsuccessful. However, closer inspection of specimens show the identity of the plant to remain consistent with *G. uncinatum* description. A similar taxon, *G.* species B, has vegetative morphological characters which discount this as an option. The specimen may be an aberrant form of more common species such as *G. huegelii* or *G. minus.* If confirmed to be *G. uncinatum*, these records will be of regional significance.

*Buttercups (***Ranunculus***)*

Many specimens of *Ranunculus* sighted during this study consisted of leaf material only. Without inflorescence, the identity of most *Ranunculus* cannot be confirmed (except *R. inundatus* and *R. pimpinellifolius*). Although some specimens have been applied to the species *R. plebius* on the basis of leaf characters, species habitat and distribution, there remains the possibility of misidentification.

*Wattles (***Acacia***)*

Again, without inflorescences (and pods), several *Acacia* specimens were difficult to identify. A commonly-occurring taxon, with very hairy bipinnate leaves and intermittent inter-jugary glands, was recorded as *A. parvipinnula*, despite some superficial resemblance to *A. mearnsii*. Thus, some *Acacia* records should be treated with caution.

*Epacridaceae including Beard-heaths (***Leucopogon*** spp)*

The study area contained a number of *Leucopogon* species. During the winter survey, many specimens lacked fully developed flowers (on which accurate identification is often based). Spring surveys confirmed the identity of most taxa, with few exceptions.

Several uncommonly-occurring Epacridaceae specimens were collected and could not be identified due to the total lack of fertile material. These have not been included in the species lists.

Acaena *species*

All fertile *Acaena* specimens (except *A. novae-zelandiae*) collected were identified as *Acaena echinata*, based on distinctive fruit characters. However, most specimens collected during the current study were infertile. Using available flora keys, the samples were identified as *Acaena echinata* on leaf characters alone. Although these classifications have been retained, the accuracy of the identifications may be in question.

Hydrocotyle *species*

Infertile material of *Hydrocotyle* was often placed within *H. laxiflora* based on gross morphological characters. However, these records should be treated with caution. Several records of an undescribed taxon of *Hydrocotyle* (*H.* sp. aff. *tripartita* (Benambra)) were made throughout the pipeline route. These differ from *H. tripartita* in that the leaves are often much larger, with crenulate margins on the leaflets, and that the plant will often be found totally inundated in streams and bogs. In these instances, the species was recorded as *Hydrocotyle* sp. or placed into *H. tripartita*. These records should be considered with caution.

Geranium *species*

Geranium is currently undergoing taxonomic revision, resulting in number of new species being described. During this study, *Geranium* records have been classified into the informally-titled taxonomic groupings determined by Smith (1994).

Taraxacum *spp*

Although the exotic *Taraxacum officinale* was also recorded, specimens of *Taraxacum* believed to be *T. aristum* were collected from bog areas of spread 2. *T. aristum* is a native to Australia, and this record is the first for New South Wales. The species has, however, been noted as *Taraxacum sp* until the identity of the specimen is confirmed.

DATA STORAGE

Information from each list taken (floristics, locality and sampling date) was stored permanently on magnetic disk in the database of Biosis Research Pty. Ltd.

VEGETATION COMMUNITIES

The ecological vegetation classes (vegetation communities) of most of the Victorian section of the proposed route have been described and mapped at a scale of 1:100000 by Woodgate *et al.* (1994) and their nomenclature is utilised within this report. The maps, in association with field inspections, were used to identify vegetation communities within the proposed corridor. In New South Wales the vegetation of the proposed route has been described (and in some instances mapped) by a number of studies including Costin (1954), with several communities re-evaluated by Benson and Wyse Jackson (1994), Benson and Howell (1994a, 1994b), Briggs and Leigh (1994) WCC (1995), CALM (1994), Mills & Jakeman (1995), The Budawang Committee (1982 & 1988) and Mills (1992).

DEFINING SIGNIFICANT SPECIES, COMMUNITIES AND SITES

Assessment of conservation status, and hence significance, can be made at the individual species level and at the vegetation community level. A vegetation community may be significant due to depletion or other factors such as its old-growth status or geographic position, even though it may contain no significant plant species.

Briggs and Leigh (in prep.) has been used as the authority on the significance of plant species at the national level. Gullan *et al.* (1990) has been used as the primary authority on the significance of plant species within Victoria (more recent publications on specific taxa are also utilised) while the lists of Beauglehole (1981, 1984 & 1985) were used to identify regionally significant occurrences. In New South Wales regionally significant occurrences were identified using Benson & Howell (1994), Keith (1994), WCC (1995), Mills and Jakeman (1995), Mills (1988), Mills (1989), Mills (1992), QEM (1995) and CALM (1994).

The Government of Victoria has identified some significant plant communities and listed them under its Flora and Fauna Guarantee Act (1988) while other communities are in the process of being listed. The conservation significance of plant communities was also assessed on the basis of information in Woodgate *et al.* (1994) and Department of Conservation and Natural Resources (1995).

Sites of botanical significance were identified using the above information and previous studies which included sections of the proposed pipeline corridor.

RESULTS

Plant Species

A total of 1251 indigenous and 171 introduced vascular plant species (ferns, conifers, flowering plants) was recorded over the entire proposed route. These species are listed in family order in Appendix 1A. Species recorded in Spread I are listed in Appendix 1B with additional species recorded within CNR quadrat records listed in Appendix 1C. Species recorded in Spreads II and III are listed in appendices 1D and 1E respectively.

Significant Species

More detailed information on the significant species recorded along the proposed pipeline corridor is provided below. Species are described in alphabetical order according to their scientific name and are grouped according to their significance (national, state and regional).

Nationally Significant Taxa

Conservation and distribution codes for these species follow Briggs and Leigh (in prep.) and are as follows:

'1'	Species only known from the type location
'2'	Species with a maximum geographic range of less than 100km
'3'	Species with a geographic range of more than 100km, but only occurring in small populations, restricted to highly specific habitats
'X'	Species presumed extinct; no new collections for at least 50 years
'E'	Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate
'V'	Vulnerable species at risk of long-term disappearance through continued depletion.
'R'	Rare , but not currently considered to be endangered.
'K'	Poorly known species that are suspected to be threatened.
'C'	Known to be represented within a conserved area.
'a'	the species is considered to be adequately conserved.
'I'	the species is known to be inadequately conserved.
'-'	the reservation status is unknown
't'	the total population occurs in conserved areas

Wattle Acacia subtilinervis

The wattle *Acacia subtilinervis* has a conservation rating of 3RCa. This erect shrub generally occurs in heathland on rocky outcrops. Several populations were recorded in heathland between Morton National Park and Nowra (KP 579.2, 579.5, 593.6, 601.6, 601.8, 617, 636.7, 642.3).

Hairpin Banksia Banksia cunninghamii *ssp.* cunninghamii

This shrub grows to 5m in heath and woodland (Harden 1991). Keith (1994) identifies the occurrence of this species as significant within the Metropolitan catchment because of its scattered distribution. Several populations of this species were recorded south of Wilton in the catchment area (KP 725.7-726).

Boronia Boronia subulifolia

Several individuals of *Boronia subulifolia* were recorded in mallee/heath near KP 587, south of Sassafras. This small shrub, to 1m high, has pink to purplish flowers. This species has a conservation code of 2RC- and has has previously been recorded at Sassafras, "...near Sassafras" (Mills & Associates 1993) and Morton NP (Briggs & Leigh in prep.).

Burr-daisy Calotis glandulosa

The Burr-daisy is an perennial herb which typically grows in grassland and sclerophyll forest at higher altitude (Harden 1992). The species is of national significance, and is listed as Vulnerable by Briggs and Leigh (1988). A past record shows the species was located along the proposed pipeline route (KP 325.8).

White Cynanchum Cynanchum elegans

White Cynanchum is a climber with a significance rating of 3ECi, generally occurring on steep slopes in dry rainforest to open forest (Matthes & Nash 1993). This species was recorded 20m to the east of the proposed easement on the south-facing slopes of Farmborough Heights Ridge, and also at Curramore, near where the proposed easement crosses Jamberoo Road (KP 677.3, 697.3).

Darwinia Darwinia grandiflora

Darwinia grandiflora is a prostrate shrub, endemic to the Nepean Ramp and has a significance rating of 2RC-. Usual habitat is poorly drained sandy soil (Harden 1991). This species was recorded in several locations in the catchment between the Link Road and Cordeaux Colliery (KP 709, 710, 712.2)

Australian Anchor Plant Discaria pubescens

This rigid, often leafless, spiny shrub grows to a height of 2.5 m. It is widespread, growing in a range of woodlands and forest communities but is considered endangered in New South Wales (Harden 1990). It was located at Jacksons Bog (KP 286.6) and the McLaughlin River (KP 352.8) during this study, and had previously been recorded near Nimmitabel (KP 360.1) and Michelago (KP 455). Briggs and Leigh (1988) list this species as 3RCa indicating *D. pubescens* to be rare in Australia.

Buttercup Doubletail Diuris aequalis

The Buttercup Doubletail is a terrestrial orchid which grows among grass in sclerophyll forests of the ranges and tablelands (Harden 1993). This species is listed as vulnerable by Briggs and Leigh (1988) and is considered to be nationally significant. Two previous records of *D. aequalis* exist within the 2 km corridor (KP 531.5, 512.1).

Mountain Cress Drabastrum alpestre

Mountain Cress, listed as rare (Briggs and Leigh 1988), is a perennial herb confined to higher altitudes (Harden 1990). An existing record of the species shows it to occur within the pipeline corridor (KP 376.8). Mountain Cress is considered as Nationally Significant.

Heath Epacris purpurascens *var* purpurascens

Epacris purpurascens var *purpurascens* has a significance rating of 2KC, and has only previously been recorded in one site to the south of Sydney (T. James *pers. comm.*). Two large populations of this species were recorded to the east and west of the abandoned airstrip (KP 724-725.1, 725.5-726.1).

Mallee Ash Eucalyptus langleyi

Mallee Ash was recorded at two sites, the first to the south of HMAS Albatross where a large population extends for a distance of up to 30 metres on both sides of the road (KP 624.1-624.6). Optical fibre excavations pass within metres of several individuals. If the proposed easement follows the west side of the road no individuals will be affected. If the proposed easement follows the east side of the road at least two individuals will be affected. The second population consists of two individuals on the edge of a Telecom easement approximately 400 m north of the intersection with Twelve Mile Road (KP 601). This is possibly the southern-most limit of this species' geographic distribution (Kevin Mills pers. comm.) and the site is therefore of conservation significance. The distribution of this species is restricted and localized (Harden 1991), hence its rating of 2V.

Privet-leaved Stringybark Eucalyptus ligustrina

Eucalyptus ligustrina is a small tree with a very sporadic distribution (Harden 1991), considered to be uncommon in the area (Keith 1994). This species is generally restricted to skeletal sandy soils, and was recorded near the Link Road intersection (KP 708, 711.1).

Ettrema Mallee Eucalyptus sturgissiana

Ettrema Mallee has a conservation rating of 2VC- and occasionally occurs on sandy poorly-drained soils as an emergent in heathland (Harden 1991; Pryor 1981). A small stand of this species was recorded near the Cassima Road intersection, and several individuals were also recorded near the Wambat Road intersection and Wandean Road intersection. All individuals recorded are located at least 15 metres from the proposed easement on Turpentine Road (KP 604.8, 607.8, 615.7).

Pigeon-house Ash Eucalyptus triflora

The Pigeon-house Ash is a mallee-like species, and is locally frequent but confined to the Budawang Ranges (Harden 1991). It is listed as 2RCa (Briggs and Leigh 1988). There are two previous records of *E. triflora* within the 2 km pipeline corridor (KP 573.7, 574.8). During this study it was not recorded along the proposed easement, but four individuals were recorded on the cliffs above the road at Bulee Gap, as well as one individual on the plateau to the north of Bulee Gap, a population to the north of Bulee Gap, and several individuals near Cherry Tree Creek. Records from this study include KPs 579.5, 578.6, 592.1.

Gully Grevillea Grevillea barklyana *var.* macleayana

Gully Grevillea is a spreading shrub which grows on sandy soils. The species has a conservation rating of 3RCa and was recorded near the Parma Road intersection (KP 624.8, 625.8).

Grevillea Grevillea renwickeana

Grevillea renwickeana, considered as rare nationally (Briggs and Leigh 1988), is a root-suckering shrub confined to the Braidwood-Nerriga area of New South Wales (Harden 1991). Previous records of the species are located within the 2 km pipeline corridor (KP 568, 570.8).

Guinea-flower Hibbertia nitida

Hibbertia nitida has a significance rating of 2RC-. This species is a shrub to 1m, with glabrous branches and leaves (Harden 1990). Several populations were recorded in the catchment area between the Link Road and Cordeaux Colliery (KP 713.2, 714, 714.1).

Tea-tree Leptospermum epacridoideum

Leptospermum epacridoideum is a shrub to 2m, has a rating of 2RC- and is mostly confined to the Jervis Bay area (Harden 1991). This species was recorded in several sites, including the western slopes of Stony Hill; west of the Ballwarra Road intersection and south of HMAS Albatross (KP 593.6, 611.5, 617.2).

Tea-tree Leptospermum sejunctum

Leptospermum sejunctum is a shrub to 1.5m, confined to the Nowra district and has a rating of 2K. This species was recorded in shrubland near the proposed easement at North Nowra. One individual, occurring near the Yarramunmun Fire Trail intersection, was also tentatively recorded as *Leptospermum sejunctum*, although no seed capsules were present for positive identification (KP 599.2, 636 638.6, 642.3). Individuals at KP 636 are on the edge of the proposed easement and therefore susceptible to disturbance.

Mat-rush Lomandra fluviatilis

Lomandra fluviatilis is a tufted perennial herb, generally restricted to creek beds on sandy soils (Harden 1993) and has a significance rating of 3RC-. This species was recorded in the catchment area in a creek line to the south east of the Link Road intersection (KP 709.3).

Honey-myrtle Melaleuca squamea

Melaleuca squamea is a shrub to 3 m occurring in heathland on wet ground (Harden 1991). The species is considered to be uncommon in the Sydney region (Keith 1994), and was recorded in heath to the south east of the Link Road intersection (KP 709).

Geebung Persoonia bargoensis

Persoonia bargoensis is a recently described species, which is restricted to the catchments of the Cataract, Cordeaux and Bargo Rivers, and has a significance rating of 2V (T. James *pers. comm.*). One individual was recorded to the east of the abandoned airstrip (KP 723.9).

Geebung Persoonia mollis *ssp.* nectens

Persoonia mollis subsp *nectens* is a small shrub, restricted to the Nepean ramp (Keith 1994). This species was recorded on several woodland sites in the catchment area (KP 720.8, 724.3).

Platysace Platysace stephensonii

Platysace stephensonii, rated 3RC- is a herb to 50cm which generally occurs in heath or woodland on sandstone. This species was recorded at KP 593.6.

Illawarra Greenhood Pterostylis gibbosa

Illawarra Greenhood *Pterostylis gibbosa* is a small terrestrial orchid with a conservation rating of 2E. This species generally occurs on poorly drained soils in remnant woodland areas with native shrub understorey (QEM 1994). This species was not recorded in the proposed easement, but is known to occur in three sites close to a proposed alternative route further to the east (east of KP 684.9).

Small Autumn Greenhood Pterostylis longipetala

This small terrestrial orchid ranges from far East Gippsland into New South Wales where it grows in open forests and woodlands on well drained soils. Backhouse and Jeans (1995) indicate the species appears to be rare over its limited geographical range. This species was recorded at one location in Victoria, in the Buldah Forest Block, on the Buldah Road (KP 253-253.5). Beauglehole (1981) also notes this species (as *P. reflexa*) from Mt. Raymond Regional Park.

Bush-pea Pultenaea aristata

Pultenaea aristata is an erect shrub generally restricted to moist sites (Harden 1991) and has a significance rating of 2VC-. This species was recorded between the Link Road and Harry Graham Drive intersections (KP 712.3).

Rulingia Rulingia hermannifolia

Two individuals of *Rulingia hermannifolia* were recorded three and 18m to the north of KP 594, north of Sassafras. Both individuals are young, and appear to have recently established in the area disturbed during excavation for the Telecom easement. This species is described by Harden (1990) as a prostrate or trailing shrub, with stems to 1m long. Its distribution is described as "...rare, chiefly confined to coastal areas from Broken Bay to Botany bay, also south to Jervis bay, and along the Shoalhaven River". This species has a conservation code of 3RCa, and it occurs in a number of biological (Briggs & Leigh in prep.). Mills (1993) lists several sight records of this species near the study.

Daisy Rutidosis leiolepis

Rutidosis leiolepis, a high-altutude grassland daisy, is considered rare in New South Wales by Harden (1992) and is listed as Vulnerable nationally by Briggs and Leigh (1988). A single previous record of the species occurs within the 2km pipeline corridor (KP 325).

Austral Dandelion *Taraxacum aristum*

This nationally rare species is not recorded for New South Wales by Harden (1992). It is a perennial herb with a taproot which favours higher altitude sites with peaty soils. *Taraxacum aristum* was recorded in one location during a spring survey at KP 282.

Pink-bells Tetratheca neglecta

Tetratheca neglecta is a compact shrub to 60cm, generally occurring in heath or woodland on sandy soils (Harden 1992). The significance rating is 3RC-. This species was recorded in the catchment area to the east of Cordeaux Colliery (KP 712.2).

Austral Toad-flax Thesium australe

This root parasite is an erect perennial herb which occurs in all eastern mainland states of Australia. Harden (1992) idicates it grows in grassland or woodland habitats, often on damp sites, and while widespread, is rare and possibly endangered. Briggs and Leigh (1988) list this species as 3ECi which indicates it is endangered in Australia and also note it is considered to be extinct in Tasmania. A single record of the species was obtained from KP 465.4 within *Themeda* grassland.

Westringia Westringia lucida

Westringia lucida is a medium, dense shrub which grows in high altitude rocky areas within snowgum woodland or alpine heath. An existing record shows the species to occur within the 2km pipeline corridor at KP 360.1. Briggs and Leigh (1988) list the species as rare nationally.

Zieria Zieria granulata

Zieria granulata has a conservation rating of 2VCi and generally occurs on dry rocky ridges in sclerophyll forest between Albion Park and Broughton Village (Mills and Jakeman in prep.). Several large populations of this species have been recorded, but small populations occur in remnant patches of vegetation. This species was recorded by Mills & Jakeman (in prep.) at 17 sites which lie within 1 km of the proposed easement between Broughton Creek and Albion Park. No individuals of *Zieria granulata* were recorded in or adjacent to the proposed easement. The nearest individual recorded in this survey was located on the northern slopes of Saddleback Mountain, near Fountaindale Creek, at least 20m west of the proposed easement (KP 668).

Taxa of State Significance

Giant Maidenhair Adiantum formosum

This fern has a restricted distribution in Victoria and is listed as rare in this state by CNR (Gullan *et al.* 1990). It was recorded at a single location in the Noorinbee Forest Block (FIS quadrat No. C20058), on private land by Forbes *et al.* (1981) at the intersection of Neilson Creek and the West Cann Road (KP 235.1).

Pinkwood Beyeria viscosa

This tall shrub is widespread in Australia where it grows on skeletal soils on ridges and hilltops or other rocky environments (Harden 1990) except in Victoria where it usually grows in gullies (Costermans 1983). In Victoria the species is largely restricted to East Gippsland where Gullan *et al.* (1990) consider it to be rare. This species was recorded within the 2 km corridor of the proposed pipeline (KP 268) by Cherry *et al.* (1986) (FIS Quadrat No. C44840).

River Leafless Bossiaea Bossiaea riparia

This riparian shrub is widespread in Victoria but has few records from East Gippsland. Beauglehole (1981) records it as a rare, interesting or restricted in this region, while Gullan *et al.* (1990) list it as rare for Victoria. River Leafless Bossiaea was recorded once in the pipeline corridor in Riparian Forest along Tonghi Creek by Brown *et al.* (1987) (KP 218).

Purple Diuris Diuris punctata *var.* punctata

This herbaceous, terrestrial orchid is widely distributed on low altitude plains where it is found in grasslands and grassy woodlands on rich, heavy, sandy loams (Backhouse and Jeans 1995). This species occurs in all eastern mainland states and South Australia and is considered vulnerable in Victoria (Gullan *et al.* 1990, Backhouse and Jeans 1995). This species was recorded within the 2 km corridor of the proposed pipeline (KP 62) by CNR (FIS Quadrat No. F48532).

Trailing Hop-bush Dodonaea procumbens

This prostrate shrub grows in low-lying, open woodlands with sandy soils and is restricted in New South Wales to the Cooma district (Harden 1991). It is therefore to be considered rare in this state. The species also occurs in Victoria. *D. procumbens* was located at five sites during this study (KP 383, 415, 420, 424, 434) and has previously been recorded near KP 414 and 417.

Showy Willow-herb Epilobium pallidiflorum

This robust, perennial herb grows along river banks or in swamps south of Sydney to South Australia and Tasmania. In Victoria it is widespread in the southern half of the state where it is considered depleted by Gullan *et al.* (1990). This species was recorded within a 2km corridor of the proposed pipeline (KP 226) by Brown *et al.* (1987) (FIS Quadrat No. C47332).

Argyle Apple Eucalyptus cinerea *ssp.* triplex

Although Argyle Apple *Eucalyptus cinerea* occurs frequently in grassy or sclerophyll forests of the southern tablelands, one form (*E. cinerea* subspecies *triplex*) is known from very few sites. Currently being listed (in Briggs and Leigh) as rare in New South Wales, *E. cinerea triplex* has been recorded within the 2km pipeline corridor (KP 483.8). As the full range of the taxon is not yet known, it is possible that pipeline development could affect some trees (P. Barrow *pers. comm.*).

Bedstraw Galium roddii

This much branched hairy perennial herb was previously known only from the Cooleman Caves district in the southern tablelands region of New South Wales. Its restricted distribution suggests it is of state significance. *Galium roddii* was recorded from one location at KP 420.

Grevillea Grevillea diffusa *ssp.* diffusa

Grevillea diffusa ssp. *diffusa* is a shrub to 1.5m, restricted to sandy soils in the Bulli-Appin area. This species was recorded in three locations in the catchment area (KP 709-710, 713.8, 721-722) the latter having resprouted after having been mown.

Guinea-flower Hibbertia calycina

This low shrub is described as rare in New South Wales by Harden (1990). Its preferred habitat is described as woodlands on rocky slopes in the southern tablelands, the ACT and Victoria. *Hibbertia calycina* was recorded in two locations along the proposed pipeline route at KPs 480 & 562.

Pennywort Hydrocotyle sp. aff. tripartita

This robust species of pennywort had leaves to 5 cm in diameter and could not be allocated to any known species in this genus. It is undoubtably an undescribed species and has been previously identified from Benambra in Victoria. It was recorded from two localities along the proposed pipeline route (KP 295.4 & 304.3) and is considered to be of at least state significance.

Prostrate Cone-bush Isopogon prostratus

This prostrate shrub grows in heaths and dry forests and its distribution in New South Wales is restricted to the south east (Harden 1991). The species also occurs in Victoria where Gullan *et al.* (1990) list it as endangered. During this study, the species was recorded from three locations, where it was found within a Proteaceous forest (KP 545) near the Shoalhaven River, in heathy woodland/forest on sandy soils (KP 554) and also along edges of a transmission easement at KP565. In each instance, stands of this taxon were very localised, occurring in distinct patches along the route.

Lacy Wedge-fern Lindsaea microphylla

This delicate, tufted fern was once considered 'rare and very localised' Willis (1970) but has subsequently been widely collected in East Gippsland. Most populations, however, are of only a few individuals with few fronds. The species is still considered rare by Gullan *et al.* (1990) and is also considered significant by Beauglehole (1981), Forbes et al. (1981) and Willis (1982). This species was recorded within a 2 km corridor of the proposed pipeline (Quadrat No. F07805, KP 198) by Mueck *et al.* (1990) and by CNR (FIS Quadrat No. F34210, KP 185.5).

Cluster-headed Mat-rush Lomandra longifolia *ssp.* exilis

This tufted perennial herb has relatively narrow leaves in comparison to sub-species *longifolia* which is common throughout eastern Australia. The sub-species *exilis* is largely restricted within Victoria to areas east of Port Phillip Bay. This taxon is considered rare by CNR (Gullan *et al.* 1990) and was commonly recorded within the 2km corridor of the proposed pipeline (KP 120-140) by Kemp *et al.* (1993).

Prickly Oxylobium Oxylobium ilicifolium

This shrubby, prickly leaved pea grows to a height of 1-3 m in both wet and dry forests from Victoria to Queensland (Harden 1991). While widespread in New South Wales it is at the southern extent of its range in Victoria where Gullan *et al.* (1990) list it as rare. Costermans (1983) suggests the species is common after disturbance, presumably fire, which stimulates germination of its hard seed.

This species was recorded at one location in Victoria, in the Buldah Forest Block, on the Buldah Road, near Buldah Gap (AMG 586700, 691325; KP 254-254.5).

Tangle Orchid Plectorrhiza tridentata

This epiphytic orchid grows in humid situations in fern gullies and rainforest, usually over water (Backhouse and Jeans 1995). This species is considered rare in Victoria by Gullan *et al.* (1990) and is also known from New South Wales and Queensland (Backhouse and Jeans 1995). This species was recorded within a 2km corridor of the proposed pipeline (KP 184.5) by CNR (FIS Quadrat No. C44731).

Dwarf Milkwort Polygala japonica

This perennial herb grows in grassland and grassy woodlands and forests. It has a very restricted distribution in Victoria, where it is largely restricted to East Gippsland, and it is considered vulnerable by (Gullan *et al.* 1990). The species is also known from New South Wales and Queensland (Harden 1992). This species was recorded within the 2km corridor of the proposed pipeline on the Gippsland Coastal Plain (KP 63) by CNR (FIS Quadrat No. F48531) along the railwayline to Bairnsdale.

Slender Mud Grass Pseudoraphis paradoxa

This rhizomatous or stoloniferous grass is known only from a few recent collections from creeks and swamps around Nowa Nowa to the mouth of the Snowy River and from the shores of Lake Glenmaggie near Heyfield and is considered endangered in Victoria by CNR (Gullan *et al.* 1990). An area of Riparian Forest and Riparian Scrub Complex just west of Nowa Nowa is designated a "Special Protection Zone" by CNR (1995) listing the presence of this species as an attribute of that area (AMG 592008,5821922, KP 110-111). The proposed pipeline traverses this area of swamp.

Knawel Scleranthus fascicularis

This prostrate perennial herb is not listed for New South Wales by Harden (1990). As a new record for the state it is considered to be of state significance. *Scleranthus fascicularis* was recorded from two locations along the proposed pipeline route at Kps 380 & 400.

Regionally Significant Taxa

Mitchell's Wattle Acacia mitchellii

This erect or spreading shrub usually grows in dry forest or heath (Harden 1991) and this occurrence is at the western edge of the species distribution in Victoria. Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area. Mitchell's Wattle was recorded at one location during this survey, east of the Perry River, in a patch of Coastal Grassy Forest (KP 33-34).

Mayfly Orchid Acianthus caudatus

This herbaceous, terrestrial orchid occurs in scattered locations across southern Victoria, where it is not particularly common (Backhouse and Jeans 1995). Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area. This species was recorded once within the 2km corridor of the proposed pipeline on the Gippsland Coastal Plain (KP 40) by CNR (FIS Quadrat No. C08001).

Australian Piert Aphanes australiana

This small annual herb is not recorded for the southern tablelands of New South Wales by Harden (1990) and is therefore considered to be of regional significance. *Aphanes australiana* was recorded from one location along the proposed pipeline route at KP 424.

Number Nine Wire-grass Aristida calycina *var.* calycina

This tufted, erect, perennial grass grows on poor or sandy soils in most mainland states (Harden 1993). In Victoria this species was recorded from one location along the proposed pipeline (KP 177.5) and was not recorded by Beauglehole (1981) in his East Gippsland study area. The species is therefore considered to be of regional significance.

Banksia Banksia paludosa

Banksia paludosa grows in woodland or heath of the coast and nearby ranges in New South Wales (Harden 1991). *B. paludosa* was recorded from five locations along the proposed pipeline, all from the extreme western edge of the species range (KP 544, 545, 554, 565, 567). The species may be considered regionally significant.

Hairpin Banksia Banksia spinulosa *var.* spinulosa

Hairpin Banksia often grows in rocky sites on the coast and adjacent ranges (Harden 1991). The species was recorded from two sites along the proposed pipeline (KP 523, 545). *B. spinulosa* var. *spinulosa* would be considered regionally significant on the basis of these disjunct occurrences.

Showy Bossiaea Bossiaea cinerea

This erect or spreading shrub grows on coastal sands in heath or sclerophyll forest from New South Wales to South Australia and Tasmania (Harden 1991). In Victoria, Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area. Showy Bossiaea was recorded in two locations during this survey (KP 4 & 34) and is recorded from one quadrat in CNR's FIS database (C08001) within the proposed pipeline corridor (KP 40).

Bossiaea Bossiaea ensata

This erect or procumbent shrub is not recorded for the southern tablelands of New South Wales by Harden (1991) and is therefore considered to be of regional significance. *Bossiaea ensata* was recorded from one location along the proposed pipeline route at KP 562.

Variable Bossiaea Bossiaea heterophylla

This variable low shrub has a restricted distribution in Victoria where it occurs only in the east. It also occurs in New South Wales and Queensland. The record within the Perry River site of significance (KP 33-34) is considered to be of regional significance by Beauglehole (1985).

Spiny Bossiaea Bossiaea obcordata

This spiny shrub is widely distributed across Victoria but is relatively uncommon throughout its range (Willis 1972). Beauglehole (1981) considered this species to be rare, interesting or restricted in East Gippsland. Spiny Bossiaea was recorded at three locations considered regionally significant along the proposed pipeline route in Victoria (KP 247-255), and in one quadrat record within the proposed 2km corridor by CNR (Quadrat No.C44823; KP 264).

Blue Pincushion Brunonia australis

Blue Pincushion is widespread in woodland and dry forest (Scarlett *et al.* 1992; Harden 1992). This species was twice recorded from *Poa* grasslands of the Monaro Plains (KP 391, 457). The species is considered to be regionally significant in these grasslands communities.

Pale Grass-lily Caesia parviflora

This tufted perennial lily is not recorded for the southern tablelands of New South Wales by Harden (1993) and is therefore considered to be of regional significance. One regionally significant record of *Caesia parviflora* was identified from along the proposed pipeline route at KP 531.

Fitzgerald's Spider Orchid Caladenia fitzgeraldii *(=*Caladenia reticulata *spp. agg.)*

This herbaceous, terrestrial orchid occurs in all eastern mainland states and is an uncommon, poorly known species (Backhouse and Jeans 1995). This species was recorded from two quadrats within the proposed pipeline corridor (KP 253 & 263) by Cherry *et al.* (1986) and was not recorded by Beauglehole (1981) in his East Gippsland study area. The species is therefore considered to be of regional significance.

Bronze Caladenia Caladenia iridescens

This orchid is widespread in Victoria but is generally uncommon (Backhouse and Jeans 1995). Beauglehole (1981 & 85) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland and East Gippsland study areas. *Caladenia iridescens* was recorded along the abandonded railway easement in the Colquhuon State Forest and at KP 242.8.

Early Caladenia Caladenia praecox

This herbaceous, terrestrial orchid is widespread in the eastern half of Victoria but has few records from East Gippsland. This species was recorded from one location within the proposed pipeline corridor (KP 260-264) by Cherry *et al.* (1986) and was not recorded by Beauglehole (1981) in his East Gippsland study area. The species is therefore considered to be of regional significance.

Pennywort Centella cordifolia

Few records of Pennywort exist for New South Wales. This creeping herb occurs mainly in damp places yet the species distribution is poorly known (Harden 1992). *C. cordifolia* was found at two sites along the proposed pipeline (KP 513 and 523), and is considered to be regionally significant.

Flat Spurge Chamaesyce drumondii

This prostrate perennial herb is not recorded for the southern tablelands of New South Wales by Harden (1990) and is therefore considered to be of regional significance. *Chamaesyce drumondii* was recorded from one location along the proposed pipeline route at KP 424.

Windmill Grass Chloris truncata

This tufted, perennial grass occurs in all mainland states except the Northern Territory where it grows in grasslands on heavy soils (Walsh and Entwisle 1994). In Victoria, Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area. Windmill Grass was recorded from one location along the proposed pipeline route (KP 62).

Conospermum Conospermum taxifolium

Usually found in heath and dry sclerophyll woodland on the coast and adjacent ranges (Harden 1991), *Conospermum taxifolium*, was located at a single site growing in heathy woodland near the Shoalhaven River (KP 545). Due to the uncommon occurrence of this species in the region, this record may be considered regionally significant.

Spurred Helmet-orchid Corybas aconitiflorus

This herbaceous, terrestrial orchid occurs in all eastern Australian states where it grows in damp shady areas in association with well drained sands and sandy loams (Backhouse and Jeans 1995). In Victoria the species is confined to the eastern half of the state and is listed by Beauglehole (1981,1984,1985) as rare, interesting or restricted over most of its range. During the present survey, Spurred Helmet-orchid was recorded from seven locations (KP 4, 77.5, 87.5, 112.5, 117, 120 & 145).

Veined Helmet-orchid Corybas dilatatus

This orchid has recently been separated from *Corybas diemenicus*. Veined Helmet-orchid is widespread across southern Victoria where it grows in cool damp forests and coastal scrubs. *Corybas diemenicus* was considered by Beauglehole (1981) to be rare, interesting or restricted in East Gippsland. Veined Helmet-orchid was recorded once within the 2km corridor of the proposed pipeline (KP 268) by Cherry *et al.* (1986) (FIS Quadrat No. C44838).

Wetland Wallaby-grass Danthonia semiannularis

This tufted perennial grass occurs in damp sites on alluvial soils and is widespread in Victoria south of the dividing range (Walsh and Entwisle 1994). *Danthonia semiannularis* was considered by Beauglehole (1985) to be rare, interesting or restricted in his Gippsland Lakes Hinterland study area. This species was recorded once during this survey, in the Bridle Creek site of significance at KP 96.

Forest Bent-grass Deyeuxia frigida

This tufted, perennial grass occurs occasionally in tall montane forests and sub-alpine woodlands in eastern Victoria and also in New South Wales (Walsh and Entwisle 1994). In Victoria, Beauglehole (1981) lists this species as rare, interesting or restricted in his East Gippsland study area. Forest Bent-grass was recorded once within the 2km corridor of the proposed pipeline (KP 266) by Cherry *et al.* (1986).

Bog Bent-grass Deyeuxia gunniana

This tufted, perennial grass occurs occasionally in *Sphagnum* bogs or broad gullies of eastern mainland states (Walsh and Entwisle 1994). In Victoria, Beauglehole (1981) lists this species as rare, interesting or restricted in his East Gippsland study area. Bog Bent-grass was recorded once within the 2km corridor of the proposed pipeline (KP 271) by Cherry *et al.* (1986).

Large-leaf Hop-bush Dodonaea triquetra

This tall, erect shrub occurs in all eastern mainland states and grows in dry or wet forest usually on sandy soils (Harden 1991). Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area. In Victoria, two regionally significant records of Large-leaf Hop-bush were recorded along the proposed pipeline route (KP 105.5 & 112.5).

Sticky Hop-bush Dodonaea viscosa

This variable shrub occurs in all states and grows in a wide variety of environments (Harden 1991). Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area. In Victoria, one regionally significant occurrance of Sticky Hop-bush was recorded along the proposed pipeline route (KP 112.5).

Apple-topped Box Eucalyptus angophoroides

This tree is largely restricted to coastal areas of eastern Victoria and southern New South Wales. Beauglehole (1981, 1985) records it as a rare, interesting or restricted species in East Gippsland and did not record it in his Gippsland Lakes Hinterland study area. Apple-topped Box was recorded on 18 occasions along the proposed pipeline route (KP 76-243) and in up to 16 quadrats within the proposed 2km pipeline corridor by Brown *et al.* (1987) and Kemp *et al.* (1993) (KP 220-225 & 120-140).

Swamp Stringybark Eucalyptus conspicua

This small tree grows on poorly drained coastal sands between Wilsons Promontory and Narrabarba (southern NSW) in small scattered populations. Hill and Johnson (1991) rate the species as rare but not threatened. The species is not recorded by Beauglehole (1981) in his East Gippsland study area but is considered regionally significant by Bramwell *et al.* (1993). Swamp Stringybark was recorded once along the proposed pipeline route (KP 127-129) and in three quadrats within the proposed 2km pipeline corridor by Bramwell *et al.* (1993) and Kemp *et al.* (1993) (KP 125-145).

Brittle Gum Eucalyptus mannifera

This small to medium-sized tree is common in the New South Wales tableland regions and in north-east Victoria where it generally grows on poor shallow soils. The species is not considered regionally significant by Beauglehole (1985) in his Gippsland Lakes Hinterland study area. The Colquhoun State Forest, however, is the southern extent of this species' range (Costermans 1983) and its occurrence in Lowland Forest is ecologically unusual (KP 100-103). Its occurrence here is therefore considered to be of regional significance.

Mallee Eucalyptus multicaulis

A small stand of *Eucalyptus multicaulis* was recorded at KP 601 in association with two individuals of *Eucalyptus langleyi*. This mallee species is described by Harden (1991) as restricted but locally frequent in its distribution. The Budawang Ranges are the southern limit of this species.

Forest Red Gum Eucalyptus tereticornis

This large tree has only recently been taxonomically separated from River Red Gum *Eucalyptus camaldulensis* and its name will probably alter again in the near future. At present the species occurs in all eastern mainland states where it grows on soils of medium to high fertility in a woodland or forest formation. In Victoria the species is at the southern extent of its range (Boland *et al.* 1984), has a restricted distribution and the community dominated by this species has been substantially cleared. Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area (listed as *Eucalyptus camaldulensis*). Forest Red Gum was recorded twice along the proposed pipeline route (KP 7-12 & 47-57) and in three CNR quadrats (F48504, F48505 & F48506) within the proposed 2km pipeline corridor by (KP 39-40).

Tight Bedstraw Galium curvihirtum

This perennnial, straggling herb is a relatively recently described species and is currently considered to be uncommon. The species is not recorded by Beauglehole (1981) in his East Gippsland study area but is considered regionally significant by Kemp *et al.* (1993). Tight Bedstraw was recorded in three quadrats within the proposed 2km pipeline corridor by Kemp *et al.* (1993) (KP 135-143).

Red-stem Cranesbill Geranium neglectum

This herb has a restricted distribution in Victoria and is confined to East Gippsland (Willis 1972, Beauglehole (1981) where it occurs in swamps and along streams. This species was recorded in a swamp on Reed Bed Creek just north of the Princess Highway by Brown *et al.* (1987)(KP 222.5).

Small Waxlip Orchid Glossodia minor

This slender terrestrial orchid is not recorded for the southern tablelands of New South Wales by Harden (1993) and is therefore considered to be of regional significance. *Glossodia minor* was recorded from one location along the proposed pipeline route at KP 554.

Red Wedge Pea Gompholobium uncinatum

Red Wedge Pea is a small decumbent shrub often distinguished by purplish-colored leaves and red-orange flowers (Harden 1991). A confirmed record of this species along the proposed pipeline route would result in a broad extension of the species range to the south. The Red Wedge Pea was located at the KP 545 and 567, growing in sandy soils and is thus considered to be regionally significant.

Hakea Hakea eriantha

Hakea eriantha is a tall shrub found growing in wet sclerophyll and woodland along the coast and escarpment ranges, south of the Budawang Range (Harden 1991). This species was located at KP 545 near the Shoalhaven River, extending the species range to the west. *H. eriantha* is thus considered to be regionally significant.

Guinea Flower Hibbertia linearis

Hibbertia linearis is a medium shrub which is widespread in heath and dry sclerophyll forest (Harden 1991). However, the species was not recorded from the southern tablelands before this current study where isolated specimens were located near the Shoalhaven River (KP 545). The species is considered to be regionally significant.

Guinea Flower Hibbertia rufa

This wiry shrub with long trailing stems is not recorded for the southern tablelands of New South Wales by Harden (1990) and is therefore considered to be of regional significance. While widespread the species is also described as uncommon, prefering sedgelands and heath environments. *Hibbertia rufa* was recorded from one location along the proposed pipeline route at KP 568.

Silky Guinea-flower Hibbertia sericea

This errect shrub occurs in all mainland states where it is widespread in heath and open woodlands on sandy or silty soils. In Victoria the species is also widespread, while Beauglehole (1981) lists this species as rare, interesting or restricted in his East Gippsland study area. Two CNR quadrats records (C07010 & C07018) exist within the proposed 2km pipeline corridor (KP 109-110).

Blady Grass Imperata cylindrica *var* major

This broad-leaf, rhizomatous perennial grass is not recorded for the southern tablelands of New South Wales by Harden (1993) and is therefore considered to be of regional significance. One regionally significant record of *Imperata cylindrica* var *major* was identified from along the proposed pipeline route at KP 545.

Beard Heath Leucopogon ?appressus

Ususally found in heath or dry sclerophyll forest around Sydney (Harden 1992), *Leucopogon ?appressus* was located at three sites along the proposed pipeline route (KP 545, 534, 508) growing in rocky soils. These disjunct occurrences extend the species range to the south, thus the species is considered to be of regional significance.

Mat-rush Lomandra elongata

This perennial tussock is not recorded for the southern tablelands of New South Wales by Harden (1990) and is therefore considered to be of regional significance. *Lomandra elongata* was recorded from two locations along the proposed pipeline route at KPs 508 & 545.

Mat-rush Lomandra hystrix

Found growing near streams on sandy soils, *Lomandra hystrix* is a large tussock-forming Mat-rush distinguished by an acute leaf tip exhibiting 2-4 lateral teeth. The species is commonly found north of Taree on the North Coast of New South Wales (Harden 1993). A single record of *L. hystrix* along the pipeline route (KP 566) extends the range of the species several hundreds of kilometres to the south. The record must be considered as regionally significant.

Red-flowered Lotus Lotus cruentus

The Red-flowered Lotus was located on the banks of Jacksons Bog (KP 286.6) and again at KP 380. Although *L. cruentus* is widespread and found growing in various communities from floodplains to sandplains, this record extends the range of the species to include the southern tablelands.

Bushy Club-moss Lycopodium deuterodensum

This multi-stemmed, erect clubmoss occurs in all eastern states and South Australia (Harden 1990). The record within the Perry River site of significance (KP 33-34) is considered to be of regional significance by Beauglehole (1985).

Red-beaks Lyperanthus nigricans

This robust terrestrial orchid is not recorded for the southern tablelands of New South Wales by Harden (1993) and is therefore considered to be of regional significance. One regionally significant record of *Lyperanthus nigricans* was identified from along the proposed pipeline route at KP 514.

Broad-leaf Stinkweed Opercularia ovata

This prostrate herb is widespread in southern Victoria and also occurs in South Australia, New South Wales and Tasmania (Willis 1972). Beauglehole (1981) lists this species as rare, interesting or restricted in his East Gippsland study area. Broad-leaf Stinkweed was recorded twice along the proposed pipeline route (KP 196 & 228) and in four CNR quadrats within the proposed 2km pipeline corridor (KP 184-186).

Wedge-leaf Everlasting Ozothamnus cuneifolius

This robust shrub is restricted in New South Wales to the South Coast and is therefore considered to be of atleast regional significance (Harden 1990). One regionally significant record of *Ozothamnus cuneifolius* was identified from along the proposed pipeline route at KP 274. This represents an extension of the known range of this species in New South Wales to include the southern tablelands region.

Conesticks Petrophile canescens

Conesticks *Petrophile canescens*, a proteaceous shrub, grows in heaths and dry sclerophyll forest on deep sandy soils to the north of Nerriga (Harden 1991). Along the proposed pipeline route, a stand of *P. canescens* was located near the Shoalhaven River (KP 545) about 30 kilometres south-west of Nerriga. The record is considered to be regionally significant.

Poison Rice-flower Pimelea pauciflora

This erect shrub is restricted in New South Wales to the southern tablelands south of Queanbeyan and is therefore considered to be of at least regional significance (Harden 1990). *Pimelea pauciflora* was recorded from one location along the proposed pipeline route at KP 352.8.

Sword Tussock-grass Poa ensiformis

This robust, loosely tufted, rhizomatous perennial grass is widely distributed in mountain forests east of Kinglake in Victoria (Walsh and Entwisle 1994). The record within the Bridle Creek site of significance (KP 95-98.5) is considered to be of regional significance by Beauglehole (1985).

Pomaderris Pomaderris *species A*

This shrub to small tree is restricted to the southern tablelands of New South Wales and is therefore considered to be of at least regional significance(Harden 1990). *Pomaderris* species A was recorded from one location along the proposed pipeline route at KP 557.

Hairy Mint-bush Prostanthera hirtula

This aromatic shrub occurs in Victoria and New South Wales. It is widely scattered through the southern half of Victoria but is uncommon (Willis 1972). Beauglehole (1981) lists this species as rare, interesting or restricted in his East Gippsland study area. Hairy Mint-bush was recorded twice along the proposed pipeline route (KP 122.5 & 129) and in two quadrats within the proposed 2km pipeline corridor by Kemp *et al.* (1993) (KP 122-132).

Rusty-hood Pterostylis *aff.* rufa

This reddish brown terrestrial orchid has flower stems to 30 cm tall. It is a poorly known, widespread taxon that is apparently uncommon (Backhouse and Jeans 1995). Beauglehole (1981) lists this taxon as rare, interesting or restricted in East Gippsland. It was recorded from one site near the intersection of Reed Bed Road and Box Ridge Track in the Noorinbee Forest Block by Brown *et al.* (1985) (KP 224).

Bentham's Bush-pea Pultenaea benthamii

This erect shrub generally grows in dry forest communities in Victoria and New South Wales (Harden 1991). In Victoria, Beauglehole (1981) lists this species as rare, interesting or restricted in his East Gippsland study area. Bentham's Bush-pea was recorded in one quadrat within the proposed 2km pipeline corridor by Forbes *et al.* (1981) (KP 82).

Halo Bush-pea Pultenaea linophylla

This erect to prostrate shrub grows in dry forest communities in Victoria and New South Wales (Harden 1991). Beauglehole (1981, 1985) lists this species as rare, interesting or restricted in his East Gippsland and Gippsland Lakes Hinterland study areas. Halo Bush-pea was recorded at five locations along the proposed pipeline route (KP 99-100, 126-130, 172, 181, & 192) and in ten quadrats within the proposed 2km pipeline corridor by Brown *et al.* (1987), Bramwell *et al.* (1993) and Kemp *et al.* (1993).

Soft Bush-pea Pultenaea mollis

This variable shrub is widespread in southern Victoria. Beauglehole (1985) lists this species as rare, interesting or restricted in his Gippsland Lakes Hinterland study area. Two regionally significant occurrences of Soft Bush-pea were recorded along the proposed pipeline route (KP 35 & 87).

Narrow Groundsel Senecio tenuiflorus

Senecio tenuiflorus is an erect annual herb which grows in disturbed sites and open woodland of the North Coast and Central Tablelands (Harden 1992). The species was recorded twice along the pipeline route (KP 566, 577), indicating *S. tenuiflorus* to be regionally significant due to this notable extension of its range to the south.

Vittadinia Vittadinia sulcata

Vittadinia sulcata is a widespread annual herb which occurs on sandy and clay loam soils beside rivers of the coast and inland slopes of New South Wales (Harden 1992). A single record of the species from the Shoalhaven River (KP 557) is the first known for the Southern Tablelands, and is thus considered regionally significant.

One-flower Early Nancy Wurmbea uniflora

This herbaceous lily is an uncommon species which generally grows in moist, heathy lowland sites from New South Wales to South Australia and Tasmania (Walsh and Entwisle 1994). In Victoria, Beauglehole (1981, 1984 & 1985) does not record this species but it is considered regionally significant by Kemp *et al.* (1993). One-flower Early Nancy was recorded in five quadrats within the proposed 2km pipeline corridor by Cherry *et al.* (1986) (KP 252-266).

Regionally Significant Species in the Morton Plateau & Slopes, Illawarra Coastal Plains and Wilton Tablelands Segments

QEM (1995) identified 78 species occurring in the West Dapto area which, although not nationally rare, have a limited local occurrence . The following species from this list were recorded in the proposed easement between Albion Park and Farmborough Heights:

Ajuga australis	Austral Bugle
Daviesia genistifolia	Broom Bitter-pea
Eucalyptus bosistoana	Coast Grey Box
Hydrocotyle peduncularis	Pennywort.
Leptospermum squarrosum	Tea-tree
Lespedeza juncea subsp sericea	Lespedeza
Marsdenia rostrata	Milk-vine
Melaleuca linariifolia	Honey-myrtle
Pomaderris aspera	Hazel Pomaderris
Zornia dyctiocarpa	Zornia

Proust (undated) listed 114 native species occurring along the banks of Charcoal Creek. Several species recorded have conservation significance, including *Cynanchum elegans*. Species recorded having regional conservation significance include :

Geijera latifolia, a small tree which generally occurs on volcanic soils in dry rainforest and reaches its southern limit at Berry (Mills 1988). Several specimens were recorded close to the proposed easement, near the Charcoal Creek crossing and also near the American Creek crossing.

Sicyos australis, a trailing herb and *Passiflora cinnabarina* a slender climber; *Alyxia ruscifolia,* an erect shrub occurring in rainforest. Wollongong is its southern limit (Harden 1992). *Sicyos australis*, *Passiflora cinnabarina* and *Alyxia ruscifolia* were not recorded in or near the proposed easement.

Mills (1988 & 1989) and Mills & Jakeman (1995) have considered regional conservation of rainforest species that occur at their geographic limit in the Illawarra region. Several specimens of Native Holly *Alchornea ilicifolia* were recorded on steep rocky slopes in regrowth forest to the north of Jamberoo. Kiama is the southern limit of this species. One young specimen of Illawarra Flame Tree *Brachychiton acerifolius* was recorded at the foot of the cliffs on the northern bank of the Shoalhaven River, the southern limit of this species. It is, however, possible that this individual was planted, as it occurs on the margin between native vegetation and formed gardens. Native Cascarilla *Croton verreauxii* is a common occurrence along some sections of the proposed easement along the upper slopes of Foxground. Foxground is the southern limit of this species (Mills & Jakeman 1995). Native Hibiscus *Hibiscus heterophyllus* was recorded in remnant stands of closed forest to the north of Jamberoo. Kiama is the southern limit of this species. Snow Wood *Pararchidendron pruinosum,* Hairy-leaved Doughwood *Melicope micrococca*, Black Apple *Planchonella australis* and *Trochocarpa laurina* were recorded in closed forest at Foxground. Shoalhaven River is the southern limit of these species. Peperomia *Peperomia leptostachya* was recorded at the foot of the cliff on the north side of the Shoalhaven River, this species' limit.

Mills (1992) and CALM (1994) list several species that have a restricted distribution in the Morton Plateau and Slopes segment. Dampiera *Dampiera scottiana* generally grows as understorey in scribbly-gum woodland. This species was recorded near the edge of the road south of HMAS Albatross and also in woodland near the proposed easement at North Nowra. The spring survey identified more individuals at KP 638.5 and near the tip at 636. Dwarf Bottlebrush *Callistemon subulatus*, a spreading shrub that generally grows along creek-banks was recorded near 063, close to the eastern edge of the new road alignment. Budawang Ash *Eucalyptus dendromorpha* has a restricted distribution, but is generally locally abundant (Harden 1991). This species is common in some rocky sections of Morton National Park. Near Tianjara Falls there are hybrid swarms of *E. dendromorpha* and Blue Mountain Ash *E. stricta*. The Nowra area is the north-east limit of the distribution of Stringybark *Eucalyptus imitans* (Harden 1991). This species was recorded in woodland near the north and south banks of the Shoalhaven River.

Appendix 1A:

Listing, in family order, of vascular plants recorded within the entire two kilometre pipeline corridor

Where there is a taxonomic conflict in nomenclature between the authorities used for Victoria and New South Wales, species and families are listed as in the various volumes of the Flora of Australia.

GYMNOSPERMS

Cupressaceae		
	Callitris endlicheri	Black Cypress Pine
	Callitris rhomboidea	Port Jackson Pine
Pinaceae		
	**Pinus radiata*	Radiata Pine
Podocarpaceae		
	Podocarpus elatus	Plum Pine

FERNS AND FERN ALLIES

Adiantaceae		
	Adiantum aethiopicum	Common Maidenhair
	Adiantum formosum	Giant Maidenhair
	Adiantum hispidulum	Rough Maidenhair
	Cheilanthes austrotenuifolia	Green Rock Fern
	Pellaea falcata var. *falcata*	Sickle Fern
	Pteris tremula	Tender Brake
Aspleniaceae		
	Asplenium bulbiferum ssp. *gracillimum*	Mother Spleenwort
	Asplenium flabellifolium	Necklace Fern
	Asplenium spp.	
	Pleurosorus rutifolius	
Athyriaceae		
	Allantodia australis	Austral Lady-fern
	Diplazium australe	
Azollaceae		
	Azolla filiculoides var. *rubra*	
	Azolla pinnata	
Blechnaceae		
	Blechnum cartilagineum	Gristle Fern
	Blechnum minus	Soft Water-fern
	Blechnum nudum	Fishbone Water-fern
	Blechnum patersonii	Strap Water-fern
	Blechnum penna-marina	Alpine Water Fern
	Blechnum wattsii	Hard Water-fern
	Doodia aspera	
	Doodia media ssp. *australis*	Common Rasp-fern
Cyatheaceae		
	Cyathea australis	Rough Tree-fern
	Cyathea australis s.l.	Rough Treefern
	Cyathea leichhardtiana s.l.	Prickly Treefern
Davalliaceae		
	Arthropteris tenella	
	Davallia pyxidata	Hare's Foot Fern
Dennstaedtiaceae		
	Dennstaedtia davallioides	Lacy Ground-fern
	Histiopteris incisa	Bat's Wing Fern
	Hypolepis glandulifera	Downy Ground-fern
	Hypolepis muelleri	Marsh Ground-fern
	Hypolepis rugosula	Ruddy Ground-fern
	Hypolepis spp.	Ground-fern
	Pteridium esculentum	Austral Bracken
Dicksoniaceae		
	Calochlaena dubia	Common Ground-fern
	Dicksonia antarctica	Soft Tree-fern

Dryopteridaceae		
	Lastreopsis acuminata	Shiny Shield-fern
	Polystichum proliferum	Mother Shield-fern
	Rumohra adiantiformis	Leathery Shield-fern
Gleicheniaceae		
	Gleichenia dicarpa	Pouched Coral-fern
	Gleichenia microphylla	Scrambling Coral-fern
	Sticherus flabellatus	Umbrella Fern
	Sticherus lobatus	Spreading Shield Fern
	Sticherus tener	Silky Fan-fern
Grammitidaceae		
	Ctenopteris heterophylla	Gipsy Fern
	Grammitis billardieri	Common Finger-fern
Hymenophyllaceae		
	Hymenophyllum cupressiforme	Common Filmy Fern
	Hymenophyllum rarum	Narrow Filmy Fern
	Polyphlebium venosum	Veined Bristle-fern
Lindsaeaceae		
	Lindsaea linearis	Screw Fern
	Lindsaea microphylla	Lacy Wedge Fern
Lycopodiaceae		
	Lycopodium deuterodensum	Bushy Clubmoss
	Lycopodium lateralis	Slender Clubmoss
Ophioglossaceae		
	Ophioglossum lusitanicum	Austral Adder's-tongue
	Ophioglossum lusitanicum ssp. *coriaceum*	Adder's Tongue
Osmundaceae		
	Todea barbara	Austral King-fern
Polypodiaceae		
	Microsorum pustulatum	Kangaroo Fern
	Microsorum scandens	Fragrant Fern
	Pyrrosia rupestris	Rock Felt Fern
Psilotaceae		
	Tmesipteris obliqua	Long Fork-fern
	Tmesipteris parva	Small Fork-fern
	Tmesipteris spp.	Fork-fern
Schizaeaceae		
	Schizaea asperula	Rough Comb-fern
	Schizaea bifida	Forked Comb Fern
Selaginellaceae		
	Selaginella uliginosa	Swamp Selaginella
Sinopteridaceae		
	Cheilanthes distans	Bristly Cloak Fern
	Cheilanthes sieberi ssp. *sieberi*	
Zamiaceae		
	Macrozamia communis	
MONOCOTYLEDONS		
Alismataceae		
	Alisma plantago-aquatica	Water Plantain
Araceae		
	Gymnostachys anceps	Settler's Flax
	**Zantedeschia aethiopica*	White Arum Lily

Araceae		
	Gymnostachys anceps	Settler's Flax
Arecaceae		
	Livistona australis	Cabbage Palm
Asparagaceae		
	**Myrsiphyllum asparagoides*	Florist's Smilax
Centrolepidaceae		
	Centrolepis fascicularis	Tufted Centrolepis
	Centrolepis strigosa ssp. *strigosa*	Hairy Centrolepis
Commelinaceae		
	Aneilema acuminatum	
	Commelina cyanea	
	Pollia crispata	
Cyperaceae		
	Baumea acuta	Pale Twig-sedge
	Baumea arthrophylla	Fine Twig-sedge
	Baumea gunnii	Slender Twig-sedge
	Baumea rubiginosa	
	Baumea rubiginosa s.s.	Soft Twig-sedge
	Baumea spp.	
	Baumea tetragona	Square Twig-sedge
	Carex appressa	Tall Sedge
	Carex bichenoviana	Sedge
	Carex breviculmis	Short-stem Sedge
	Carex fascicularis	Tassel Sedge
	Carex gaudichaudiana	Fen Sedge
	Carex inversa	Common Sedge
	Carex inversa var. *parvula*	Common Sedge
	Carex longebrachiata	Bergalia Tussock
	Carex spp.	Sedge
	Carex tereticaulis	
	Caustis flexuosa	Curly-wig
	Caustis pentandra	Thick Twist-rush
	Caustis recurvata	
	Cyathochaeta diandra	
	**Cyperus congestus*	Dense Flat-sedge
	Cyperus difformis	
	**Cyperus eragrostis*	Drain Flat-sedge
	Cyperus gunnii ssp. *gunnii*	
	Cyperus lucidus	Leafy Flat-sedge
	Cyperus polystachyos	
	Cyperus spp.	
	Eleocharis acuta	Common Spike-sedge
	Eleocharis gracilis	Slender Spike-sedge
	Eleocharis pusilla	
	Eleocharis sphacelata	Tall Spike-sedge
	Gahnia clarkei	Tall Saw-sedge
	Gahnia filifolia	
	Gahnia melanocarpa	Black-fruit Saw-sedge
	Gahnia radula	Thatch Saw-sedge
	Gahnia sieberiana	Red-fruit Saw-sedge
	Gahnia subaequiglumis	
	Gymnoschoenus sphaerocephalus	
	Isolepis fluitans	Floating Club-sedge
	Isolepis habra	Wispy Club-sedge
	Isolepis inundata	Swamp Club-sedge
	Isolepis marginata	Little Club-sedge
	Isolepis nodosa	Knobby Club-sedge
	Isolepis platycarpa	
	Isolepis spp.	
	Isolepis subtilissima	Club-sedge
	Lepidosperma concavum	Sand-hill Sword-sedge
	Lepidosperma elatius	
	Lepidosperma filiforme	Common Rapier-sedge
	Lepidosperma gunnii	
	Lepidosperma laterale	Variable Sword-sedge
	Lepidosperma laterale var. *laterale*	Variable Sword-sedge
	Lepidosperma laterale var. *majus*	Variable Sword-sedge
	Lepidosperma limicola	
	Lepidosperma longitudinale	Pithy Sword-sedge
	Lepidosperma neesii	Stiff Rapier-sedge
	Lepidosperma spp.	
	Lepidosperma tortuosum	
	Lepidosperma urophorum	Tailed Rapier-sedge
	Lipocarpha microcephala	Button Rush
	Ptilanthelium deustum	

	Schoenoplectus validus	
	Schoenus apogon	Common Bog-sedge
	Schoenus brevifolius	Zig-zag Bog-sedge
	Schoenus ericetorum	
	Schoenus evansianus	
	Schoenus maschalinus	Leafy Bog-sedge
	Schoenus melanostachys	
	Schoenus tenuissimus	Slender Bog-sedge
	Schoenus turbinatus	
	Tetraria capillaris	Hair-sedge
Haemodoraceae		
	Haemodorum corymbosum	
	Haemodorum planifolium	
Hydrocharitaceae		
	Vallisneria spp.	
Hypoxidaceae		
	Hypoxis hygrometrica	Golden Weather-grass
Iridaceae		
	Diplarrena moraea	Butterfly Flag
	**Freesia hybrid*	Freesia
	Libertia paniculata	
	Patersonia fragilis	Short Purple-flag
	Patersonia glabrata	Leafy Purple-flag
	Patersonia occidentalis	Long Purple-flag
	Patersonia sericea	
	Patersonia spp.	
	**Romulea rosea*	Common Onion-grass
	Watsonia spp.	
Juncaceae		
	Juncus alexandri	
	Juncus amabilis	
	**Juncus articulatus*	Jointed Rush
	Juncus australis	Austral Rush
	Juncus bufonius	Toad Rush
	**Juncus bulbosus*	
	Juncus continuus	
	Juncus falcatus	
	Juncus filicaulis	
	Juncus flavidus	
	Juncus gregiflorus	Green Rush
	Juncus homalocaulis	
	Juncus laeviusculus	
	Juncus pallidus	Pale Rush
	Juncus pauciflorus	Loose-flower Rush
	Juncus planifolius	
	Juncus prismatocarpus	Branching Rush
	Juncus sarophorus	
	Juncus spp.	Rush
	Juncus subsecundus	
	Juncus usitatus	
	Juncus vaginatus	
	Luzula densiflora	
	Luzula flaccida Form A	
	Luzula meridionalis	
	Luzula meridionalis var. *flaccida*	Common Woodrush
	Luzula meridionalis var. *densiflora*	Common Woodrush
	Luzula spp.	
Juncaginaceae		
	Triglochin procerum	Water Ribbons
	Triglochin rheophilum	Water-ribbons
	Triglochin spp.	Water-ribbons
	Triglochin striatum	Streaked Arrow-grass
Lemnaceae		
	Spirodela punctata	
Lilaeaceae		
	**Narcissus* spp.	Daffodil

Liliaceae		
	Arthropodium milleflorum	Pale Vanilla-lily
	Arthropodium minus	
	Arthropodium spp.	
	Arthropodium strictum	Chocolate-lily
	Bulbine bulbosa	Native Leek
	Burchardia umbellata	Milkmaids
	Caesia calliantha	Blue Grass-lily
	Caesia parviflora	Pale Grass-lily
	Dianella caerulea	
	Dianella caerulea var. *caerulea*	Paroo Lily
	Dianella longifolia	Pale Flax-lily
	Dianella longifolia var. *longifolia*	
	Dianella revoluta	Black-anther Flax-lily
	Dianella spp.	
	Dianella tasmanica	Tasman Flax-lily
	Drymophila cyanocarpa	Turquoise Berry
	Laxmannia gracilis	
	**Myrsiphyllum asparagoides*	Smilax Asparagus
	Sowerbaea juncea	Rush Lily
	Stypandra glauca	Nodding Blue Lily
	Thelionema caespitosum	Tufted Lily
	Thysanotus juncifolius	
	Thysanotus patersonii	Twining Fringe-lily
	Thysanotus tuberosus	Common Fringe-lily
	Tricoryne elatior	Yellow Rush-lily
	Wurmbea dioica ssp. *dioica*	Common Early Nancy
	Wurmbea uniflora	One-flower Early Nancy
Luzuriagaceae		
	Eustrephus latifolius	Wombat Berry
	Geitonoplesium cymosum	Scrambling Lily
Orchidaceae		
	Acianthus caudatus	Mayfly Orchid
	Acianthus exsertus/pusillus	Tiny Gnat Orchid
	Acianthus fornicatus	Pixie Caps
	Acianthus pusillus	Tiny Gnat Orchid
	Arthrochilus huntianus	Elbow Orchid
	Caladenia caerulea	Blue Caladenia
	Caladenia carnea	Pink Fairy
	Caladenia carnea spp. agg.	Pink Fingers Caladenia
	Caladenia carnea var. *carnea*	Pink Fingers Caladenia
	Caladenia catenata	White Caladenia
	Caladenia dilatata spp. agg.	Green-comb Spider-orchid
	Caladenia filamentosa	Daddy Long-legs Orchid
	Caladenia gracilis	Musky Caladenia
	Caladenia iridescens	Bronze Caladenia
	Caladenia phaeoclavia	Brown-clubbed Spider-orchid
	Caladenia praecox	Early Caladenia
	Caladenia reticulata spp. agg.	Veined Spider-orchid
	Caladenia spp.	Caladenia
	Caleana major	Large Duck-orchid
	Calochilus imberbis	Shaved Beard-orchid
	Calochilus paludosus	Red Beard Orchid
	Calochilus robertsonii	Purplish Beard-orchid
	Chiloglottis reflexa	Autumn Bird-orchid
	Chiloglottis spp.	
	Chiloglottis valida	Common Bird-orchid
	Corybas aconitiflorus	Spurred Helmet-orchid
	Corybas diemenicus	Veined Helmet-orchid
	Corybas fimbriatus	Fringed Helmet-orchid
	Corybas spp.	Helmet-orchid
	Cryptostylis erecta	Tartan Tongue Orchid
	Cryptostylis leptochila	Small Tongue-orchid
	Cryptostylis spp.	Tongue-orchid
	Cryptostylis subulata	Large Tongue Orchid
	Cymbidium suave	Snake Orchid
	Cyrtostylis reniformis	Mosquito Orchid
	Dendrobium linguiforme	Tongue Orchid
	Dipodium punctatum	Hyacinth Orchid
	Dipodium spp.	Hyacinth Orchid
	Diuris corymbosa	Wallflower Donkey Orchid
	Diuris lanceolata	Snake Orchid
	Diuris maculata	Spotted Doubletail
	Diuris pardina	Leopard Orchid
	Diuris punctata var. *punctata*	
	Diuris spp.	
	Diuris sulphurea	Tiger Orchid
	Eriochilus cucullatus	
	Glossodia major	Waxlip Orchid
	Glossodia minor	Small Waxlip Orchid
	Glossodia spp.	Wax-lip Orchid

	Liparis reflexa	
	Lyperanthus nigricans	Red-beaks
	Lyperanthus suaveolens	Brown-beaks
	Microtis ?unifolia	Common Onion Orchid
	Microtis parviflora	Slender Onion-orchid
	Microtis spp.	
	Orthoceras strictum	Horned Orchid
	Plectorrhiza tridentata	Tangle Orchid
	Prasophyllum brevilabre	Short-lip Leek-orchid
	Pterostylis aff. *rufa*	Rusty-hood
	Pterostylis bicolor	
	Pterostylis concinna	Trim Greenhood
	Pterostylis curta	Blunt Greenhood
	Pterostylis furcata	Sickle Greenhood
	Pterostylis grandiflora	Cobra Greenhood
	Pterostylis longifolia	Tall Greenhood
	Pterostylis longifolia s.l.	Tall Greenhood
	Pterostylis mutica	Midget Greenhood
	Pterostylis nutans	Nodding Greenhood
	Pterostylis parviflora s.s.	Tiny Greenhood
	Pterostylis spp.	Greenhood
	r *Pterostylis longipetala*	Small Autumn Greenhood
	Sarcochilus australis	Butterfly Orchid
	Spiranthes sinensis ssp. *australis*	Ladies' Tresses
	Thelymitra carnea	Tiny Sun Orchid
	Thelymitra ixioides var. *ixioides*	Dotted Sun Orchid
	Thelymitra media	Tall Sun-orchid
	Thelymitra pauciflora	Slender Sun Orchid
	Thelymitra spp.	Sun-orchid
Poaceae		
	Agrostis avenacea	Common Blown Grass
	Agrostis avenacea var. *avenacea* s.l.	
	Agrostis avenacea var. *perennis*	Blown-grass
	**Agrostis capillaris*	Brown-top Bent
	**Agrostis capillaris* s.l.	Browntop Bent
	Agrostis spp.	
	Agrostis venusta s.l.	Graceful Bent
	**Aira caryophyllea*	Silvery Hair-grass
	**Aira elegans*	Elegant Hair-grass
	**Aira elegantissima*	Delicate Hairgrass
	**Aira praecox*	Early Hairgrass
	Aira spp.	Hair-grass
	**Alopecurus pratensis*	Meadow Fox-tail
	Amphipogon strictus var. *strictus*	Greybeard Grass
	**Andropogon virginicus*	Whisky Grass
	Anisopogon avenaceus	Oat Speargrass
	**Anthoxanthum odoratum*	Sweet Vernal-grass
	Aristida calycina var. *calycina*	Number Nine Wire-grass
	Aristida ramosa	
	Aristida spp.	
	Aristida vagans	Threeawn Speargrass
	**Avena sativa*	Oats
	**Axonopus affinis*	Narrow-leaved Carpet-grass
	Bothriochloa macra	Red Grass
	**Briza maxima*	Large Quaking-grass
	**Briza minor*	Lesser Quaking-grass
	**Bromus catharticus*	Prairie Grass
	**Bromus hordeaceus*	Soft Brome
	**Bromus molliformis*	Soft Brome
	Chionochloa pallida	Silvertop Wallaby-grass
	Chloris truncata	Windmill Grass
	Cymbopogon refractus	Barbed Wire Grass
	Cymbopogon spp.	
	Cynodon dactylon	Couch
	**Cynodon dactylon* var. *dactylon*	Couch
	**Dactylis glomerata*	Cocksfoot
	Danthonia caespitosa	Ringed Wallaby Grass
	Danthonia eriantha	
	Danthonia geniculata	Kneed Wallaby-grass
	Danthonia laevis	
	Danthonia linkii	
	Danthonia linkii var. *linkii*	Wallaby Grass
	Danthonia longifolia	Longleaf Wallaby Grass
	Danthonia nudiflora	
	Danthonia penicillata	Slender Wallaby Grass
	Danthonia pilosa	Velvet Wallaby-grass
	Danthonia pilosa var. *pilosa*	Smooth-flower Wallaby Grass
	Danthonia racemosa	
	Danthonia racemosa var. *racemosa*	Stiped Wallaby-grass
	Danthonia semiannularis	Wetland Wallaby-grass
	Danthonia setacea	Bristly Wallaby-grass
	Danthonia spp.	Wallaby-grass
	Danthonia tenuior	
	Deyeuxia contracta	Compact Bent-grass

Deyeuxia densa	Heath Bent-grass
Deyeuxia frigida	Forest Bent-grass
Deyeuxia gunniana	Bog Bent-grass
Deyeuxia monticola var. *monticola*	Mountain Bent-grass
Deyeuxia quadriseta	Reed Bent-grass
Deyeuxia rodwayi	Tasman Bent-grass
Deyeuxia scaberula	Rough Bent-grass
Deyeuxia spp.	Bent-grass
Dichanthium sericeum ssp. *sericeum*	
Dichelachne crinita	Long-hair Plume-grass
Dichelachne micrantha	Shorthair Plumegrass
Dichelachne rara	Common Plume-grass
Dichelachne sieberiana s.s.	Plume-grass
Dichelachne spp.	Plume-grass
Echinopogon caespitosus	
Echinopogon mckiei	
Echinopogon ovatus	Common Hedgehog-grass
**Ehrharta erecta*	Panic Veldt Grass
**Ehrharta longiflora*	Annual Veldt Grass
**Eleusine tristachya*	Goose Grass
Elymus scabrus	Common Wheat-grass
Enneapogon nigricans	Niggerheads
Entolasia marginata	Bordered Panic
Entolasia stricta	Wiry Panic
Eragrostis brownii	Common Love-grass
**Eragrostis curvula*	African Lovegrass
Eragrostis elongata	Clustered Lovegrass
Eragrostis leptostachya	Paddock Lovegrass
Eragrostis spp.	
Eragrostis trachycarpa	
Festuca spp.	
Glyceria australis	Australian Sweetgrass
**Glyceria maxima*	Reed Sweetgrass
Hemarthria uncinata	Matgrass
Hemarthria uncinata var. *uncinata*	Mat Grass
Hierochloe rariflora	Cane Holy Grass
**Holcus lanatus*	Yorkshire Fog
**Hordeum leporinum*	Barley Grass
**Hordeum marinum*	Sea Barley Grass
Imperata cylindrica	Blady Grass
Imperata cylindrica var. *major*	Blady Grass
Isachne globosa	Swamp Millet
**Lolium multiflorum*	Italian Ryegrass
**Lolium perenne*	Perennial Ryegrass
Lolium spp.	
Microlaena stipoides	
Microlaena stipoides var. *stipoides*	Weeping Grass
**Nassella trichotoma*	Serrated Tussock
Oplismenus aemulus	
Oplismenus hirtellus	Basket-grass
Oplismenus imbecillis	
Panicum simile	Two Colour Panic
Panicum spp.	
**Paspalum dilatatum*	Paspalum
**Paspalum distichum*	Water Couch
**Paspalum urvillei*	Vasey Grass
**Pennisetum clandestinum*	Kikuyu Grass
Pentapogon quadrifidus	Five-awned Spear-grass
**Phalaris aquatica*	Toowoomba Canary-grass
**Phalaris minor*	Lesser Canary Grass
**Phalaris* spp.	
Phragmites australis	Common Reed
Plinthanthesis paradoxa	
Poa affinis	
Poa affinis	
**Poa annua*	Annual Meadow-grass
**Poa bulbosa*	Bulbous Poa
Poa clelandii	Matted Tussock-grass
Poa ensiformis	Sword Tussock-grass
Poa helmsii	Broad-leaved Snowgrass
Poa labillardieri	Common Tussock-grass
Poa meionectes	
Poa phillipsiana	
**Poa pratensis*	Kentucky Bluegrass
Poa saxicola	Rock Poa
Poa sieberiana	Grey Tussock-grass
Poa sieberiana var. *hirtella*	Grey Tussock-grass
Poa sieberiana var. *sieberiana*	Grey Tussock-grass
Poa spp.	Tussock-grass
Poa tenera	Slender Tussock-grass
**Setaria gracilis* var. *pauciseta*	Slender Pigeon Grass
**Setaria* spp.	Pigeon Grass
**Sporobolus indicus* var. *capensis*	Indian Rat-tail Grass
Stipa bigeniculata	
Stipa blackii	
Stipa flavescens	

	Stipa mollis	Supple Spear-grass
	Stipa pubescens	
	Stipa ramosissima	Stout Bamboo Grass
	Stipa rudis	Veined Spear-grass
	Stipa rudis ssp. *nervosa*	Veined Spear-grass
	Stipa rudis ssp. *rudis*	Veined Spear-grass
	Stipa scabra	Speargrass
	Stipa setacea	Corkscrew Grass
	Stipa setacea	Corkscrew Grass
	Stipa spp.	Spear-grass
	Stipa stuposa	
	Tetrarrhena juncea	Forest Wire-grass
	Tetrarrhena turfosa	Peaty Rice-grass
	Themeda triandra (*australis*)	Kangaroo Grass
	**Vulpia bromoides*	Squirrel Tail Fescue
	**Vulpia muralis*	Wall Fescue
	**Vulpia myuros*	Rat's Tail Fescue
	**Vulpia* spp.	
Potamogetonaceae		
	Potamogeton tricarinatus	Floating Pondweed
Restionaceae		
	Empodisma minus	Spreading Rope-rush
	Hypolaena fastigiata	
	Leptocarpus tenax	
	Lepyrodia anarthria	
	Lepyrodia scariosa	
	Restio complanatus	Flat Cord-rush
	Restio dimorphus	
	Restio fastigiatus	
	Restio fimbriatus	
	Restio gracilis	
	Restio tetraphyllus ssp. *tetrapyhllus*	Tassel Cord-rush
Smilacaceae		
	Eustrephus latifolius	Wombat Berry
	Geitonoplesium cymosum	Scrambling Lily
	Smilax australis	Austral Sarsaparilla
	Smilax glyciphylla	Sweet Sarsaparilla
Typhaceae		
	Typha domingensis	Narrow-leaved Cumbungi
	Typha orientalis	Broad-leaved Cumbungi
Uvulariaceae		
	Schelhammera undulata	
Xanthorrhoeaceae		
	Lomandra bracteata	
	Lomandra confertifolia	
	Lomandra confertifolia ssp. *leptostachya*	Slender Mat-rush
	Lomandra confertifolia ssp. *rubiginosa*	
	Lomandra elongata	Mat-rush
	Lomandra filiformis	Wattle Mat-rush
	Lomandra filiformis ssp. *coriacea*	
	Lomandra filiformis ssp. *filiformis*	
	Lomandra glauca	Pale Mat-rush
	Lomandra gracilis	
	Lomandra hystrix	Mat-rush
	Lomandra longifolia	Spiny-headed Mat-rush
	Lomandra micrantha ssp. *tuberculata*	Small-flowered Mat-rush
	Lomandra minus	Mat-rush
	Lomandra multiflora ssp. *multiflora*	Many-flowered Mat-rush
	Lomandra nana	Dwarf Mat-rush
	Lomandra obliqua	
	Lomandra spp.	
	Xanthorrhoea australis	Austral Grass-tree
	Xanthorrhoea concava	
	Xanthorrhoea minor ssp. *lutea*	Small Grass-tree
	Xanthorrhoea resinifera	Spear Grass-tree
	Xanthorrhoea spp.	
Xyridaceae		
	Xyris gracilis	Slender Yellow-eye
	Xyris juncea	
	Xyris operculata	Tall Yellow-eye

Zannichelliaceae		
	Lepilaena spp.	
DICOTYLEDONS		
Acanthaceae		
	Brunoniella australis	Blue Trumpet
	Brunoniella pumilio	Dwarf Blue Trumpet
	Pseuderanthemum variabile	Pastel Flower
Amaranthaceae		
	Alternanthera denticulata	Lesser Joyweed
Anacardiaceae		
	Euroschinus falcata var. *falcata*	Ribbonwood
Apiaceae		
	Actinotus helianthi	Flannel Flower
	Actinotus minor	Lesser Flannel Flower
	Centella asiatica	Pennywort
	Centella cordifolia	Centella
	**Daucus carota*	Carrot
	Daucus glochidiatus	Native Carrot
	Eryngium rostratum	Blue Devil
	**Foeniculum vulgare*	Fennel
	Hydrocotyle acutiloba	Broad-leaf Pennywort
	Hydrocotyle algida	Pennywort
	**Hydrocotyle bonariensis*	
	Hydrocotyle foveolata	Yellow Pennywort
	Hydrocotyle geranifolia	Forest Pennywort
	Hydrocotyle hirta	Hairy Pennywort
	Hydrocotyle laxiflora	Stinking Pennywort
	Hydrocotyle peduncularis	
	Hydrocotyle pterocarpa	Wing Pennywort
	Hydrocotyle sibthorpoides	Shining Pennywort
	Hydrocotyle spp.	
	Hydrocotyle tripartita	Slender Pennywort
	Oreomyrrhis eriopoda	Australian Carraway
	Oreomyrrhis spp.	
	Oschatzia cuneifolia	Wedge Oschatzia
	Platysace ericoides	
	Platysace heterophylla	Slender Platysace
	Platysace lanceolata	Shrubby Platysace
	Platysace linearifolia	
	Platysace stephensonii	
	Xanthosia dissecta	Cut-leaf Xanthosia
	Xanthosia pilosa	Woolly Xanthosia
	Xanthosia pusilla	Heath Xanthosia
	Xanthosia tridentata	Rock Xanthosia
Apocynaceae		
	Parsonsia brownii	Mountain Silkpod
	Parsonsia straminea	Common Silkpod
	**Vinca major*	Periwinkle
Aquifoliaceae		
	**Ilex aquifolium*	Holly
Araliaceae		
	Astrotricha latifolia	
	Astrotricha longifolia	
	Polyscias elegans	Celery Wood
	Polyscias murrayi	Pencil Cedar
	Polyscias sambucifolia	Elderberry Panax
Asclepiadaceae		
	**Araujia hortorum*	Moth Plant
	Marsdenia flavescens	Hairy Milk Vine
	Marsdenia rostrata	Common Milk Vine
	Marsdenia suaveolens	Scented Marsdenia
	Tylophora barbata	Bearded Tylophora

Asteraceae

**Ageratina adenophora*	Crofton Weed
**Ageratina riparia*	Mistflower
**Arctotheca calendula*	Capeweed
Arrhenechthites mixta	Purple Fireweed
Bedfordia arborescens	Blanket-leaf
**Bidens pilosa*	Cobblers Pegs
Brachycome angustifolia var. *heterophylla*	
Brachycome ciliaris	Variable Daisy
Brachycome ciliaris var. *ciliaris*	
Brachycome decipiens	Field Daisy
Brachycome diversifolia var. *diversifolia*	
Brachycome spp.	
Brachyscome spathulata ssp. *spathulata*	Spoon Daisy
Bracteantha bracteata	Golden Everlasting
Calocephalus citreus	Lemon Beauty-heads
Calomeria amaranthoides	Incense Plant
Calotis scabiosifolia var. *integrifolia*	
**Carthamus lanatus*	Saffron Thistle
Cassinia aculeata	Common Cassinia
Cassinia arcuata	Sifton Bush
Cassinia longifolia	Shiny Cassinia
Cassinia quinquefaria	
Cassinia trinerva	Three-nerved Cassinia
Centipeda minima	Spreading Sneezeweed
Chrysocephalum apiculatum	Common Everlasting
Chrysocephalum baxteri	White Everlasting
Chrysocephalum semipapposum	Clustered Everlasting
Chrysocephalum spp.	
**Cirsium* spp.	
**Cirsium vulgare*	Spear Thistle
**Conyza albida*	Fleabane
**Conyza bilbaoana*	Fleabane
**Conyza bonariensis*	Tall Fleabane
**Conyza* spp.	
Cotula australis	Common Cotula
**Cotula coronopifolia*	Water Buttons
Craspedia canens	
Craspedia coolaminica	
Craspedia glauca sp. *G*	
Craspedia glauca spp. agg.	Common Billy-buttons
Craspedia jamesii	Green Billy-buttons
Craspedia spp.	
Craspedia spp.	Billy-buttons
Craspedia variabilis	
Cymbonotus lawsonianus	Bear's Ear
Cymbonotus preissianus	Austral Bear's-ears
Cymbonotus spp.	
**Delairea odorata*	Cape Ivy
**Dittrichia graveolens*	Stinkweed
Erigeron species B (aff. *pappocromus*)	
Erigeron spp.	
Euchiton gymnocephalus s.s. (*Gnaphalium*)	Creeping Cudweed
Euchiton involucratus s.l. (*Gnaphalium*)	Star Cudweed
Euchiton sphaericus (*Gnaphalium*)	Annual Cudweed
**Gamochaeta purpurea* sensu Ross(1993)	Spiked Cudweed
**Gamochaeta purpurea* ssp. agg.	Cudweed
Gnaphalium argentifolium	
Gnaphalium spp.	
Helichrysum collinum	
Helichrysum elatum	
Helichrysum leucopsideum	Satin Everlasting
Helichrysum rutidolepis s.l.	Pale Everlasting
Helichrysum scorpioides	Button Everlasting
**Helminthotheca echioides*	Ox-tongue
**Hypochaeris glabra*	Smooth Catsear
**Hypochaeris radicata*	Catsear
Isoetopsis graminifolia	Grass Cushion
Lagenifera gracilis	Slender Lagenifera
Lagenifera stipitata	Common Lagenifera
**Leontodon taraxacoides*	Hairy Hawkbit
**Leontodon taraxacoides* ssp. *taraxacoides*	Lesser Hawkbit
Leptinella filicula	Mountain Cotula
Leptorhynchos linearis	Shiny Buttons
Leptorhynchos squamatus ssp. *B*	
Microseris lanceolata	
Olearia alpicola	Alpine Daisy Bush
Olearia argophylla	Musk Daisy-bush
Olearia erubescens	Moth Daisy-bush
Olearia lirata	Snow Daisy-bush
Olearia microphylla	
Olearia myrsinoides	Silky Daisy-bush
Olearia phlogopappa	
Olearia ramulosa	Twiggy Daisy-bush
Olearia spp.	

	Olearia tomentosa	
	Olearia viscidula	Wallaby Weed
	Ozothamnus argophyllus	
	Ozothamnus conditus	Pepper Everlasting
	Ozothamnus cuneifolius	Wedge-leaf Everlasting
	Ozothamnus diosmifolius	White Dogwood
	Ozothamnus ferrugineus	Tree Everlasting
	Ozothamnus obcordatus	Grey Everlasting
	Ozothamnus spp.	Everlasting
	Ozothamnus thyrsoideus	
	Podolepis jaceoides	Showy Copper-wire Daisy
	Pseudognaphalium luteo-album	Jersey Cudweed
	Senecio glomeratus	Annual Fireweed
	Senecio hispidulus var. *hispidulus*	
	**Senecio jacobaea*	Ragwort
	Senecio lautus ssp. *alpinus*	
	Senecio lautus ssp. *lanceolatus*	
	Senecio linearifolius	Fireweed Groundsel
	Senecio minimus	Shrubby Fireweed
	Senecio quadridentatus	Cotton Fireweed
	Senecio spp.	Groundsel
	Senecio tenuiflorus	Narrow Groundsel
	Senecio velleioides	Forest Groundsel
	Sigesbeckia orientalis	Indian Weed
	Sigesbeckia orientalis ssp. *orientalis*	Indian Weed
	**Silybum marianum*	Variegated Thistle
	Solenogyne dominii	
	Solenogyne gunnii	
	Solenogyne spp.	
	**Sonchus asper* s.l.	Rough Sow-thistle
	**Sonchus asper* ssp. *glaucescens*	Prickly Sowthistle
	**Sonchus oleraceus*	Sow-thistle
	Stuartina muelleri	Spoon Cudweed
	**Taraxacum officinale*	Dandelion
	**Taraxacum* Sect. *Ruderalia*	Garden Dandelion
	Taraxacum spp.	
	**Tragopogon porrifolius*	Salsify
	Triptilodiscus pygmaeus	
	**Vellereophyton dealbatum*	White Cudweed
	Vittadinia cuneata var. *cuneata*	Fuzzy New Holland Daisy
	Vittadinia hispidula var. *hispidula*	
	Vittadinia muelleri	
	Vittadinia spp.	
	Vittadinia sulcata	
Basellaceae		
	**Anredera cordifolia*	Madeira Vine
Baueraceae		
	Bauera rubioides	
Bignoniaceae		
	Pandorea pandorana	Wonga Vine
Boraginaceae		
	Cynoglossum australe	Australian Hound's-tongue
	Cynoglossum latifolium	Forest Hound's-tongue
	Cynoglossum spp.	
	Cynoglossum suaveolens	Sweet Hound's-tongue
	**Echium plantagineum*	Paterson's Curse
	Echium spp.	
	**Echium vulgare*	Vipers Bugloss
	Ehretia acuminata var. *acuminata*	Koda
	Myosotis australis	Australian Forget-me-not
	**Myosotis discolor*	Forget-me-not
Brassicaceae		
	**Brassica nigra*	Black Mustard
	**Brassica rapa* ssp. *sylvestris*	Turnip
	**Capsella bursa-pastoris*	Shepherd's Purse
	Cardamine paucijuga	Annual Bitter-cress
	Cardamine spp.	Bitter-cress
	**Cardaria draba*	Hoary Cress
	**Erophila verna* ssp. *praecox*	
	**Hirschfeldia incana*	Hairy Brassica
	Lepidium pseudotasmanicum	Shade Pepper-cress
	**Raphanus raphanistrum*	Wild Radish
	Rorippa dictyosperma	Forest Bitter-cress
	Rorippa spp.	

Brunoniaceae		
	Brunonia australis	Blue Pincushion
Callitrichaceae		
	Callitriche muelleri	Round Water Starwort
	Callitriche spp.	Starwort
	**Callitriche stagnalis*	Water Starwort
Campanulaceae		
	Lobelia alata	Angled Lobelia
	Lobelia gibbosa s.l.	Tall Lobelia
	Lobelia pratioides	Poison Lobelia
	Lobelia rhombifolia s.l.	Tufted Lobelia
	Wahlenbergia communis	Tufted Bluebell
	Wahlenbergia gracilenta s.l.	Annual Bluebell
	Wahlenbergia gracilis s.l.	Sprawling Bluebell
	Wahlenbergia gracilis s.s.	Sprawling Bluebell
	Wahlenbergia gymnoclada	Naked Bluebell
	Wahlenbergia luteola	
	Wahlenbergia multicaulis s.l.	Many-stemmed Bluebell
	Wahlenbergia planiflora	
	Wahlenbergia spp.	Bluebell
	Wahlenbergia stricta	Tall or Austral Bluebell
	Wahlenbergia stricta ssp. *stricta*	Tall Bluebell
Caprifoliaceae (Sambucaceae)		
	Sambucus australasica	Native Elderberry
	Sambucus gaudichaudiana	White Elderberry
Caryophyllaceae		
	**Cerastium glomeratum*	Mouse-ear Chickweed
	**Cerastium semidecandrum*	Lesser Mouse-ear Chickweed
	**Moenchia erecta*	Erect Chickweed
	**Paronychia brasiliana*	Chilean Whitlow Wort
	**Petrorhagia prolifera*	Proliferous Pink
	**Petrorhagia velutina*	
	**Polycarpon tetraphyllum*	Four-leaved Allseed
	**Sagina apetala*	Annual Pearlwort
	Scleranthus biflorus	
	Scleranthus diander	
	Scleranthus fascicularis	Knawel
	Scleranthus spp.	
	**Silene gallica*	French Catchfly
	Spergularia spp.	
	Stellaria angustifolia	Swamp Starwort
	Stellaria flaccida	Forest Starwort
	**Stellaria media*	Common Chickweed
	Stellaria multiflora	Rayless Starwort
	Stellaria pungens	Prickly Starwort
	Stellaria spp.	Starwort
Casuarinaceae		
	Allocasuarina distyla	
	Allocasuarina glareicola	
	Allocasuarina gymnanthera	
	Allocasuarina littoralis	Black Sheoke
	Allocasuarina nana	
	Allocasuarina paludosa	Scrub Sheoke
	Allocasuarina spp.	
	Allocasuarina torulosa	Forest Oak
	Allocasuarina verticillata	Drooping Sheoak
	Casuarina cunninghamiana ssp. *cunninghamiana*	River Oak
	Casuarina glauca	Swamp Oak
Celastraceae		
	Cassine australis	Red Olive Plum
	Celastrus australis	Staff Climber
Chenopodiaceae		
	Chenopodium pumilio	Clammy Goosefoot
	Einadia hastata	Saloop Saltbush
	Einadia nutans	Climbing Saltbush
	Einadia spp.	
	Sarcocornia quinqueflora	Beaded Glasswort
Chloanthaceae		
	Chloanthes stoechadis	

Clusiaceae		
	Hypericum gramineum	Small St John's Wort
	Hypericum japonicum	Matted St John's Wort
	**Hypericum perforatum*	St John's Wort
Convolvulaceae		
	Calystegia marginata	Forest Bindweed
	Convolvulus erubescens	
	Dichondra repens	Kidney-weed
	Dichondra species A	
Crassulaceae		
	Crassula decumbens var. *decumbens*	
	Crassula helmsii	Swamp Stonecrop
	Crassula sieberiana	Australian Stonecrop
	Crassula sieberiana ssp. *tetramera*	Australian Stonecrop
	**Crassula tetragona*	Crassula
Cunoniaceae		
	Aphanopetalum resinosum	Gum Vine
	Ceratopetalum apetalum	Coachwood
	Schizomeria ovata	Crabapple
Dilleniaceae		
	Hibbertia acicularis	Prickly Guinea Flower
	Hibbertia aspera	Rough Guinea-flower
	Hibbertia calycina	Prickly Erect Guinea-flower
	Hibbertia dentata	Trailing Guinea-flower
	Hibbertia empetrifolia	Tangled Guinea-flower
	Hibbertia linearis	
	Hibbertia monogyna	
	Hibbertia nitida	
	Hibbertia obtusifolia	Grey Guinea-flower
	Hibbertia prostrata	Bundled Guinea-flower
	Hibbertia riparia	
	Hibbertia rufa	
	Hibbertia scandens	Climbing Guinea Flower
	Hibbertia sericea	Silky Guinea-flower
	Hibbertia serpyllifolia	Thyme Guinea-flower
	Hibbertia virgata	Twiggy Guinea-flower
Dipsacaceae		
	**Dipsacus fullonum* ssp. *fullonum*	Wild Teasel
Droseraceae		
	Drosera auriculata	
	Drosera binata	Forked Sundew
	Drosera peltata	Tall Sundew
	Drosera peltata ssp. *auriculata*	Tall Sundew
	Drosera peltata ssp. *peltata*	Pale Sundew
	Drosera pygmaea	
	Drosera spatulata	Rosy Sundew
Ebenaceae		
	Diospyros australis	Black Plum
	Diospyros pentamera	Myrtle Ebony
Elaeocarpaceae		
	Elaeocarpus holopetalus	Black Oliveberry
	Elaeocarpus kirtonii	Silver Quandong
	Elaeocarpus reticulatus	Blueberry Ash
	Sloanea australis	Maiden's Blush
Elatinaceae		
	Elatine gratioloides	Waterwort

Epacridaceae		
	Acrotriche serrulata	Honeypots
	Astroloma humifusum	Cranberry Heath
	Brachyloma daphnoides	Daphne Heath
	Epacris calvertiana	
	Epacris coriacea	
	Epacris impressa	Common Heath
	Epacris lanuginosa	Woolly-style Heath
	Epacris longiflora	Fuschia Heath
	Epacris microphylla	
	Epacris microphylla var. *microphylla*	
	Epacris obtusifolia	Blunt-leaf Heath
	Epacris paludosa	Swamp Heath
	Epacris pulchella	
	Epacris purpurascens	
	Leucopogon amplexicaulis	
	Leucopogon appressus	
	Leucopogon collinus	Fringed Beard-heath
	Leucopogon ericoides	Pink Beard-heath
	Leucopogon esquamatus	
	Leucopogon fletcheri	
	Leucopogon fraseri	
	Leucopogon juniperinus	Long-flower Beard-heath
	Leucopogon lanceolatus	
	Leucopogon lanceolatus var. *lanceolatus*	Lance Beard-heath
	Leucopogon microphyllus	
	Leucopogon neo-anglicus	
	Leucopogon setiger	
	Leucopogon spp.	
	Leucopogon virgatus	Common Beard-heath
	Lissanthe strigosa	Peach Heath
	Melichrus urceolatus	Urn Heath
	Monotoca elliptica	Tree Broom-heath
	Monotoca scoparia	Prickly Broom-heath
	Sprengelia incarnata	Pink Swamp-heath
	Styphelia adscendens	Golden Heath
	Styphelia spp.	
	Styphelia tubiflora	
	Trochocarpa laurina	Tree Heath
	Woollsia pungens	
Escalloniaceae		
	Abrophyllum ornans	Native Hydrangea
	Polyosma cunninghamii	Featherwood
Euphorbiaceae		
	Amperea xiphoclada	
	Amperea xiphoclada var. *xiphoclada*	Broom Spurge
	Baloghia inophylla	Brush Bloodwood
	Beyeria viscosa	Pinkwood
	Breynia oblongifolia	Coffee Bush
	Chamaesyce drummondii	Caustic Weed
	Claoxylon australe	Brittlewood
	Croton verreauxii	Green or Native Cascarilla
	**Euphorbia peplus*	Petty Spurge
	Glochidion ferdinandi	Cheese Tree
	Micrantheum ericoides	
	Micrantheum hexandrum	
	Omalanthus populifolius	Bleeding Heart
	Phyllanthus gasstroemii	
	Phyllanthus hirtellus	Thyme Spurge
	Poranthera ericifolia	
	Poranthera microphylla	Small Poranthera
	Ricinocarpos pinifolius	Wedding Bush
Eupomatiaceae		
	Eupomatia laurina	Bolwarra
Fabaceae		
	Almaleea subumbellata	Wiry Bush-pea
	Aotus ericoides	Common Aotus
	Bossiaea buxifolia	Matted Bossiaea
	Bossiaea cinerea	Showy Bossiaea
	Bossiaea ensata	
	Bossiaea foliosa	
	Bossiaea heterophylla	Variable Bossiaea
	Bossiaea obcordata	Spiny Bossiaea
	Bossiaea prostrata	Creeping Bossiaea
	Bossiaea rhombifolia	
	Bossiaea riparia	
	Bossiaea scolopendria	

**Chamaecytisus palmensis*	Tree Lucerne
**Cytisus scoparius* ssp. *scoparius*	English Broom
Daviesia acicularis	
Daviesia alata	
Daviesia corymbosa	
Daviesia latifolia	Hop Bitter-pea
Daviesia leptophylla	Narrow-leaf Bitter-pea
Daviesia mimosoides	
Daviesia ulicifolia	Gorse Bitter Pea
Desmodium brachypodum	Large Tick-trefoil
Desmodium gunnii	Southern Tick-trefoil
Desmodium varians	Slender Tick-trefoil
Dillwynia brunioides	
Dillwynia cinerascens	Grey Parrot-pea
Dillwynia floribunda	
Dillwynia glaberrima	Smooth Parrot-pea
Dillwynia juniperina	
Dillwynia phylicoides	
Dillwynia ramosissima	
Dillwynia retorta	
Dillwynia sericea	Showy Parrot-pea
Dillwynia spp.	
**Genista monspessulana*	Montpellier Broom
Glycine canescens	Silky Glycine
Glycine clandestina	Twining Glycine
Glycine microphylla	Small-leaf Glycine
Glycine tabacina	
Glycine tabacina s.l.	Variable Glycine
Gompholobium glabratum	Dainty Wedge Pea
Gompholobium grandiflorum	Large Wedge Pea
Gompholobium huegelii	Common Wedge-pea
Gompholobium latifolium	Golden Glory Pea
Gompholobium minus	Dwarf Wedge Pea
Gompholobium pinnatum	Pinnate Wedge Pea
Gompholobium species B	
Gompholobium spp.	
Gompholobium uncinatum	Red Wedge Pea
Gompholobium virgatum	Leafy Wedge Pea
Gompholobium virgatum var. *aspalathoides*	
Goodia lotifolia var. *pubescens*	Golden-tip
Hardenbergia violacea	Purple Coral-pea
Hovea linearis	Common Hovea
Indigofera australis	Austral Indigo
Jacksonia scoparia	Dogwood
Kennedia prostrata	Running Postman
Kennedia rubicunda	Dusky Coral-pea
Lespedeza juncea ssp. *sericea*	
Lotus cruentus	Red Bird's-foot Trefoil
Lotus spp.	
**Lotus* spp. (naturalised)	Trefoil
**Medicago laciniata*	Cut-leaved Medic
Medicago lupulina	Black Medic
**Medicago* spp.	
Mirbelia pungens	
Mirbelia rubiifolia	
Mirbelia speciosa ssp. *speciosa*	
Oxylobium arborescens	Tall Oxylobium
Oxylobium ilicifolium	Prickly Shaggy Pea
Oxylobium procumbens	Trailing Shaggy Pea
Phyllota grandiflora	
Phyllota phylicoides	Heath Phyllota
Platylobium formosum	Handsome Flat-pea
Psoralea tenax	Emu-foot
Pultenaea aristata	
Pultenaea benthamii	Bentham's Bush-pea
Pultenaea blakelyi	
Pultenaea daphnoides	Large-leaf Bush-pea
Pultenaea dentata	
Pultenaea divaricata	
Pultenaea elliptica	
Pultenaea flexilis	
Pultenaea hispidula	
Pultenaea juniperina	Prickly Bush-pea
Pultenaea linophylla	Halo Bush-pea
Pultenaea microphylla	
Pultenaea mollis	Soft Bush-pea
Pultenaea procumbens	
Pultenaea retusa	Blunt Bush-pea
Pultenaea scabra	Rough Bush-pea
Pultenaea spp.	
Pultenaea stipularis	
Pultenaea stricta	Rigid Bush-pea
Pultenaea subspicata	
Pultenaea villosa	
r *Oxylobium ilicifolium*	Prickly Oxylobium
**Senna pendula* var. *glabrata*	

	Sphaerolobium vimineum	
	Sphaerolobium vimineum s.l.	Leafless Globe-pea
	Swainsona sericea	
	**Trifolium angustifolium*	Narrow-leaved Clover
	**Trifolium arvense*	Haresfoot Clover
	**Trifolium cernuum*	
	**Trifolium dubium*	Suckling Clover
	**Trifolium fragiferum*	Strawberry Clover
	**Trifolium repens*	White Clover
	**Trifolium* spp.	
	**Trifolium subterraneum*	Subterranean Clover
	**Vicia sativa*	Common Vetch
	**Vicia* spp.	
	Viminaria juncea	Native Broom
	Zornia dyctiocarpa var. *dyctiocarpa*	Zornia
Flacourtiaceae		
	Scolopia braunii	Flintwood
Gentianaceae		
	**Centaurium erythraea*	Common Centaury
	**Centaurium tenuiflorum*	Branched Centaury
	Centaurium spicatum	Spike Centaury
	Sebaea ovata	Yellow Centaury
Geraniaceae		
	**Erodium botrys*	Long Storksbill
	**Erodium cicutarium*	Common Storksbill
	Erodium crinitum	Blue Storksbill
	**Erodium moschatum*	Musky Crowfoot
	Geranium homeanum	Crane's-bill
	**Geranium molle* var. *molle*	Cranesbill Geranium
	Geranium neglectum	Red-stem Cranesbill
	Geranium potentilloides	Cinquefoil Cranesbill
	Geranium retrorsum	Grassland Cranesbill
	Geranium scabrifolium	Rough Cranesbill
	Geranium solanderi	Native Geranium
	Geranium solanderi var. *solanderi*	Austral Cranesbill
	Geranium sp. aff. solanderi	Soft Cranesbill
	Geranium spp.	Cranesbill
	Geranium subglabrous	Naked Cranesbill
	Pelargonium australe	Austral Stork's-bill
	Pelargonium inodorum	Kopata
Gesneriaceae		
	Fieldia australis	Fieldia
Goodeniaceae		
	Brunonia australis	Blue Pincushion
	Coopernookia barbata	
	Dampiera purpurea	
	Dampiera scottiana	
	Dampiera stricta	Blue Dampiera
	Goodenia bellidifolia	
	Goodenia elongata	Lanky Goodenia
	Goodenia glomerata	
	Goodenia hederacea	
	Goodenia hederacea ssp. *hederacea*	
	Goodenia heterophylla	
	Goodenia humilis	Swamp Goodenia
	Goodenia ovata	Hop Goodenia
	Goodenia paniculata	
	Scaevola ramosissima	Hairy Fan-flower
	Velleia paradoxa	
Haloragaceae		
	Gonocarpus humilis	Shade Raspwort
	Gonocarpus longifolius	
	Gonocarpus micranthus	
	Gonocarpus micranthus ssp. *micranthus*	Creeping Raspwort
	Gonocarpus spp.	
	Gonocarpus tetragynus	Common Raspwort
	Gonocarpus teucrioides	Germander Raspwort
	Haloragis heterophylla	Varied Raspwort
	Myriophyllum crispatum	
	Myriophyllum simulans	Amphibious Milfoil
	Myriophyllum spp.	Milfoil
	Myriophyllum variifolium	

Icacinaceae		
	Citronella moorei	Churnwood
	Pennantia cunninghamii	Brown Beech
Lamiaceae		
	Ajuga australis	Austral Bugle
	Ajuga spp.	
	Hemigenia purpurea	
	Lycopus australis	Australian Gipsywort
	**Marrubium vulgare*	Horehound
	Mentha laxiflora	Forest Mint
	Plectranthus parviflorus	
	Plectranthus spp.	
	Prostanthera hirtula	Hairy Mint-bush
	Prostanthera incana	Velvet Mint-bush
	Prostanthera lasianthos	Victorian Christmas-bush
	Prostanthera linearis	Narrow-leaved Mint-bush
	Prostanthera rotundifolia	Round-leaf Mint-bush
	**Prunella vulgaris*	Self-heal
	**Salvia verbenaca*	Wild Sage
Lauraceae		
	Cassytha glabella	Slender Dodder-laurel
	Cassytha melantha	Coarse Dodder-laurel
	Cassytha phaeolasia	Rusty Dodder-laurel
	Cassytha pubescens	
	Cassytha pubescens s.s.	Downy Dodder-laurel
	Cassytha spp.	
	Cinnamomum oliveri	Oliver's Sassafras
	Cryptocarya glaucescens	Jackwood
	Cryptocarya microneura	Murrogun
	Endiandra sieberi	Hard Corkwood
	Litsea reticulata	Bolly Gum
Lentibulariaceae		
	Utricularia dichotoma	Fairy Aprons
Linaceae		
	Linum marginale	Native Flax
Lobeliaceae		
	Isotoma axillaris	Showy Isotome
	Isotoma fluviatilis	Swamp Isotome
	Lobelia alata	Angled Lobelia
	Pratia purpurascens	Whiteroot
Loganiaceae		
	Mitrasacme polymorpha	
	Mitrasacme pilosa	Hairy Mitrewort
	Mitrasacme pilosa var. *stuartii*	Hairy Mitrewort
	Mitrasacme serpyllifolia	Thyme Mitrewort
Loranthaceae		
	Amyema congener ssp. *congener*	
	Amyema gaudichaudii	
	Amyema miquelii	Box Mistletoe
	Amyema pendulum	
	Amyema pendulum ssp. *pendulum*	Drooping Mistletoe
	Amyema spp.	
	Muellerina eucalyptoides	
Lythraceae		
	Lythrum hyssopifolia	Small Loosestrife
	Lythrum salicaria	Purple Loosestrife
Malaceae		
	**Crataegus monogyna*	Hawthorn
Malvaceae		
	Abutilon oxycarpum	Flannel Weed
	Hibiscus heterophyllus ssp. *heterophyllus*	Native Rosella
	Howittia trilocularis	Blue Howittia
	**Malva parviflora*	Small-flowered Mallow
	**Modiola caroliniana*	Red-flowered Mallow

Meliaceae		
	Melia azedarach	White Cedar
	Synoum glandulosum	Scentless Rosewood
	Toona ciliata	Red Cedar
Menispermaceae		
	Sarcopetalum harveyanum	Pearl Vine
	Stephania japonica var. *discolor*	Snake Vine
Menyanthaceae		
	Nymphoides montana	
	Villarsia exaltata	Erect Marsh-flower
Mimosaceae		
	Acacia aculeatissima	Thin-leaf Wattle
	**Acacia baileyana*	Cootamundra Wattle
	Acacia binervata	Two-veined Hickory
	Acacia brownii	
	Acacia buxifolia	Box-leaved Wattle
	Acacia cognata	Narrow-leaf Bower Wattle
	Acacia dawsonii	Poverty Wattle
	Acacia dealbata	Silver Wattle
	Acacia decora	Western Golden Wattle
	Acacia decurrens	Black Wattle
	Acacia dorothea	
	Acacia elata	Mountain Cedar Wattle
	Acacia elongata	
	Acacia falcata	
	Acacia falciformis	Pale Hickory Wattle
	Acacia filicifolia	Fern-leaved Wattle
	Acacia genistifolia	Spreading Wattle
	Acacia gunnii	Ploughshare Wattle
	Acacia implexa	Lightwood
	Acacia irrorata	Green Wattle
	Acacia lanigera	Hairy Wattle
	Acacia leprosa	
	Acacia linifolia	Flax-leaved Wattle
	Acacia longifolia	Sallow Wattle
	Acacia maidenii	Maiden's Wattle
	Acacia mearnsii	Black Wattle
	Acacia melanoxylon	Blackwood
	Acacia mitchellii	Mitchell's Wattle
	Acacia mucronata	Narrow-leaf Wattle
	Acacia mucronata var. *longifolia*	
	Acacia myrtifolia	Red-stemmed Wattle
	Acacia obliquinervia	Mountain Hickory Wattle
	Acacia obtusata	
	Acacia obtusifolia	
	Acacia oxycedrus	Spike Wattle
	Acacia paradoxa	Kangaroo Thorn
	Acacia parramattensis	
	Acacia parvipinnula	Silver-stemmed Wattle
	Acacia penninervis	Mountain Hickory
	Acacia pycnantha	Golden Wattle
	Acacia rubida	Red-leaved Wattle
	Acacia siculiformis	Dagger Wattle
	Acacia spp.	
	Acacia stricta	Hop Wattle
	Acacia suaveolens	Sweet Wattle
	Acacia subtilinervis	
	Acacia terminalis	Sunshine Wattle
	Acacia ulicifolia	Prickly Moses
	Acacia verniciflua	Varnish Wattle
	Acacia verticillata	Prickly Moses
	Pararchidendron pruinosum var. *pruinosum*	Snow Wood
Monimiaceae s.l.		
	Doryphora sassafras	Sassafras
	Hedycarya angustifolia	Native Mulberry
	Palmeria scandens	Anchor Vine
	Wilkiea huegeliana	Veiny Wilkiea
Moraceae		
	Ficus coronata	Creek Sandpaper Fig
	Ficus macrophylla ssp. *macrophylla*	Moreton Bay Fig
	Ficus rubiginosa	Port Jackson Fig
	Ficus superba var. *henneana*	Deciduous Fig
	Maclura cochinchinensis	Cockspur Thorn
	Malaisia scandens ssp. *scandens*	Burny Vine
	Streblus brunonianus	Whalebone Tree

Myoporaceae		
	Myoporum acuminatum	
Myrsinaceae		
	Rapanea howittiana	Muttonwood
	Rapanea variabilis	Muttonwood
Myrtaceae		
	Acmena smithii	Lilly Pilly
	Angophora floribunda	Apple
	Backhousia myrtifolia	Grey Myrtle
	Baeckea brevifolia	
	Baeckea densifolia	
	Baeckea diosmifolia	
	Baeckea imbricata	
	Baeckea utilis	Mountain Baeckea
	Baeckea virgata	Tall Baeckea
	Callistemon citrinus	Crimson Bottlebrush
	Callistemon linearis	Narrow-leaved Bottlebrush
	Callistemon pallidus	Lemon Bottlebrush
	Callistemon salignus	Sweet Willow Bottlebrush
	Callistemon sieberi	River Bottlebrush
	Callistemon subulatus	
	Calytrix tetragona	
	Darwinia grandiflora	
	Darwinia taxifolia ssp. *macrolaena*	
	Eucalyptus agglomerata	Blue-leaved Stringybark
	Eucalyptus aggregata	Black Gum
	Eucalyptus amplifolia	Cabbage Gum
	Eucalyptus angophoroides	Apple-topped Box
	Eucalyptus angophoroides/bridgesiana	Apple-topped Box/But But
	Eucalyptus baueriana	Blue Box
	Eucalyptus baxteri	Brown Stringybark
	Eucalyptus blakelyi	Blakely's Red Gum
	Eucalyptus bosistoana	Coast Grey Box
	Eucalyptus botryoides	Bangalay
	Eucalyptus bridgesiana	But But
	Eucalyptus consideniana	Yertchuk
	Eucalyptus conspicua	Swamp Stringybark
	Eucalyptus crebra	Narrow-leaved Ironbark
	Eucalyptus croajingolensis	Gippsland Peppermint
	Eucalyptus cypellocarpa	Mountain Grey Gum
	Eucalyptus dendromorpha	
	Eucalyptus dives	Peppermint
	Eucalyptus elata	River Peppermint
	Eucalyptus eugenioides	Thin-leaved Stringybark
	Eucalyptus fastigata	Cut-tail
	Eucalyptus fibrosa	Red Ironbark
	Eucalyptus globoidea	White Stringybark
	Eucalyptus globulus ssp. *pseudoglobulus*	Gippsland Blue Gum
	Eucalyptus gummifera	Red Bloodwood
	Eucalyptus imitans	
	Eucalyptus langleyi	
	Eucalyptus ligustrina	Privet-leaved Stringybark
	Eucalyptus longifolia	Woollybutt
	Eucalyptus macrorhyncha	Red Stringybark
	Eucalyptus macrorhyncha ssp. *macrorhyncha*	Red Stringybark
	Eucalyptus maculata	Spotted Gum
	Eucalyptus mannifera	Brittle Gum
	Eucalyptus melliodora	Yellow Box
	Eucalyptus moluccana	Grey Box
	Eucalyptus muelleriana	Yellow Stringybark
	Eucalyptus multicaulis	Whipstick Ash
	Eucalyptus niphophila	Snow Gum
	Eucalyptus nortonii	Bundy
	Eucalyptus obliqua	Messmate
	Eucalyptus oblonga	Stringybark
	Eucalyptus ovata	Swamp Gum
	Eucalyptus paniculata	Grey Ironbark
	Eucalyptus pauciflora	Snow Gum
	Eucalyptus pilularis	Blackbutt
	Eucalyptus piperita	Sydney Peppermint
	Eucalyptus polyanthemos	Red Box
	Eucalyptus polyanthemos ssp. *vestita*	Red Box
	Eucalyptus pryoriana	Coast Manna Gum
	Eucalyptus punctata	Grey Gum
	Eucalyptus quadrangulata	White-topped Box
	Eucalyptus racemosa	Scribbly Gum
	Eucalyptus radiata	Narrow-leaved Peppermint
	Eucalyptus resinifera	Red Mahogany
	Eucalyptus robertsonii	
	Eucalyptus robertsonii ssp. *robertsonii*	Monaro Peppermint

	Eucalyptus robusta	Swamp Mahogany
	Eucalyptus rossii	Scribbly Gum
	Eucalyptus rubida	Candlebark
	Eucalyptus saligna	Sydney Blue Gum
	Eucalyptus scias ssp. *callimastha*	
	Eucalyptus sclerophylla	Scribbly Gum
	Eucalyptus sideroxylon	Mugga
	Eucalyptus sieberi	Silvertop Ash
	Eucalyptus smithii	Ironbark Peppermint
	Eucalyptus sparsifolia	Narrow-leaved Stringybark
	Eucalyptus spp.	
	Eucalyptus stellulata	Black Sally
	Eucalyptus stricta	Mallee Ash
	Eucalyptus tereticornis	Forest Red Gum
	Eucalyptus tricarpa	Red Ironbark
	Eucalyptus triflora	Pigeon House Ash
	Eucalyptus viminalis	Manna Gum
	Kunzea ambigua	Tick Bush
	Kunzea cambagei	
	Kunzea capitata	
	Kunzea ericoides	Burgan
	Kunzea parvifolia	
	Leptospermum arachnoides	
	Leptospermum brevipes	
	Leptospermum continentale	Prickly Teatree
	Leptospermum emarginatum	
	Leptospermum epacridoideum	
	Leptospermum juniperinum	
	Leptospermum lanigerum	Woolly Tea-tree
	Leptospermum morrisonii	
	Leptospermum myrsinoides	Heath Tea-tree
	Leptospermum myrtifolium	
	Leptospermum obovatum	
	Leptospermum parvifolium	
	Leptospermum polygalifolium	
	Leptospermum polygalifolium ssp. *polygalifolium*	
	Leptospermum rotundifolium	
	Leptospermum scoparium	
	Leptospermum sejunctum	
	Leptospermum spp.	
	Leptospermum squarrosum	
	Leptospermum trinervium	
	Melaleuca decora	
	Melaleuca ericifolia	Swamp Paperbark
	Melaleuca linariifolia	
	Melaleuca nodosa	
	Melaleuca parvistaminea	
	Melaleuca spp.	
	Melaleuca squarrosa	Scented Paperbark
	Melaleuca styphelioides	Prickly-leaved Tea Tree
	Melaleuca thymifolia	
	Rhodamnia rubescens	Scrub Turpentine
	Syncarpia glomulifera	Turpentine
	Syzygium australe	Brush Cherry
	Tristaniopsis laurina	Kanooka
Nymphaeaceae		
	**Nymphaea mexicana*	Yellow Water-lily
Olacaceae		
	Olax stricta	
Oleaceae		
	Notelaea longifolia	Large Mock-olive
	Notelaea venosa	Veined Mock-olive
Onagraceae		
	Epilobium billardierianum	Robust Willow-herb
	Epilobium billardierianum ssp. *billardierianum*	
	Epilobium billardierianum ssp. *cinereum*	
	Epilobium billardierianum ssp. *hydrophilum*	
	**Epilobium ciliatum*	Glandular Willow-herb
	Epilobium hirtigerum	
	Epilobium pallidiflorum	Showy Willow-herb
	Epilobium spp.	Willow-herb
	**Oenothera* spp.	
	**Oenothera stricta* ssp. *stricta*	

Oxalidaceae		
	Oxalis corniculata	
	Oxalis corniculata spp. agg.	Yellow Wood-sorrel
	Oxalis exilis	Shady Wood-sorrel
	Oxalis perennans	Grassland Wood-sorrel
	Oxalis radicosa	Wood-sorrel
	Oxalis spp.	Wood-sorrel
Passifloraceae		
	Passiflora herbertiana ssp. *herbertiana*	Native Passionfruit
Peperomiaceae		
	Peperomia leptostachya	
	Peperomia tetraphylla	
Phytolaccaceae		
	**Phytolacca octandra*	Red-ink Weed
Piperaceae		
	Piper novae-hollandiae	Giant Pepper Vine
Pittosporaceae		
	Billardiera longiflora	Purple Apple-berry
	Billardiera scandens	Common Apple-berry
	Bursaria lasiophylla	
	Bursaria lasiophylla var. *lasiophylla*	
	Bursaria spinosa	Sweet Bursaria
	Bursaria spinosa var. *macrophylla*	
	Citriobatus pauciflorus	Orange Thorn
	Pittosporum bicolor	Banyalla
	Pittosporum revolutum	
	Pittosporum undulatum	Sweet Pittosporum
	Rhytidosporum procumbens	White Marianth
Plantaginaceae		
	**Plantago coronopus*	Buck's-horn Plantain
	Plantago debilis	Shade Plantain
	Plantago gaudichaudii	
	Plantago hispida	
	**Plantago lanceolata*	Lamb's Tongues
	Plantago spp.	Plantain
	Plantago varia	
Polygalaceae		
	Comesperma defoliatum	Leafless Milkwort
	Comesperma ericinum	Heath Milkwort
	Comesperma ericinum form A	
	Comesperma retusum	Mountain Milkwort
	Comesperma volubile	Love Creeper
	Polygala japonica	Dwarf Milkwort
Polygonaceae		
	**Acetosella vulgaris*	Sheep Sorrel
	Persicaria decipiens	Slender Knotweed
	Persicaria hydropiper	Water Pepper
	Persicaria praetermissa	Spotted Knotweed
	Persicaria prostrata	Creeping Knotweed
	Persicaria spp.	Knotweed
	Persicaria subsessilis	Hairy Knotweed
	Rumex brownii	Slender Dock
	**Rumex crispus*	Curled Dock
	Rumex dumosus	Wiry Dock
	Rumex spp.	
Portulacaceae		
	Calandrinia eremaea	
	Calandrinia spp.	
	Neopaxia australasica	
Primulaceae		
	**Anagallis arvensis*	Scarlet Pimpernel
	Samolus valerandi	Common Brookweed

Proteaceae		
	Banksia cunninghamii	
	Banksia ericifolia	
	Banksia marginata	Silver Banksia
	Banksia oblongifolia	
	Banksia paludosa	
	Banksia serrata	Saw Banksia
	Banksia spinulosa	
	Banksia spinulosa var. *cunninghamii*	Hairpin Banksia
	Conospermum longifolium	
	Conospermum taxifolium	
	Conospermum tenuifolium	
	Grevillea arenaria	
	Grevillea baueri	
	Grevillea baueri ssp. *asperula*	
	Grevillea buxifolia	Grey Spider Flower
	Grevillea diffusa	
	Grevillea juniperina	
	Grevillea lanigera	
	Grevillea linearifolia	
	Grevillea mucronulata	
	Grevillea oleoides	
	Grevillea sericea	
	Hakea dactyloides	
	Hakea eriantha	Tree Hakea
	Hakea gibbosa	
	Hakea microcarpa	Small-fruited Hakea
	Hakea salicifolia	Willow-leaved Hakea
	Hakea sericea	
	Hakea sp. (ex *H. sericea* sensu Willis 1972)	Bushy Hakea
	Hakea teretifolia	
	Isopogon anemonifolius	
	Isopogon prostratus	
	Lambertia formosa	Mountain Devil
	Lomatia fraseri	Tree Lomatia
	Lomatia ilicifolia	Holly Lomatia
	Lomatia myricoides	River Lomatia
	Lomatia silaifolia	Crinkle Bush
	Persoonia bargoensis	
	Persoonia chamaepeuce	
	Persoonia confertiflora	Cluster-flower Geebung
	Persoonia juniperina	
	Persoonia lanceolata	
	Persoonia laurina	
	Persoonia levis	Broad-leaved Geebung
	Persoonia linearis	Narrow-leaf Geebung
	Persoonia microphylla	
	Persoonia mollis	
	Persoonia mollis ssp. *budawangensis*	
	Persoonia mollis ssp. *leptophylla*	
	Persoonia mollis ssp. *livens*	
	Persoonia mollis ssp. *nectens*	
	Persoonia pinifolia	Pine-leaved Geebung
	Petrophile canescens	
	Petrophile pedunculata	
	Petrophile pulchella	
	Petrophile sessilis	
	Stenocarpus salignus	Scrub Beefwood
	Symphionema paludosum	
	Telopea oreades	Gippsland Waratah
	Telopea speciosissima	Waratah
Ranunculaceae		
	Clematis aristata	Mountain Clematis
	Clematis glycinoides	Headache Vine
	Clematis glycinoides var. *glycinoides*	Forest Clematis
	Clematis microphylla	Small-leaved Clematis
	Clematis microphylla var. *leptophylla*	
	Ranunculus amphitrichus	Small River Buttercup
	Ranunculus inundatus	
	Ranunculus lappaceus	Australian Buttercup
	Ranunculus pimpinellifolius	
	Ranunculus plebeius	
	Ranunculus plebeius s.s.	Forest Buttercup
	Ranunculus pumilio	
	Ranunculus sessiliflorus	Annual Buttercup
	Ranunculus sessiliflorus var. *sessiliflorus*	Annual Buttercup
	Ranunculus spp.	Buttercup
Resedaceae		
	**Reseda luteola*	Weld

Rhamnaceae		
	Alphitonia excelsa	Red Ash
	Cryptandra amara	
	Cryptandra amara var. *amara*	
	Cryptandra propinqua	
	Cryptandra scortechinii	
	Discaria pubescens	Australian Anchor Plant
	Emmenosperma alphitonioides	Yellow Ash
	Pomaderris angustifolia	
	Pomaderris aspera	Hazel Pomaderris
	Pomaderris elliptica	Smooth Pomaderris
	Pomaderris eriocephala	Woolly-head Pomaderris
	Pomaderris ferruginea	Rusty Pomaderris
	Pomaderris intermedia	Citron Pomaderris
	Pomaderris lanigera	Woolly Pomaderris
	Pomaderris ligustrina	Privet Pomaderris
	Pomaderris prunifolia	
	Pomaderris species A	
	Spyridium parvifolium	Dusty Miller
Rosaceae		
	Acaena agnipila	Hairy Sheep's Burr
	Acaena echinata	Sheep's Burr
	Acaena novae-zelandiae	Bidgee-widgee
	Acaena ovina	
	Acaena spp.	Sheep's Burr
	**Aphanes arvensis*	Parsley-piert
	Aphanes australiana	
	**Cotoneaster pannosus*	Cotoneaster
	**Potentilla recta*	
	**Rosa rubiginosa*	Sweet Briar
	**Rubus discolor*	Blackberry
	**Rubus fruticosus* spp. agg.	Blackberry
	Rubus hillii	Molucca Bramble
	Rubus parvifolius	Native Raspberry
	**Rubus polyanthemus*	Blackberry
	Rubus rosifolius	Rose-leaf Bramble
	**Rubus* spp.	
	**Sanguisorba minor* ssp. *muricata*	Sheep's Burnet
Rubiaceae		
	Asperula conferta	Common Woodruff
	Asperula euryphylla	
	Asperula pusilla	Alpine Woodruff
	Asperula scoparia	Prickly Woodruff
	Coprosma hirtella	Rough Coprosma
	Coprosma quadrifida	Prickly Currant Bush
	Galium ?roddii	
	Galium binifolium	Reflexed Bedstraw
	Galium curvihirtum	Tight Bedstraw
	**Galium divaricatum*	Slender Bedstraw
	Galium gaudichaudii	Rough Bedstraw
	Galium migrans	Bedstraw
	**Galium murale*	Small Bedstraw
	Galium propinquum	Maori Bedstraw
	Galium spp.	Bedstraw
	Leptostigma reptans	Dwarf Nertera
	Morinda jasminoides	
	Nertera granadensis	
	Opercularia aspera	Coarse Stinkweed
	Opercularia hispida	Hairy Stinkweed
	Opercularia ovata	Broad-leaf Stinkweed
	Opercularia varia	Variable Stinkweed
	Pomax umbellata	Pomax
	Psychotria loniceroides	Hairy Psychotria
	**Sherardia arvensis*	Field Madder
Rutaceae		
	Acronychia oblongifolia	Common Acronychia
	Boronia floribunda	Pale-pink Boronia
	Boronia ledifolia	Sydney Boronia
	Boronia nana	Dwarf Boronia
	Boronia nana var. *hyssopifolia*	Dwarf Boronia
	Boronia parviflora	Swamp Boronia
	Boronia subulifolia	
	Correa lawrenciana	Mountain Correa
	Correa reflexa	Common Correa
	Correa reflexa var. *reflexa*	Common Correa
	Crowea exalata	
	Eriostemon australasius ssp. *australasius*	
	Eriostemon scaber	
	Eriostemon trachyphyllus	Rock Wax-flower

	Melicope micrococca	Hairy-leaved Doughwood
	Phebalium diosmeum	
	Phebalium phylicifolium	Mountain Phebalium
	Philotheca salsolifolia	
	Sarcomelicope simplicifolia ssp. _simplicifolia_	
	Zieria arborescens	Stinkwood
	Zieria smithii	Sandfly Zieria
Salicaceae		
	*_Salix_ spp.	
Sambucaceae		
	Sambucus australasica	Native Elderberry
Santalaceae		
	Choretrum candollei	White Sour Bush
	Exocarpos cupressiformis	Cherry Ballart
	Exocarpos strictus	Pale-fruit Ballart
	Leptomeria acida	Native Currant
	Omphacomeria acerba	
Sapindaceae		
	Alectryon subcinereus	Wild Quince
	Dodonaea multijuga	
	Dodonaea procumbens	
	Dodonaea triquetra	Large-leaf Hop-bush
	Dodonaea viscosa	Sticky Hop-bush
	Dodonaea viscosa ssp. _angustissima_	Hop Bush
	Guioa semiglauca	
Sapotaceae		
	Planchonella australis	Black Apple
Scrophulariaceae		
	Derwentia derwentiana	Derwent Speedwell
	Euphrasia spp.	
	Gratiola peruviana	Austral Brooklime
	Gratiola pumilo	Dwarf Brooklime
	*_Kickxia elatine_	Sharp-leaved Fluellen
	*_Linaria arvensis_	
	*_Linaria pelisseriana_	Pelisser's Toadflax
	*_Linaria_ spp.	Toad-flax
	Mazus pumilio	Swamp Mazus
	*_Parentucellia latifolia_	Red Bartsia
	*_Parentucellia_ spp.	
	*_Verbascum thapsus_	Great Mullein
	*_Verbascum thapsus_ ssp. _thapsus_	Great Mullein
	*_Verbascum virgatum_	Twiggy Mullein
	Veronica calycina	Hairy Speedwell
	Veronica gracilis	Slender Speedwell
	Veronica plebeia	Trailing Speedwell
Solanaceae		
	*_Datura_ spp.	Thorn-apple
	Duboisia myoporoides	Corkwood
	*_Lycium ferocissimum_	African Box-thorn
	Solanum aviculare	Kangaroo Apple
	*_Solanum chenopodioides_	Whitetip Nightshade
	*_Solanum nigrum_	Black Nightshade
	Solanum prinophyllum	Forest Nightshade
	Solanum pungetium	Eastern Nightshade
	Solanum spp.	Kangaroo Apple
	Solanum vescum	Gunyang
Stackhousiaceae		
	Stackhousia monogyna	Creamy Candles
	Stackhousia nuda	
Sterculiaceae		
	Brachychiton acerifolius	Flame Tree
	Commersonia fraseri	Brush Kurrajong
	Lasiopetalum ferrugineum	
	Lasiopetalum macrophyllum	Shrubby Velvet-bush
	Rulingia hermanniifolia	

Stylidiaceae		
	Stylidium graminifolium	Grass Triggerplant
	Stylidium laricifolium	Tree Triggerplant
	Stylidium lineare	Narrow-leaved Triggerplant
	Stylidium productum	
Symplocaceae		
	Symplocos thwaitesii	Buff Hazelwood
Thymelaeaceae		
	Pimelea axiflora	Bootlace Bush
	Pimelea curviflora	
	Pimelea curviflora var. *sericea*	
	Pimelea curviflora/micrantha	Curved/Silky Rice-flower
	Pimelea glauca	
	Pimelea humilis	Common Rice-flower
	Pimelea ligustrina	Tall Rice-flower
	Pimelea linifolia	Slender Rice-flower
	Pimelea linifolia ssp. *linifolia*	
	Pimelea pauciflora	
	Pimelea spp.	
Tremandraceae		
	Tetratheca bauerifolia	Heath Pink-bells
	Tetratheca pilosa	Hairy Pink-bells
	Tetratheca thymifolia	Black-eyed Susan
Ulmaceae		
	Trema aspera	Native Peach
Urticaceae		
	Australina pusilla ssp. *muelleri*	Shade Nettle
	Dendrocnide excelsa	Giant Stinging Tree
	Elatostema reticulatum var. *reticulatum*	
	Urtica incisa	Stinging Nettle
Verbenaceae		
	Clerodendrum tomentosum	
	**Lantana camara*	Lantana
	**Verbena bonariensis*	Purpletop
Violaceae		
	Hybanthus monopetalus	Slender Violet-bush
	Hybanthus vernonii	
	Hymenanthera dentata	Tree Violet
	Hymenanthera spp.	
	Viola ? cleistogamoides	Violet
	Viola betonicifolia	
	Viola betonicifolia ssp. *betonicifolia*	Showy Violet
	Viola hederacea	Ivy-leaved Violet
	Viola hederacea ssp. *hederacea*	Ivy-leaf Violet
	Viola sieberiana	
Viscaceae		
	Notothixos subaureus	Golden Mistletoe
Vitaceae		
	Cissus antarctica	Water Vine
	Cissus hypoglauca	Giant Water Vine
Winteraceae		
	Tasmannia insipida	Brush Pepperbush
	Tasmannia lanceolata	Mountain Pepper

Appendix 1B

Vascular plant species and their frequencies of occurrence in the 72 lists collected in Spread I from Longford to the Victorian/New South Wales border.

* indicates introduced species
r indicates species is rare
d indicates species is depleted
v indicates species is vulnerable

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
8	*Acacia aculeatissima*		1	1
14	**Acacia baileyana*		1	
21	*Acacia cognata*		2	4
25	*Acacia dealbata*		7	8
33	*Acacia falciformis*			7
38	*Acacia genistifolia*	2	15	
41	*Acacia gunnii*		1	
45	*Acacia implexa*	1	1	1
53	*Acacia longifolia*		23	3
56	*Acacia mearnsii*	6	23	8
57	*Acacia melanoxylon*	1	17	15
60	*Acacia mitchellii*	1		
62	*Acacia mucronata*		13	13
63	*Acacia myrtifolia*		16	4
67	*Acacia obliquinervia*			2
71	*Acacia oxycedrus*	2	3	
78	*Acacia pycnantha*	1		
91	*Acacia stricta*		15	10
92	*Acacia suaveolens*		7	
95	*Acacia terminalis*		32	2
98	*Acacia ulicifolia*	1	7	
100	*Acacia verticillata*		8	
104	*Acaena agnipila*			1
106	*Acaena echinata*	2	1	3
105	*Acaena novae-zelandiae*	1	13	7
8004	*Acaena* spp.		1	
2966	**Acetosella vulgaris*	2	3	2
4439	*Acianthus pusillus*	3	20	4
115	*Acmena smithii*		5	2
123	*Acrotriche serrulata*	3	30	12
129	*Adiantum aethiopicum*	1	15	5
151	*Agrostis avenacea*	2	6	3
153	**Agrostis capillaris*		12	
164	**Aira caryophyllea*			1
167	**Aira praecox*	1	1	
8024	*Aira* spp.		1	2
168	*Ajuga australis*		1	2
677	*Allocasuarina littoralis*	3	12	7
683	*Allocasuarina paludosa*	1	3	
206	*Amperea xiphoclada* var. *xiph.*	1	24	4
218	*Amyema miquelii*		4	
220	*Amyema pendulum* ssp. *pend.*	3	15	3
223	**Anagallis arvensis*	1	8	6
231	*Anisopogon avenaceus*		3	
236	**Anthoxanthum odoratum*		1	1
237	*Aotus ericoides*		7	2
255	**Arctotheca calendula*	4	4	
3630	*Aristida calycina* var. *calycina*		1	
284	*Asperula scoparia*	1	1	3
288	*Asplenium flabellifolium*		4	5
304	*Astroloma humifusum*	1	18	10
337	*Australina pusilla* ssp. *muelleri*		2	
346	**Axonopus affinis*		4	1
358	*Baeckea virgata*		5	
363	*Banksia marginata*	2	14	
366	*Banksia serrata*	4	21	2
367	*Banksia spinulosa* var. *cunn.*		2	
371	*Bauera rubioides*		10	
373	*Baumea acuta*		1	

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
374	*Baumea arthrophylla*		1	
376	*Baumea gunnii*		2	
4229	*Baumea rubiginosa* s.s.		1	
382	*Bedfordia arborescens*		2	10
401	*Billardiera longiflora*			1
403	*Billardiera scandens*		34	9
404	*Blechnum cartilagineum*		10	7
407	*Blechnum minus*		4	
408	*Blechnum nudum*		16	6
409	*Blechnum patersonii*		3	1
413	*Blechnum wattsii*		2	
433	*Bossiaea buxifolia*			1
434	*Bossiaea cinerea*	2		
438	*Bossiaea heterophylla*	1		
439	*Bossiaea obcordata*		7	4
440	*Bossiaea prostrata*		1	1
483	*Brachyloma daphnoides*	1		
478	*Brachyscome spathulata* ssp. *spat.*		4	
1611	*Bracteantha bracteata*		5	10
495	**Briza maxima*	1	1	
496	**Briza minor*		2	1
498	**Bromus catharticus*	2		
508	*Brunonia australis*		2	
512	*Burchardia umbellata*		11	4
515	*Bursaria spinosa*	2	12	6
518	*Caesia parviflora*		1	
3680	*Caladenia carnea* var. *carnea*	1	9	8
3667	*Caladenia catenata*		4	2
536	*Caladenia iridescens*		2	
4344	*Caladenia phaeoclavia*	1	1	3
8171	*Caladenia* spp.			1
557	*Caleana major*		2	
562	*Callistemon citrinus*	1	13	
571	*Callitriche muelleri*		1	
8177	*Callitriche* spp.		3	
574	**Callitriche stagnalis*	1	1	
887	*Calochlaena dubia*		25	6
590	*Calomeria amaranthoides*		2	2
616	*Cardamine paucijuga*		1	
8191	*Cardamine* spp.	1	1	
623	*Carex appressa*	1	6	1
627	*Carex breviculmis*		15	9
638	*Carex fascicularis*		1	
639	*Carex gaudichaudiana*		1	
642	*Carex inversa*			1
645	*Carex longebrachiata*			4
8194	*Carex* spp.		1	
666	*Cassinia aculeata*		20	15
668	*Cassinia longifolia*	1	26	14
669	*Cassinia trinerva*		3	
671	*Cassytha glabella*		9	
672	*Cassytha melantha*		1	6
673	*Cassytha phaeolasia*	1	25	4
674	*Cassytha pubescens* s.s.	1	2	1
688	*Caustis flexuosa*		2	
689	*Caustis pentandra*	1		
702	**Centaurium erythraea*	1	25	10
706	*Centella cordifolia*	2	16	
708	*Centipeda minima*		2	1

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
713	*Centrolepis fascicularis*		5	
716	*Centrolepis strigosa* ssp. *strigosa*		1	
719	**Cerastium glomeratum*		2	1
946	**Chamaecytisus palmensis*		1	
730	*Cheilanthes austrotenuifolia*		7	1
748	*Chenopodium pumilio*			1
753	*Chiloglottis reflexa*		12	
973	*Chionochloa pallida*		20	15
756	*Chloris truncata*	1		
1608	*Chrysocephalum baxteri*		1	
1628	*Chrysocephalum semipapposum*			4
782	**Cirsium vulgare*	2	17	10
783	*Cissus hypoglauca*		6	
788	*Clematis aristata*		24	13
789	*Clematis glycinoides* var. *gly.*		2	2
797	*Comesperma ericinum*		6	1
799	*Comesperma retusum*		1	
801	*Comesperma volubile*	2	9	2
810	**Conyza albida*	2	18	6
817	*Coprosma hirtella*			1
822	*Coprosma quadrifida*		9	8
832	*Correa reflexa*	1	17	3
835	*Corybas aconitiflorus*	1	6	
8260	*Corybas* spp.	1		
846	*Cotula australis*	1	1	1
4647	*Craspedia jamesii*		1	
8264	*Craspedia* spp.		1	3
866	*Crassula sieberiana*	1	1	
4337	*Crassula sieberiana* ssp. *tetramera*	1		2
883	*Cryptostylis leptochila*		1	
112	*Cryptostylis reniformis*	1		
8275	*Cryptostylis* spp.		5	2
884	*Cryptostylis subulata*			1
895	*Cyathea australis*		16	10
903	*Cymbonotus preissianus*		1	8
4554	**Cynodon dactylon* var. *dact.*			2
908	*Cynoglossum australe*		1	
909	*Cynoglossum latifolium*		1	
910	*Cynoglossum suaveolens*			1
916	**Cyperus congestus*		1	
918	**Cyperus eragrostis*		6	3
926	*Cyperus lucidus*		2	
112	*Cyrtostylis reniformis*		1	
948	**Dactylis glomerata*	1		
958	*Dampiera stricta*		17	3
969	*Danthonia longifolia*			1
975	*Danthonia pilosa*	1	4	4
977	*Danthonia racemosa* var. *rac.*	1	3	3
979	*Danthonia semiannularis*		1	
980	*Danthonia setacea*	1	8	
8313	*Danthonia* spp.	1	1	3
8315	**Datura* spp.			1
988	**Daucus carota*		1	
996	*Daviesia latifolia*		14	6
1000	*Daviesia leptophylla*	1	1	
999	*Daviesia ulicifolia*	1	9	14
3118	**Delairea odorata*		1	
2415	*Derwentia derwentiana*			1
1008	*Desmodium gunnii*		4	6

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
1021	*Deyeuxia monticola* var. *mont.*			1
1023	*Deyeuxia quadriseta*		6	5
8326	*Deyeuxia* spp.		4	4
1027	*Dianella caerulea* var. *caer.*		39	15
1028	*Dianella longifolia*	1		
1029	*Dianella revoluta*	1	12	6
1030	*Dianella tasmanica*		11	8
1033	*Dichelachne crinita*		1	1
3792	*Dichelachne rara*		8	7
3791	*Dichelachne sieberiana* s.s.			2
8330	*Dichelachne* spp.			2
1036	*Dichondra repens*	4	21	8
1039	*Dicksonia antarctica*		4	2
1050	*Dillwynia cinerascens*	1		
1058	*Dillwynia sericea*	1	2	
1063	*Diplarrena moraea*		1	3
8341	*Dipodium* spp.			1
1070	**Dipsacus fullonum* ssp. *fullonum*		1	
1077	**Dittrichia graveolens*	1	3	1
1085	*Diuris sulphurea*	1	7	5
1093	*Dodonaea triquetra*		5	
1095	*Dodonaea viscosa*		2	
1098	*Doodia media* ssp. *australis*		1	4
3689	*Drosera peltata*	1	11	
1102	*Drosera peltata* ssp. *auriculata*		6	2
1107	*Drosera peltata* ssp. *peltata*	1	1	
1109	*Drosera spatulata*		3	
1111	*Drymophila cyanocarpa*			1
1122	*Echinopogon ovatus*	1	6	1
1128	**Ehrharta erecta*	1	1	1
1129	**Ehrharta longiflora*	1		
1132	*Einadia hastata*	2	1	1
1137	*Elaeocarpus reticulatus*		12	3
1139	*Eleocharis acuta*		3	
1141	*Eleocharis gracilis*		2	
1146	*Eleocharis sphacelata*		4	
146	*Elymus scabrus*		1	2
1155	*Empodisma minus*		5	
1161	*Entolasia marginata*		8	4
1165	*Epacris impressa*	1	37	13
1166	*Epacris lanuginosa*		2	
1168	*Epacris obtusifolia*		1	
1169	*Epacris paludosa*		1	
8397	*Epilobium* spp.	1	1	2
1185	*Eragrostis brownii*	1	18	1
1227	*Eriostemon trachyphyllus*		1	
1255	*Eucalyptus angoph./bridg.*			6
1247	*Eucalyptus angophoroides*		17	1
1249	*Eucalyptus baueriana*		4	
1250	*Eucalyptus baxteri*		10	
1253	*Eucalyptus bosistoana*		3	3
1254	*Eucalyptus botryoides*		17	2
3758	*Eucalyptus bridgesiana*		1	2
1264	*Eucalyptus consideniana*	1	8	3
1766	*Eucalyptus conspicua*		1	
4495	*Eucalyptus croajingolensis*	1	13	1
1267	*Eucalyptus cypellocarpa*		28	16
1274	*Eucalyptus elata*		2	5
1276	*Eucalyptus fastigata*			1

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
1281	*Eucalyptus globoidea*		43	17
1285	*Eucalyptus globulus* ssp. *pseudo.*		1	9
1294	*Eucalyptus macrorhyncha* ssp. *mac.*		3	
1296	*Eucalyptus mannifera*		3	
1297	*Eucalyptus melliodora*	1	1	
1300	*Eucalyptus muelleriana*		2	8
1304	*Eucalyptus obliqua*		10	8
1307	*Eucalyptus ovata*		9	1
1308	*Eucalyptus pauciflora*	2		
1310	*Eucalyptus polyanthemos* ssp. *vest.*		13	9
4487	*Eucalyptus pryoriana*	4		
4461	*Eucalyptus robertsonii* ssp. *rob.*			3
1318	*Eucalyptus sieberi*		27	12
1322	*Eucalyptus tereticornis*	2		
1317	*Eucalyptus tricarpa*		10	
1323	*Eucalyptus viminalis*		3	1
1466	*Euchiton gymnocephalus* s.s.		14	5
3749	*Euchiton involucratus* s.l.		3	2
1471	*Euchiton sphaericus*		1	
1332	**Euphorbia peplus*		1	
1346	*Eustrephus latifolius*		7	4
1350	*Exocarpos cupressiformis*	4	21	11
1353	*Exocarpos strictus*		4	14
1366	*Fieldia australis*		2	
1387	*Gahnia clarkei*		20	2
1392	*Gahnia melanocarpa*		5	3
1394	*Gahnia radula*	2	24	12
1395	*Gahnia sieberiana*		25	4
1404	*Galium binifolium*		5	
1409	*Galium gaudichaudii*		3	3
1411	*Galium migrans*		1	
1413	*Galium propinquum*		1	1
8464	*Galium* spp.		8	8
4336	**Gamochaeta purpurea* (Ross 1993)		9	1
1427	*Geranium homeanum*	1	5	1
1431	*Geranium potentilloides*	3	8	12
1432	*Geranium retrorsum*	1		
1434	*Geranium solanderi*	2	5	6
8474	*Geranium* spp.	1		
1440	*Gleichenia dicarpa*		3	
1441	*Gleichenia microphylla*	1	11	1
1445	*Glossodia major*	2	6	5
8482	*Glossodia* spp.		2	
1455	*Glycine clandestina*	2	15	9
1457	*Glycine tabacina* s.l.		1	
1481	*Gompholobium huegelii*		1	
1484	*Gonocarpus humilis*		1	9
1486	*Gonocarpus micranthus* ssp. *micr.*		13	
1489	*Gonocarpus tetragynus*	2	6	12
1490	*Gonocarpus teucrioides*	1	33	5
1496	*Goodenia elongata*		1	
1507	*Goodenia ovata*		21	15
1517	*Goodia lotifolia* var. *pubescens*		7	8
1524	*Gratiola peruviana*	1	10	2
3753	*Gratiola pumilo*		1	
1563	*Hakea eriantha*		9	7
1571	*Hakea sp.(=H. sericea* Willis 1972)		7	
1584	*Haloragis heterophylla*		1	
1596	*Hardenbergia violacea*	2	22	13

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
1600	*Hedycarya angustifolia*		2	1
1619	*Helichrysum leucopsideum*		4	5
1626	*Helichrysum scorpioides*	2	15	9
1654	*Hemarthria uncinata* var. *uncinata*		3	
1661	*Hibbertia acicularis*		3	
1662	*Hibbertia aspera*		24	12
1663	*Hibbertia calycina*		1	
1665	*Hibbertia dentata*		1	
1667	*Hibbertia empetrifolia*		26	7
1671	*Hibbertia obtusifolia*		15	11
1674	*Hibbertia prostrata*	1		
1677	*Hibbertia sericea*	1	6	
1678	*Hibbertia serpyllifolia*		3	2
1683	*Hibbertia stricta*		1	
1684	*Hibbertia virgata*	2		
1687	*Hierochloe rariflora*		9	5
1691	*Histiopteris incisa*		1	1
1692	**Holcus lanatus*	4	14	3
1705	*Hovea linearis*	1	14	10
1708	*Howittia trilocularis*		2	1
1715	*Hydrocotyle acutiloba*			1
1721	*Hydrocotyle geraniifolia*		1	
1722	*Hydrocotyle hirta*	1	25	10
1723	*Hydrocotyle laxiflora*	2	6	6
1728	*Hydrocotyle sibthorpioides*		4	2
1729	*Hydrocotyle tripartita*	1	4	2
1731	*Hymenanthera dentata*	3	1	2
1734	*Hymenophyllum cupressiforme*		5	
1741	*Hypericum gramineum*	2	30	14
1743	*Hypericum japonicum*		1	2
1744	**Hypericum perforatum*	1		
1747	**Hypochoeris glabra*	1	1	2
1748	**Hypochoeris radicata*	6	44	14
1752	*Hypolepis glandulifera*			1
1751	*Hypolepis muelleri*		1	
1753	*Hypolepis rugosula*		4	
8556	*Hypolepis* spp.		2	
1759	**Ilex aquifolium*			1
1760	*Imperata cylindrica*	2	14	7
1761	*Indigofera australis*		5	6
1775	*Isolepis fluitans*		1	
1776	*Isolepis habra*			1
1779	*Isolepis inundata*		7	1
1782	*Isolepis nodosa*		1	
1787	*Isolepis subtilissima*		1	
1806	**Juncus articulatus*		5	1
1808	*Juncus australis*	1	2	1
1810	*Juncus bufonius*		1	
1820	*Juncus gregiflorus*		3	
1830	*Juncus pallidus*		2	1
1831	*Juncus pauciflorus*		2	2
1834	*Juncus prismatocarpus*		1	
8601	*Juncus* spp.		6	5
1847	*Kennedia prostrata*		6	
1848	*Kennedia rubicunda*		9	5
1849	**Kickxia elatine*			1
1856	*Kunzea ericoides*	5	34	11
1861	*Lagenifera gracilis*		26	8
1863	*Lagenifera stipitata*	1	9	9

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
1876	*Lastreopsis acuminata*			1
1895	**Leontodon taraxacoides*		2	
1910	*Lepidium pseudotasmanicum*		1	
1917	*Lepidosperma concavum*	3	4	
1920	*Lepidosperma filiforme*		4	
1923	*Lepidosperma laterale*			12
4700	*Lepidosperma laterale* var. *lat.*	2	38	4
4701	*Lepidosperma laterale* var. *maj.*		7	
1926	*Lepidosperma longitudinale*		2	
1927	*Lepidosperma neesii*		2	
1930	*Lepidosperma urophorum*		3	2
849	*Leptinella filicula*			2
1943	*Leptorhynchos linearis*		1	
1956	*Leptospermum continentale*	2	29	9
1958	*Leptospermum lanigerum*		3	
1961	*Leptospermum myrsinoides*	1		
2268	*Leptostigma reptans*		1	2
1978	*Leucopogon ericoides*	2	7	
1982	*Leucopogon juniperinus*		4	
1983	*Leucopogon lanceolatus* var. *lanc.*		10	18
1995	*Leucopogon virgatus*	1		
2014	*Lindsaea linearis*		11	1
2021	*Lissanthe strigosa*		1	7
2026	*Lobelia pratioides*		1	
2036	**Lolium perenne*	1		
2039	*Lomandra confertifolia* ssp. *lepto.*		1	1
2042	*Lomandra filiformis*	1	14	10
2046	*Lomandra longifolia*	5	40	19
2048	*Lomandra multiflora* ssp. *multi.*		3	7
2050	*Lomatia fraseri*			3
2051	*Lomatia ilicifolia*		17	10
2052	*Lomatia myricoides*		2	
9285	**Lotus* spp. (naturalised)		1	1
2070	*Luzula meridionalis* var. *flac.*	1	15	12
2078	**Lycium ferocissimum*	1		
2079	*Lycopodium deuterodensum*	1		
2085	*Lycopus australis*		1	
2086	*Lyperanthus nigricans*		1	
2087	*Lyperanthus suaveolens*			1
2092	*Lythrum hyssopifolia*		1	1
2122	**Malva parviflora*	1		
2125	*Marsdenia rostrata*		9	
2133	*Mazus pumilio*		1	
2147	*Melaleuca ericifolia*	1	10	2
2153	*Melaleuca squarrosa*		13	2
2179	*Microlaena stipoides* var. *stip.*	6	44	18
2184	*Microsorum scandens*		1	
2210	*Mitrasacme pilosa*		4	
4736	*Mitrasacme pilosa* var. *stu.*		1	
2212	*Mitrasacme serpyllifolia*		6	
2213	**Modiola caroliniana*	1	1	1
2218	*Monotoca elliptica*	2	1	
2220	*Monotoca scoparia*	2	5	4
2244	*Myosotis australis*		1	
3873	*Myriophyllum simulans*		2	
8765	*Myriophyllum* spp.	1	4	
274	**Myrsiphyllum asparagoides*		1	
8798	**Narcissus* spp.		1	
2282	*Notelaea venosa*		6	1

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
4569	**Nymphaea mexicana*		1	
2299	*Olearia argophylla*		2	6
2304	*Olearia erubescens*		1	6
2312	*Olearia lirata*		26	4
2316	*Olearia myrsinoides*		1	7
2322	*Olearia ramulosa*		4	1
2339	*Opercularia aspera*		13	1
2340	*Opercularia hispida*		4	4
2341	*Opercularia ovata*		1	1
2344	*Opercularia varia*		23	2
2349	*Oplismenus hirtellus*			2
2379	*Oxalis corniculata* spp. agg.	1		1
2381	*Oxalis exilis*		14	4
2386	*Oxalis perennans*	1		
8835	*Oxalis* spp.			2
2393	*Oxylobium arborescens*		1	
1613	*Ozothamnus conditus*		1	1
1614	*Ozothamnus cuneifolius*		7	
1616	*Ozothamnus ferrugineus*		11	4
8838	*Ozothamnus* spp.			1
2399	*Pandorea pandorana*		7	2
2426	*Parsonsia brownii*		3	
2430	**Paspalum dilatatum*	2	10	2
2431	**Paspalum distichum*	1		
2435	*Patersonia fragilis*		3	
2436	*Patersonia glabrata*		23	2
2442	*Pelargonium australe*			1
2446	*Pelargonium inodorum*		1	
4809	*Pellaea falcata* var. *falc.*		3	3
2451	**Pennisetum clandestinum*	2	3	
3919	*Persicaria decipiens*		1	1
3938	*Persicaria praetermissa*		1	
8877	*Persicaria* spp.	1	1	
2462	*Persoonia confertiflora*		7	2
2465	*Persoonia linearis*		32	14
2476	**Phalaris aquatica*	2		1
2497	*Phragmites australis*	1	3	
2501	*Phyllanthus hirtellus*	1	18	
2510	**Phytolacca octandra*			1
2515	*Pimelea axiflora*		4	1
2523	*Pimelea humilis*	2	23	4
2524	*Pimelea ligustrina*			3
2539	**Pinus radiata*		3	1
2543	*Pittosporum undulatum*	1	7	2
2553	**Plantago coronopus*		4	
2555	*Plantago debilis*		4	5
2561	**Plantago lanceolata*	2	9	4
8901	*Plantago* spp.			1
2568	*Platylobium formosum*		25	6
2569	*Platylobium obtusangulum*	1		
2573	*Platysace lanceolata*		11	5
2580	**Poa annua*		1	
2590	*Poa ensiformis*		10	9
2600	*Poa labillardieri*	1	2	1
2602	*Poa morrisii*	1		
2608	*Poa sieberiana*			15
4834	*Poa sieberiana* var. *hirt.*		2	
4835	*Poa sieberiana* var. *sieb.*	2	37	6
8909	*Poa* spp.		2	

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
2610	*Poa tenera*		7	5
2638	*Polyphlebium venosum*		2	
2643	*Polyscias sambucifolia*		7	5
2645	*Polystichum proliferum*		2	4
2650	*Pomaderris aspera*		19	7
2663	*Pomaderris elliptica*		1	
2657	*Pomaderris eriocephala*		2	
2658	*Pomaderris ferruginea*	1	1	
2660	*Pomaderris lanigera*		1	1
2662	*Pomaderris ligustrina*		1	
2677	*Pomax umbellata*		10	1
2683	*Poranthera microphylla*	1	15	3
2693	*Potamogeton tricarinatus*		1	
2740	*Prostanthera hirtula*		2	
2743	*Prostanthera lasianthos*		5	2
2749	*Prostanthera rotundifolia*		1	
2757	**Prunella vulgaris*		10	4
2762	*Pseudognaphalium luteoalbum*	1	6	4
2777	*Pteridium esculentum*	5	42	21
2779	*Pteris tremula*		2	2
2789	*Pterostylis concinna*	3	5	
2802	*Pterostylis longifolia* s.l.		1	1
2806	*Pterostylis nutans*	1	2	
4033	*Pterostylis parviflora* s.s.		5	
8946	*Pterostylis* spp.		4	2
2844	*Pultenaea daphnoides*		3	7
2854	*Pultenaea juniperina*		2	3
2857	*Pultenaea linophylla*		5	
2859	*Pultenaea mollis*	1	7	
2870	*Pultenaea retusa*	1	13	5
2871	*Pultenaea scabra*		11	
2907	*Ranunculus amphitrichus*	1		
2894	*Ranunculus lappaceus*		2	5
3973	*Ranunculus plebeius* s.s.			1
4912	*Ranunculus sessiliflorus* var. *sessiliflorus*		1	
8978	*Ranunculus* spp.		6	6
2916	*Rapanea howittiana*		3	1
2917	**Raphanus raphanistrum*	1		
2926	*Restio tetraphyllus* ssp. *tetra.*		1	
402	*Rhytidosporum procumbens*		28	
2938	*Ricinocarpos pinifolius*	1		
4113	**Romulea rosea*	2	3	
2950	**Rosa rubiginosa*	1	1	2
2395	r*Oxylobium ilicifolium*			1
2813	r*Pterostylis longipetala*			1
2952	**Rubus fruticosus* spp. agg.	2	19	7
2953	*Rubus hillii*		3	1
2956	*Rubus parvifolius*		3	6
2961	*Rubus rosifolius*			1
2968	*Rumex brownii*			1
2970	**Rumex crispus*	1	1	1
2985	**Sagina apetala*		1	
2999	*Sambucus gaudichaudiana*		2	
3012	*Sarcocornia quinqueflora*		1	
3023	*Scaevola ramosissima*		19	4
3039	*Schoenus apogon*		22	4
3041	*Schoenus brevifolius*	1	1	
3048	*Schoenus maschalinus*	1	4	1
3055	*Schoenus tenuissimus*		1	

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
3098	*Selaginella uliginosa*		12	
3107	*Senecio glomeratus*		1	
3113	**Senecio jacobaea*	1		
3115	*Senecio linearifolius*		2	9
3119	*Senecio minimus*		3	6
3124	*Senecio quadridentatus*	1		
9058	*Senecio* spp.		2	4
3129	*Senecio tenuiflorus*	2	17	8
4952	**Setaria gracilis* var. *pauc.*	1	1	1
9059	**Setaria* spp.		1	
3149	*Sigesbeckia orientalis*		4	3
3151	**Silene gallica*			1
3166	*Smilax australis*		8	6
3169	*Solanum aviculare*		2	
3171	**Solanum chenopodioides*			1
3183	**Solanum nigrum*	2	4	3
3186	*Solanum prinophyllum*		12	1
9072	*Solanum* spp.		1	
3203	**Sonchus asper* s.l.		2	1
3204	**Sonchus oleraceus*	3	3	1
3221	*Sphaerolobium vimineum* s.l.	1	3	
3226	**Sporobolus indicus* var. *cape.*		2	2
3231	*Sprengelia incarnata*		1	
3235	*Spyridium parvifolium*		5	
3244	*Stackhousia monogyna*		7	3
3250	*Stellaria flaccida*		3	6
3255	*Stellaria pungens*		3	1
9094	*Stellaria* spp.		4	
3279	*Stipa mollis*		1	
3289	*Stipa rudis*		1	
4941	*Stipa rudis* ssp. *nervosa*		5	1
4942	*Stipa rudis* ssp. *rudis*	1	1	
9099	*Stipa* spp.	1	2	
3303	*Stylidium graminifolium*		1	2
3309	*Stypandra glauca*		19	7
3310	*Styphelia adscendens*	1		
3336	**Taraxacum* Sect. *Ruderalia*			2
3337	*Tasmannia lanceolata*		1	1
3339	*Telopea oreades*			1
3345	*Tetraria capillaris*		10	2
3348	*Tetrarrhena juncea*		33	9
3350	*Tetratheca bauerifolia*			9
3353	*Tetratheca pilosa*		20	4
5005	*Thelymitra ixioides* var. *ixioides*	1	3	1
3382	*Thelymitra pauciflora*			2
9134	*Thelymitra* spp.	1	4	3
3387	*Themeda triandra*	3	16	10
3399	*Thysanotus patersonii*	1	7	3
3405	*Tmesipteris parva*		1	
9147	*Tmesipteris* spp.		1	
3406	*Todea barbara*		3	
3421	*Tricoryne elatior*		1	
3435	**Trifolium repens*	2	5	2
4076	*Triglochin rheophilum*		1	
9162	*Triglochin* spp.		1	
3449	*Triglochin stratum*		1	
3458	*Tristaniopsis laurina*		7	1
3467	*Tylophora barbata*		12	13
3476	*Urtica incisa*	2	4	3

Species Number	Species	Gipps. Coastal Plains	East Gipps. Foothills	Cann River Valley
3491	**Vellereophyton dealbatum*		1	
3494	**Verbascum thapsus*		1	
3496	**Verbena bonariensis*		3	3
3503	*Veronica calycina*		5	8
3506	*Veronica gracilis*		1	
3512	*Veronica plebeia*		6	2
3524	**Vinca major*	1		
7473	*Viola ? cleistogamoides*		1	
3526	*Viola betonicifolia* ssp. *beton.*		6	2
3528	*Viola hederacea*		38	19
5058	*Viola hederacea* ssp. *hederacea*		1	
5065	*Vittadinia cuneata* var. *cune.*			1
3548	**Vulpia muralis*	1		
4069	*Wahlenbergia gracilis* s.s.		6	3
3557	*Wahlenbergia gymnoclada*			2
9236	*Wahlenbergia* spp.		12	3
3559	*Wahlenbergia stricta*	1	1	
4082	*Wurmbea dioica*	1		
3583	*Wurmbea uniflora*			1
3588	*Xanthorrhoea minor* ssp. *lutea*		24	5
3589	*Xanthorrhoea resinifera*		2	
3591	*Xanthosia dissecta*		4	
3592	*Xanthosia pilosa*		13	
3593	*Xanthosia pusilla*		1	
3594	*Xanthosia tridentata*		14	
3595	*Xyris gracilis*		1	
3599	**Zantedeschia aethiopica*		1	
3601	*Zieria arborescens*		2	

Appendix 1C

Species recorded in the 178 CNR quadrats within the 2km corridor in Victoria and not recorded during the current survey.

* indicates introduced species
r indicates species is rare
d indicates species is depleated
v indicates species is vulnerable

Species Number		Species	Common Name	No. of Quads	% of Quads. (178)
8003		*Acacia* spp.	Wattle	1	.56
99		*Acacia verniciflua*	Varnish Wattle	3	1.68
110		*Acianthus caudatus*	Mayfly Orchid	1	.56
111		*Acianthus exsertus/pusillus*	Tiny Gnat Orchid	9	5.05
8007		*Acianthus* spp.	Gnat Orchid	1	.56
132	r	*Adiantum formosum*	Giant Maidenhair	1	.56
8022		*Agrostis* spp.	Blown-grass	1	.56
166	*	*Aira elegans*	Elegant Hair-grass	2	1.12
312		*Allantodia australis*	Austral Lady-fern	1	.56
2875		*Almaleea subumbellata*	Wiry Bush-pea	1	.56
183	*	*Alopecurus pratensis*	Meadow Fox-tail	1	.56
8049		*Amyema* spp.	Mistletoe	1	.56
266		*Arrhenechthites mixta*	Purple Fireweed	1	.56
268		*Arthrochilus huntianus*	Elbow Orchid	1	.56
269		*Arthropodium milleflorum*	Pale Vanilla-lily	2	1.12
8079		*Arthropodium* spp.	Vanilla-lily	1	.56
1038		*Arthropodium strictum*	Chocolate-lily	2	1.12
278		*Asperula conferta*	Common Woodruff	1	.56
287		*Asplenium bulbiferum* ssp. *grac.*	Mother Spleenwort	3	1.68
381		*Baumea tetragona*	Square Twig-sedge	3	1.68
396	r	*Beyeria viscosa*	Pinkwood	1	.56
405		*Blechnum chambersii*	Lance Water-fern	3	1.68
428		*Boronia nana*	Dwarf Boronia	1	.56
4276		*Boronia nana* var. *hyssop.*	Dwarf Boronia	1	.56
441	r	*Bossiaea riparia*	River Bossiaea	1	.56
449		*Brachyscome angustifolia*	Grassland Daisy	1	.56
510		*Bulbine bulbosa*	Yellow Bulbine-lily	1	.56
519		*Caesia calliantha*	Blue Grass-lily	1	.56
4341		*Caesia parviflora* var. *parvi.*	Pale Grass-lily	1	.56
532		*Caladenia dilatata* spp. agg.	Green-comb Spider-orchid	5	2.8
534		*Caladenia filamentosa*	Daddy Long-legs Spider-orchid	1	.56
535		*Caladenia gracilis*	Musky Caladenia	1	.56
543		*Caladenia praecox*	Early Caladenia	5	2.8
546		*Caladenia reticulata* spp. agg.	Veined Spider-orchid	2	1.12
3670		*Calochilus imberbis*	Shaved Beard-orchid	1	.56
589		*Calochilus robertsonii*	Purplish Beard-orchid	2	1.12
603		*Calystegia marginata*	Forest Bindweed	2	1.12
691		*Celastrus australis*	Staff Climber	1	.56
705	*	*Centaurium tenuiflorum*	Branched Centaury	1	.56
733		*Cheilanthes sieberi* ssp. *sieb.*	Narrow Rock Fern	1	.56
751		*Chiloglottis valida*	Common Bird-orchid	3	1.68
796		*Comesperma defoliatum*	Leafless Milkwort	1	.56
811	*	*Conyza bilbaoana*	Fleabane	2	1.12
812	*	*Conyza bonariensis*	Tall Fleabane	1	.56
831		*Correa lawrenciana*	Mountain Correa	2	1.12
838		*Corybas diemenicus*	Veined Helmet-orchid	1	.56
839		*Corybas fimbriatus*	Fringed Helmet-orchid	1	.56
844	*	*Cotoneaster pannosus*	Cotoneaster	1	.56
7056		*Craspedia glauca* sp. *G*	Billy-buttons	1	.56
853		*Craspedia glauca* spp. *agg.*	Common Billy-buttons	8	4.49
860	*	*Crassula decumbens* var. *decum.*	Spreading Crassula	2	1.12
1461	*	*Crassula tetragona*	Crassula	1	.56
885		*Ctenopteris heterophylla*	Gipsy Fern	1	.56
965		*Danthonia geniculata*	Kneed Wallaby-grass	2	1.12
974		*Danthonia penicillata*	Slender Wallaby-grass	1	.56
981		*Danthonia tenuior*	Purplish Wallaby-grass	1	.56
989		*Daucus glochidiatus*	Austral Carrot	1	.56
1005		*Dennstaedtia davallioides*	Lacy Ground-fern	1	.56
1013		*Deyeuxia contracta*	Compact Bent-grass	1	.56

Species Number		*Species*	Common Name	No. of Quads	% of Quads. (178)
1016		*Deyeuxia densa*	Heath Bent-grass	1	.56
1017		*Deyeuxia frigida*	Forest Bent-grass	1	.56
1018		*Deyeuxia gunniana*	Bog Bent-grass	1	.56
1024		*Deyeuxia rodwayi*	Tasman Bent-grass	3	1.68
1025		*Deyeuxia scaberula*	Rough Bent-grass	4	2.24
1051		*Dillwynia glaberrima*	Smooth Parrot-pea	5	2.8
1068		*Dipodium punctatum*	Hyacinth Orchid	4	2.24
1080		*Diuris maculata (D. pardina)*	Leopard Orchid	9	5.05
1472		*Diuris pardina*	Panther Orchid	1	.56
1084	v	*Diuris punctata var. punctata*	Purple Diuris	1	.56
1096		*Doodia aspera*	Prickly Rasp-fern	1	.56
1103		*Drosera binata*	Forked Sundew	1	.56
1108		*Drosera pygmaea*	Tiny Sundew	4	2.24
1136		*Elaeocarpus holopetalus*	Black Oliveberry	4	2.24
1174		*Epilobium billardierianum*	Robust Willow-herb	6	3.37
1176	*	*Epilobium ciliatum*	Glandular Willow-herb	1	.56
1180	d	*Epilobium pallidiflorum*	Showy Willow-herb	1	.56
1219		*Eriochilus cucullatus*	Parson's Bands	1	.56
1407		*Galium curvihirtum*	Tight Bedstraw	3	1.68
1412	*	*Galium murale*	Small Bedstraw	1	.56
1420		*Geitonoplesium cymosum*	Scrambling Lily	1	.56
1429		*Geranium neglectum*	Red-stem Cranesbill	1	.56
1451		*Glyceria australis*	Australian Sweet-grass	1	.56
3741		*Glycine microphylla*	Small-leaf Glycine	2	1.12
1501		*Goodenia hederacea*	Ivy Goodenia	1	.56
1503		*Goodenia humilis*	Swamp Goodenia	3	1.68
1508		*Goodenia paniculata*	Branched Goodenia	3	1.68
1625		*Helichrysum rutidolepis* s.l.	Pale Everlasting	1	.56
2511	*	*Helminthotheca echioides*	Ox-tongue	1	.56
1720		*Hydrocotyle foveolata*	Yellow Pennywort	3	1.68
1726		*Hydrocotyle pterocarpa*	Wing Pennywort	4	2.24
1737		*Hymenophyllum rarum*	Narrow Filmy Fern	2	1.12
1780		*Isolepis marginata*	Little Club-sedge	2	1.12
1822		*Juncus homalocaulis*	Wiry Rush	1	.56
1833		*Juncus planifolius*	Broad-leaf Rush	5	2.8
1841		*Juncus sarophorus*	Rush	4	2.24
1843		*Juncus subsecundus*	Finger Rush	3	1.68
1846		*Juncus vaginatus*	Clustered Rush	1	.56
1874		*Lasiopetalum macrophyllum*	Shrubby Velvet-bush	3	1.68
1929		*Lepidosperma tortuosum*	Tortuous Rapier-sedge	1	.56
1943		*Leptorhynchos linearis*	Shiny Buttons	5	2.8
1951		*Leptospermum brevipes*	Slender Tea-tree	1	.56
1975		*Leucopogon collinus*	Fringed Beard-heath	6	3.37
2015	r	*Lindsaea microphylla*	Lacy Wedge-fern	2	1.12
2017		*Linum marginale*	Native Flax	1	.56
2020		*Lipocarpha microcephala*	Button Rush	1	.56
2024		*Lobelia alata*	Angled Lobelia	4	2.24
2025		*Lobelia gibbosa* s.l.	Tall Lobelia	12	6.74
2026		*Lobelia pratioides*	Poison Lobelia	1	.56
2027		*Lobelia rhombifolia* s.l.	Tufted Lobelia	2	1.12
3843		*Lomandra nana*	Dwarf Mat-rush	1	.56
8684		*Lomandra* spp.	Mat-rush	6	3.37
2069		*Luzula meridionalis var. den.*	Common Woodrush	23	12.92
2093		*Lythrum salicaria*	Purple Loosestrife	1	.56
2167		*Mentha laxiflora*	Forest Mint	1	.56
2183		*Microsorum pustulatum*	Kangaroo Fern	6	3.37
2187		*Microtis parviflora*	Slender Onion-orchid	2	1.12
2211		*Mitrasacme polymorpha*	Varied Mitrewort	1	.56
2224		*Morinda jasminoides*	Jasmine Morinda	4	2.24

Species Number		Species	Common Name	No. of Quads	% of Quads. (178)
2345		*Ophioglossum lusitanicum*	Austral Adder's-tongue	1	.56
2370		*Orthoceras strictum*	Horned Orchid	1	.56
2389		*Oxalis radicosa*	Wood-sorrel	4	2.24
8835		*Oxalis* spp.	Wood-sorrel	7	3.93
1620		*Ozothamnus obcordatus*	Grey Everlasting	1	.56
2437		*Patersonia occidentalis*	Long Purple-flag	1	.56
2438		*Patersonia sericea*	Silky Purple-flag	2	1.12
2456		*Pentapogon quadrifidus*	Five-awned Spear-grass	2	1.12
2637		*Persicaria subsessilis*	Hairy Knotweed	1	.56
2517		*Pimelea curviflora/micrantha*	Curved/Silky Rice-flower	9	5.05
2525		*Pimelea linifolia*	Slender Rice-flower	3	1.68
2540		*Pittosporum bicolor*	Banyalla	3	1.68
2558		*Plantago gaudichaudii*	Narrow Plantain	1	.56
2566		*Plantago varia*	Variable Plantain	2	1.12
2572		*Platysace heterophylla*	Slender Platysace	1	.56
2574	r	*Plectorrhiza tridentata*	Tangle Orchid	1	.56
2584		*Poa clelandii*	Matted Tussock-grass	3	1.68
2601		*Poa meionectes*	Fine-leaf Tussock-grass	1	.56
2623	v	*Polygala japonica*	Dwarf Milkwort	1	.56
2673		*Pomaderris intermedia*	Citron Pomaderris	1	.56
2703		*Prasophyllum brevilabre*	Short-lip Leek-orchid	2	1.12
2816		*Pterostylis* aff. *rufa*	Rusty-hood	1	.56
2797		*Pterostylis furcata*	Sickle Greenhood	1	.56
2837		*Pultenaea benthamii*	Bentham's Bush-pea	1	.56
2846		*Pultenaea dentata*	Clustered Bush-pea	1	.56
2852		*Pultenaea hispidula*	Rusty Bush-pea	1	.56
2872		*Pultenaea stricta*	Rigid Bush-pea	2	1.12
2883		*Pyrrosia rupestris*	Rock Felt-fern	1	.56
2925		*Restio complanatus*	Flat Cord-rush	4	2.24
2943		*Rorippa dictyosperma*	Forest Bitter-cress	1	.56
8995		*Rorippa* spp.	Bitter-cress	4	2.24
2959	*	*Rubus discolor*	Blackberry	1	.56
2958	*	*Rubus polyanthemus*	Blackberry	3	1.68
2976		*Rumohra adiantiformis*	Leathery Shield-fern	1	.56
3009		*Sarcochilus australis*	Butterfly Orchid	1	.56
3013		*Sarcopetalum harveyanum*	Pearl Vine	5	2.8
3029		*Schizaea asperula*	Rough Comb-fern	2	1.12
3030		*Schizaea bifida*	Forked Comb-fern	1	.56
3092		*Sebaea ovata*	Yellow Sebaea	1	.56
3111		*Senecio hispidulus*	Rough Fireweed	6	3.37
3131		*Senecio velleioides*	Forest Groundsel	2	1.12
3193		*Solanum vescum*	Gunyang	8	4.49
3195		*Solenogyne dominii*	Solenogyne	2	1.12
3207		*Sowerbaea juncea*	Rush Lily	1	.56
3251	*	*Stellaria media*	Chickweed	2	1.12
3252		*Stellaria multiflora*	Rayless Starwort	1	.56
3262		*Sticherus lobatus*	Spreading Fan-fern	27	15.16
3263		*Sticherus tener*	Silky Fan-fern	1	.56
9128		*Tetrarrhena* spp.	Wire-grass	1	.56
3349		*Tetrarrhena turfosa*	Peaty Rice-grass	1	.56
3308		*Thelionema caespitosum*	Tufted Lily	4	2.24
3379		*Thelymitra media*	Tall Sun-orchid	1	.56
3398		*Thysanotus juncifolius*	Rush Fringe-lily	2	1.12
3400		*Thysanotus tuberosus*	Common Fringe-lily	25	14.04
3402		*Tmesipteris obliqua*	Long Fork-fern	1	.56
3427	*	*Trifolium dubium*	Suckling Clover	4	2.24
3479		*Utricularia dichotoma*	Purple Bladderwort	2	1.12
3509		*Veronica notabilis*	Forest Speedwell	3	1.68
3520		*Villarsia exaltata*	Erect Marsh-flower	2	1.12

Species Number		*Species*	Common Name	No. of Quads	% of Quads. (178)
3529		*Viola sieberiana*	Tiny Violet	1	.56
3544	*	*Vulpia bromoides*	Squirrel-tail Fescue	2	1.12
3549	*	*Vulpia myuros*	Rat's-tail Fescue	1	.56
3555		*Wahlenbergia gracilenta* s.l.	Annual Bluebell	3	1.68
3560		*Wahlenbergia multicaulis* s.l.	Many-stemmed Bluebell	2	1.12
3587		*Xanthorrhoea australis*	Austral Grass-tree	1	.56
3597		*Xyris operculata*	Tall Yellow-eye	1	.56

Appendix 1D

Vascular plant species recorded from the 51 lists taken in Spread II from the Victorian/New South Wales border to the Endrick River.

+ indicates species recorded

* indicates introduced species

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
2185	*Acacia brownii*			+
2187	*Acacia buxifolia*			+
2197	*Acacia dawsonii*		+	+
2198	*Acacia dealbata*	+	+	+
2202	*Acacia decurrens*			+
2220	*Acacia genistifolia*		+	+
2224	*Acacia gunnii*	+	+	+
2237	*Acacia lanigera*		+	+
2245	*Acacia longifolia*			+
2250	*Acacia mearnsii*			+
2251	*Acacia melanoxylon*	+		+
2254	*Acacia mucronata* var. *longifolia*	+		
2255	*Acacia myrtifolia*			+
2257	*Acacia obtusata*			+
2262	*Acacia paradoxa*		+	
2263	*Acacia parramattensis*		+	+
2264	*Acacia parvipinnula*			+
2273	*Acacia rubida*		+	+
2277	*Acacia siculiformis*	+		
3880	*Acaena agnipila*	+	+	
3881	*Acaena echinata*	+	+	+
3882	*Acaena novae-zelandiae*	+	+	+
3883	*Acaena ovina*	+		+
6006	*Acaena* spp.	+	+	+
3521	**Acetosella vulgaris*	+	+	+
1233	*Acrotriche serrulata*		+	+
7	*Adiantum aethiopicum*			+
4428	*Agrostis avenacea var perennis*	+		
3039	*Agrostisavenacea* var. *avenac* s.l.	+	+	+
3041	**Agrostis capillaris* s.l.	+		
3049	*Agrostis venusta* s.l.		+	
6032	*Agrostis* spp.		+	+
3051	**Aira caryophyllea*	+	+	
3053	**Aira elegantissima*		+	
3054	**Aira praecox*	+	+	+
6034	*Aira* spp.		+	+
1925	*Ajuga australis*	+	+	
826	*Allocasuarina glareicola*			+
827	*Allocasuarina gymnanthera*			+
828	*Allocasuarina littoralis*	+	+	+
831	*Allocasuarina paludosa*			+
6043	*Allocasuarina* spp.			+
834	*Allocasuarina verticillata*		+	
2092	*Amyema pendulum*		+	+
6063	*Amyema* spp.			+
3587	**Anagallis arvensis*		+	+
3067	**Anthoxanthum odoratum*	+		
1403	*Aotus ericoides*			+
3886	**Aphanes arvensis*		+	+
3887	*Aphanes australiana*		+	
264	**Arctotheca calendula*		+	+
3071	*Aristida calycina* var. *calycina*			+
3080	*Aristida ramosa*	+	+	+
6094	*Aristida* spp.		+	+
3081	*Aristida vagans*		+	+
83	*Arthropodium minus*		+	
6099	*Arthropodium* spp.	+		
3914	*Asperula conferta*	+	+	+
3915	*Asperula euryphylla*	+	+	

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
3917	*Asperula pusilla*	+	+	+
3918	*Asperula scoparia*	+	+	
235	*Asplenium flabellifolium*		+	+
1234	*Astroloma humifusum*			+
3097	**Avena sativa*	+		
611	*Azolla filiculoides* var. *rubra*	+		
2353	*Baeckea utilis*			+
3600	*Banksia marginata*			+
3602	*Banksia paludosa*			+
3607	*Banksia spinulosa*			+
966	*Baumea gunnii*	+		
972	*Baumea rubiginosa*			+
6140	*Baumea* spp.		+	
2994	*Billardiera scandens*			+
636	*Blechnum minus*	+	+	+
1408	*Bossiaea buxifolia*	+		
1410	*Bossiaea ensata*			+
1411	*Bossiaea foliosa*	+	+	+
1416	*Bossiaea obcordata*		+	+
1418	*Bossiaea prostrata*	+		+
1421	*Bossiaea riparia*		+	
3103	*Bothriochloa macra*			+
278	*Brachycome angustifolia* var. *heter.*	+	+	+
282	*Brachycome ciliaris*			+
281	*Brachycome ciliaris* var. *ciliaris*		+	+
283	*Brachycome decipiens*			+
285	*Brachycome diversifolia* var. *diver.*	+	+	
6160	*Brachycome* spp.	+		
1236	*Brachyloma daphnoides*	+	+	+
310	*Bracteantha bracteata*	+		
85	**Brassica nigra*		+	
672	**Brassica rapa* ssp. *sylvestris*		+	
3106	**Briza maxima*			+
3107	**Briza minor*			+
3114	**Bromus hordeaceus*		+	+
3117	**Bromus molliformis*		+	
1700	*Brunonia australis*	+	+	
1	*Brunoniella australis*			+
226	*Bulbine bulbosa*	+	+	
893	*Burchardia umbellata*			+
2997	*Bursaria lasiophylla*	+	+	+
2996	*Bursaria lasiophylla* var. *lasio.*		+	+
3005	*Bursaria spinosa*		+	+
3002	*Bursaria spinosa* var. *macrophylla*			+
91	*Caesia parviflora*			+
2697	*Caladenia caerulea*			+
2700	*Caladenia carnea*			+
6187	*Caladenia* spp.			+
3566	*Calandrinia eremaea*		+	
6188	*Calandrinia* spp.	+		
2358	*Callistemon pallidus*		+	+
2364	*Callistemon sieberi*	+		
952	*Callitris endlicheri*		+	+
315	*Calocephalus citreus*			+
325	*Calotis scabiosifolia* var. *integ.*	+		
2366	*Calytrix tetragona*			+
677	**Capsella bursa-pastoris*	+	+	
688	**Cardaria draba*	+		
2331	*Carex appressa*	+	+	+

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
4430	*Carex bichenoviana*	+		
981	*Carex breviculmis*	+	+	+
991	*Carex gaudichaudiana*	+		+
4429	*Carex inversa*	+	+	
4436	*Carex inversa var parvula*		+	
6217	*Carex spp.*	+	+	+
1001	*Carex tereticaulis*	+		
332	**Carthamus lanatus*	+	+	
333	*Cassinia aculeata*	+	+	+
334	*Cassinia arcuata*	+		
342	*Cassinia longifolia*	+	+	+
343	*Cassinia quinquefaria*		+	+
2006	*Cassytha pubescens*			+
6223	*Cassytha spp.*			+
835	*Casuarina cunninghamiana ssp. cunn.*			+
1004	*Caustis flexuosa*			+
1661	**Centaurium erythraea*		+	+
1190	*Centella cordifolia*			+
773	**Cerastium glomeratum*		+	+
774	**Cerastium semidecandrum*			+
1342	*Chamaesyce drummondii*	+	+	
4179	*Cheilanthes distans*	+	+	
4180	*Cheilanthes sieberi ssp. sieberi*	+	+	+
6250	*Chiloglottis spp.*		+	+
3132	*Chionochloa pallida*	+	+	+
3135	*Chloris truncata*		+	
4068	*Choretrum candollei*			+
360	*Chrysocephalum apiculatum*	+	+	+
361	*Chrysocephalum semipapposum*	+	+	+
6263	*Chrysocephalum spp.*		+	
6268	**Cirsium spp.*			+
364	**Cirsium vulgare*	+	+	+
3770	*Clematis microphylla*			+
3768	*Clematis microphylla var. lepto.*		+	
3614	*Conospermum taxifolium*			+
911	*Convolvulus erubescens*	+	+	
6293	**Conyza spp.*		+	+
3925	*Coprosma quadrifida*			+
373	*Cotula australis*		+	
374	**Cotula coronopifolia*	+		
377	*Craspedia canens*			+
378	*Craspedia coolaminica*			+
6307	*Craspedia spp.*	+		
386	*Craspedia variabilis*		+	
931	*Crassula decumbens var. decumbens*			+
932	*Crassula helmsii*	+		
936	*Crassula sieberiana*	+	+	+
2119	**Crataegus monogyna*	+	+	
3822	*Cryptandra amara var. amara*	+	+	+
3828	*Cryptandra propinqua*			+
3829	*Cryptandra scortechinii*			+
390	*Cymbonotus lawsonianus*	+	+	
391	*Cymbonotus preissianus*	+	+	+
6330	*Cymbonotus spp.*	+	+	+
3142	*Cymbopogon refractus*	+		
6331	*Cymbopogon spp.*		+	+
3143	*Cynodon dactylon*		+	
6335	*Cynoglossum spp.*	+		
1030	*Cyperus gunnii ssp. gunnii*	+		

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
1039	*Cyperus lucidus*	+		
6337	*Cyperus* spp.	+		
1433	*Cytisus scoparius* ssp. *scoparius*	+		
3148	**Dactylis glomerata*	+	+	+
3154	*Danthonia caespitosa*	+	+	+
3157	*Danthonia eriantha*		+	
3159	*Danthonia laevis*	+	+	
3162	*Danthonia linkii*	+		
3166	*Danthonia nudiflora*		+	
3167	*Danthonia penicillata*			+
3168	*Danthonia pilosa* var. *pilosa*	+	+	+
3171	*Danthonia racemosa*		+	+
3174	*Danthonia setacea*	+	+	
6348	*Danthonia* spp.	+	+	+
3176	*Danthonia tenuior*			+
128	*Daucus glochidiatus*	+	+	+
1440	*Daviesia leptophylla*			+
1443	*Daviesia mimosoides*	+	+	+
1447	*Daviesia ulicifolia*	+		
4116	*Derwentia derwentiana*	+		
1452	*Desmodium varians*	+	+	+
6366	*Deyeuxia* spp.		+	
2974	*Dianella caerulea*	+		
2979	*Dianella longifolia*	+	+	+
2982	*Dianella revoluta*	+	+	+
6367	*Dianella* spp.		+	+
2983	*Dianella tasmanica*			+
3205	*Dichanthium sericeum* ssp. *sericeum*		+	
3208	*Dichelachne crinita*		+	
6370	*Dichelachne* spp.		+	+
915	*Dichondra repens*	+	+	+
916	*Dichondra species A*	+	+	
1454	*Dillwynia brunioides*			+
1455	*Dillwynia cinerascens*		+	
1462	*Dillwynia phylicoides*		+	+
1464	*Dillwynia ramosissima*			+
1465	*Dillwynia retorta*		+	
1466	*Dillwynia sericea*		+	+
6379	*Dillwynia* spp.			+
3833	*Discaria pubescens*	+		
2786	*Diuris corymbosa*			+
2789	*Diuris lanceolata*	+		
2792	*Diuris pardina*			+
4091	*Dodonaea procumbens*		+	
4097	*Dodonaea viscosa* ssp. *angustissima*	+	+	
1206	*Drosera auriculata*		+	+
1210	*Drosera peltata*	+		+
3242	*Echinopogon mckiei*			+
3243	*Echinopogon ovatus*			+
656	**Echium plantagineum*		+	
6412	*Echium* spp.	+		+
657	**Echium vulgare*	+	+	
866	*Einadia nutans*	+	+	+
6418	*Einadia* spp.	+		
1229	*Elatine gratioloides*	+		
1058	*Eleocharis acuta*	+		
1063	*Eleocharis gracilis*	+		
1069	*Eleocharis pusilla*	+		
1070	*Eleocharis sphacelata*	+		

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
3249	**Eleusine tristachya*		+	
2330	*Elmyus scaber*	+	+	+
3253	*Enneapogon nigricans*	+	+	+
3257	*Entolasia stricta*			+
1248	*Epacris impressa*	+		
1252	*Epacris microphylla*			+
1250	*Epacris microphylla var. micro.*			+
2652	*Epilobium billardierianum ssp. bill*	+		
2653	*Epilobium billardierianum ssp. cine*	+	+	+
2654	*Epilobium billardierianum ssp. hydr*	+		
2660	*Epilobium hirtigerum*	+		
6437	*Epilobium spp.*	+		+
3260	*Eragrostis brownii*		+	+
3262	**Eragrostis curvula*		+	
3263	*Eragrostis elongata*	+		
6439	*Eragrostis spp.*		+	+
3274	*Eragrostis trachycarpa*			+
6444	*Erigeron spp.*	+		
2802	*Eriochilus cucullatus*		+	
1670	**Erodium botrys*	+		
1672	**Erodium cicutarium*		+	
1673	*Erodium crinitum*	+		
1674	**Erodium moschatum*	+		
695	**Erophila verna ssp. praecox*	+		
132	*Eryngium rostratum*		+	
2385	*Eucalyptus aggregata*			+
2400	*Eucalyptus blakelyi*			+
2404	*Eucalyptus bridgesiana*		+	+
2420	*Eucalyptus croajingolensis*	+		
2422	*Eucalyptus cypellocarpa*	+		
2432	*Eucalyptus dives*	+	+	+
2433	*Eucalyptus elata*			+
2436	*Eucalyptus fastigata*	+		
2463	*Eucalyptus macrorhyncha*		+	+
2466	*Eucalyptus mannifera*	+	+	+
2468	*Eucalyptus melliodora*		+	+
2473	*Eucalyptus muelleriana*		+	+
2475	*Eucalyptus niphophila*		+	
2477	*Eucalyptus nortonii*		+	
2484	*Eucalyptus ovata*	+		
2491	*Eucalyptus pauciflora*	+	+	+
2498	*Eucalyptus polyanthemos*		+	+
2508	*Eucalyptus radiata*	+		+
2515	*Eucalyptus robertsonii*		+	
2517	*Eucalyptus rossii*		+	+
2521	*Eucalyptus rubida*	+	+	+
2530	*Eucalyptus smithii*	+		
6458	*Eucalyptus spp.*		+	+
2534	*Eucalyptus stellulata*	+		+
2544	*Eucalyptus viminalis*	+	+	+
6461	*Euphrasia spp.*	+		
4071	*Exocarpos cupressiformis*		+	
4073	*Exocarpos strictus*			+
6472	*Festuca spp.*		+	
134	**Foeniculum vulgare*			+
1084	*Gahnia sieberiana*	+		+
3930	**Galium divaricatum*			+
3931	*Galium gaudichaudii*			+
3934	**Galium murale*		+	+

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
3936	*Galium roddii*		+	
6485	*Galium* spp.		+	+
1473	**Genista monspessulana*			+
2723	*Geranium homeanum*			+
1677	**Geranium molle* var. *molle*	+	+	
1682	*Geranium potentilloides*			+
1683	*Geranium retrorsum*		+	+
4437	*Geranium scabrifolium*		+	+
1686	*Geranium solanderi*	+		
1685	*Geranium solanderi* var. *solanderi*		+	+
2725	*Geranium* sp. aff. *solanderi*	+	+	+
6496	*Geranium* spp.			+
2724	*Geranium subglabrous*	+	+	+
2827	*Glossodia major*			+
2828	*Glossodia minor*			+
6503	*Glossodia* spp.			+
3288	*Glyceria australis*	+		
3291	**Glyceria maxima*	+		
1475	*Glycine canescens*		+	+
1476	*Glycine clandestina*		+	+
1479	*Glycine tabacina*	+	+	
412	*Gnaphalium argentifolium*	+	+	
416	*Gnaphalium gymnocephalum*	+	+	+
417	*Gnaphalium involucratum*	+	+	+
6509	*Gnaphalium* spp.		+	+
1482	*Gompholobium huegelii*	+	+	+
1484	*Gompholobium minus*			+
1486	*Gompholobium* species B			+
6512	*Gompholobium* spp.			+
1487	*Gompholobium uncinatum*			+
1490	*Gompholobium virgatum*			+
1488	*Gompholobium virgatum* var. *aspala*.			+
1750	*Gonocarpus longifolius*			+
1753	*Gonocarpus micranthus*	+		+
6514	*Gonocarpus* spp.	+		
1756	*Gonocarpus tetragynus*	+	+	+
1717	*Goodenia hederacea* ssp. *hederacea*	+		+
3047	*Goodenia humilis*			+
4139	*Gratiola peruviana*	+		+
3639	*Grevillea juniperina*			+
3640	*Grevillea lanigera*	+		
1745	*Haemodorum corymbosum*			+
3671	*Hakea dactyloides*			+
3673	*Hakea eriantha*			+
3677	*Hakea microcarpa*	+		
3680	*Hakea sericea*			+
3682	*Hakea teretifolia*			+
1763	*Haloragis heterophylla*	+	+	+
1492	*Hardenbergia violacea*		+	+
435	*Helichrysum rutidolepis*	+		
436	*Helichrysum scorpioides*	+		+
437	**Helminthotheca echioides*			+
3294	*Hemarthria uncinata*	+		
1178	*Hibbertia calycina*		+	+
1187	*Hibbertia linearis*			+
1191	*Hibbertia obtusifolia*	+	+	+
1195	*Hibbertia rufa*			+
1199	*Hibbertia serpyllifolia*			+
699	**Hirschfeldia incana*		+	

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
3298	**Holcus lanatus*	+	+	+
3303	**Hordeum leporinum*	+	+	
3304	**Hordeum marinum*		+	
1496	*Hovea linearis*	+	+	+
137	*Hydrocotyle algida*	+		+
4439	*Hydrocotyle foveolata*			+
4431	*Hydrocotyle hirta*	+		+
140	*Hydrocotyle laxiflora*	+	+	+
141	*Hydrocotyle peduncularis*	+	+	+
4432	*Hydrocotyle sibthorpoides*	+		
6569	*Hydrocotyle spp.*		+	+
142	*Hydrocotyle tripartita*	+	+	+
6570	*Hymenanthera spp.*	+		
889	*Hypericum gramineum*	+	+	+
890	*Hypericum japonicum*	+		+
892	**Hypericum perforatum*	+	+	
439	**Hypochaeris glabra*		+	
441	**Hypochaeris radicata*	+	+	+
3307	*Imperata cylindrica var. major*			+
1503	*Indigofera australis*		+	+
442	*Isoetopsis graminifolia*	+	+	+
1090	*Isolepis fluitans*	+		
1098	*Isolepis platycarpa*			+
6590	*Isolepis spp.*	+	+	+
3689	*Isopogon prostratus*			+
2045	*Isotoma fluviatilis*			+
1505	*Jacksonia scoparia*			+
1860	*Juncus alexandri*	+		+
1861	*Juncus amabilis*	+	+	
1865	*Juncus australis*	+	+	+
1867	**Juncus bufonius*		+	
1868	**Juncus bulbosus*	+		
1875	*Juncus continuus*	+		
1877	*Juncus falcatus*			+
1878	*Juncus filicaulis*		+	+
1880	*Juncus flavidus*	+	+	
1882	*Juncus gregiflorus*		+	
1883	*Juncus holoschoenus*			+
1884	*Juncus homalocaulis*	+	+	
1889	*Juncus laeviusculus*			+
1896	*Juncus planifolius*	+		
1903	*Juncus sarophorus*	+		+
6595	*Juncus spp.*	+	+	+
1905	*Juncus subsecundus*	+	+	+
1908	*Juncus usitatus*		+	
1909	*Juncus vaginatus*		+	
2548	*Kunzea ambigua*			+
2551	*Kunzea ericoides*		+	+
2553	*Kunzea parvifolia*	+	+	+
446	*Lagenifera stipitata*	+		+
97	*Laxmannia gracilis*		+	+
448	**Leontodon taraxacoides ssp. taraxac*			+
1108	*Lepidosperma filiforme*	+		+
1111	*Lepidosperma gunnii*		+	+
1113	*Lepidosperma laterale*			+
1115	*Lepidosperma longitudinale*			+
6626	*Lepidosperma spp.*		+	+
1119	*Lepidosperma tortuosum*			+
1120	*Lepidosperma urophorum*			+

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins'/ Nerriga Hills
6627	*Lepilaena spp.*	+		
454	*Leptorhynchos squamatus ssp. B*	+	+	+
2560	*Leptospermum brevipes*			+
2561	*Leptospermum continentale*			+
2568	*Leptospermum juniperinum*			+
2570	*Leptospermum lanigerum*	+		+
2575	*Leptospermum myrsinoides*			+
2576	*Leptospermum myrtifolium*	+		+
2577	*Leptospermum obovatum*	+	+	+
2582	*Leptospermum polygalifolium ssp. po*			+
2587	*Leptospermum scoparium*			+
6635	*Leptospermum spp.*			+
2591	*Leptospermum squarrosum*		+	+
1264	*Leucopogon appressus*			+
1267	*Leucopogon ericoides*		+	+
1270	*Leucopogon fletcheri*		+	+
1276	*Leucopogon lanceolatus*			+
1281	*Leucopogon microphyllus*			+
6643	*Leucopogon spp.*		+	+
1288	*Leucopogon virgatus*			+
4145	**Linaria arvensis*		+	+
4146	**Linaria pelisseriana*	+	+	+
6651	**Linaria spp.*	+	+	
2034	*Linum marginale*		+	
1290	*Lissanthe strigosa*		+	+
2046	*Lobelia alata*		+	
3319	**Lolium multiflorum*		+	
3320	**Lolium perenne*	+		
6662	*Lolium spp.*		+	
2067	*Lomandra bracteata*		+	+
2071	*Lomandra confertifolia ssp. rubigin*		+	+
4426	*Lomandra elongata*			+
2078	*Lomandra filiformis*		+	+
2075	*Lomandra filiformis ssp. coriacea*		+	+
2076	*Lomandra filiformis ssp. filiformis*			+
2080	*Lomandra glauca*	+		+
3046	*Lomandra hystrix*			+
2082	*Lomandra longifolia*	+	+	+
2083	*Lomandra micrantha ssp. tuberculata*	+	+	
84	*Lomandra minus*			+
2085	*Lomandra multiflora ssp. multiflora*	+	+	+
2086	*Lomandra obliqua*			+
6663	*Lomandra spp.*		+	+
3692	*Lomatia ilicifolia*			+
3693	*Lomatia myricoides*		+	+
3645	*Lotus cruentus*	+		
6666	*Lotus spp.*		+	+
1914	*Luzula densiflora*		+	+
1915	*Luzula flaccida Form A*	+	+	+
1918	*Luzula meridionalis*		+	+
6671	*Luzula spp.*	+	+	+
2831	*Lyperanthus nigricans*			+
2113	*Lythrum salicaria*	+		
1932	**Marrubium vulgare*		+	
1524	**Medicago laciniata*		+	
1525	*Medicago lupulina*	+	+	
6702	**Medicago spp.*	+	+	+
2605	*Melaleuca parvistaminea*		+	+
6703	*Melaleuca spp.*			+

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
1292	Melichrus urceolatus	+	+	+
1363	Micrantheum hexandrum			+
3326	Microlaena stipoides	+	+	+
467	Microseris lanceolata		+	+
6721	Microtis spp.	+	+	+
1537	Mirbelia pungens			+
2065	Mitrasacme polymorpha			+
2148	*Modiola caroliniana	+	+	+
784	*Moenchia erecta		+	+
1296	Monotoca scoparia		+	+
662	Myosotis australis		+	
664	*Myosotis discolor		+	+
1771	Myriophyllum crispatum			+
1782	Myriophyllum simulans	+		
6745	Myriophyllum spp.	+	+	+
1784	Myriophyllum variifolium			+
3333	*Nassella trichotoma	+	+	
3574	Neopaxia australasica	+		
3940	Nertera granadensis	+		
2168	Nymphoides montana	+		
6768	Oenothera spp.		+	
2675	*Oenothera stricta ssp. stricta		+	
471	Olearia alpicola			+
472	Olearia argophylla	+		
486	Olearia myrsinoides	+		
489	Olearia phlogopappa	+		
4076	Omphacomeria acerba			+
3941	Opercularia aspera		+	+
3944	Opercularia varia		+	+
2679	Ophioglossum lusitanicum ssp. coria	+	+	+
147	Oreomyrrhis eriopoda	+	+	
6781	Oreomyrrhis spp.		+	+
2938	Oxalis exilis	+	+	+
2941	Oxalis perennans		+	
6791	Oxalis spp.	+	+	+
1547	Oxylobium procumbens	+		
4433	Ozothamnus cuneifolius	+		
513	Ozothamnus thyrsoideus	+	+	+
3357	Panicum simile	+	+	+
6796	Panicum spp.	+		
4156	*Parentucellia latifolia		+	+
6804	Parentucellia spp.		+	
785	*Paronychia brasiliana		+	+
3366	Paspalum distichum		+	
1840	Patersonia fragilis			+
1843	Patersonia sericea			+
6812	Patersonia spp.			+
1690	Pelargonium inodorum		+	
3535	Persicaria hydropiper		+	
3540	Persicaria prostrata			+
3701	Persoonia chamaepeuce			+
3703	Persoonia confertiflora	+		
3718	Persoonia linearis			+
3720	Persoonia microphylla			+
3724	Persoonia mollis ssp. leptophylla			+
3725	Persoonia mollis ssp. livens			+
3742	Petrophile canescens			+
4427	*Petrorhagia prolifera	+	+	
787	*Petrorhagia velutina	+	+	+

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
3381	**Phalaris aquatica*	+	+	
3386	**Phalaris minor*		+	
6827	**Phalaris* spp.	+	+	+
4017	*Phebalium phylicifolium*	+		
3388	*Phragmites australis*	+		+
4289	*Pimelea curviflora*	+		+
4287	*Pimelea curviflora* var. *sericea*	+	+	+
4290	*Pimelea glauca*	+		
4303	*Pimelea linifolia*		+	
4301	*Pimelea linifolia* ssp. *linifolia*		+	
4304	*Pimelea pauciflora*	+		
6843	*Pimelea* spp.	+		
2989	**Pinus radiata*	+		+
3021	*Plantago debilis*		+	
3023	*Plantago gaudichaudii*			+
3025	*Plantago hispida*		+	+
3026	**Plantago lanceolata*	+	+	
6852	*Plantago* spp.	+	+	+
3032	*Plantago varia*	+	+	+
1558	*Platylobium formosum*			+
6857	*Plectranthus* spp.			+
241	*Pleurosorus rutifolius*		+	
3646	**Poa annua*		+	
3396	**Poa bulbosa*	+		
3404	*Poa helmsii*		+	
3408	*Poa labillardieri*	+	+	+
3409	*Poa meionectes*		+	+
3411	*Poa phillipsiana*	+		
3413	**Poa pratensis*	+	+	
3415	*Poa saxicola*			+
3417	*Poa sieberiana* var. *hirtella*	+		
3418	*Poa sieberiana* var. *sieberiana*	+	+	+
6860	*Poa* spp.	+	+	+
3420	*Poa tenera*	+		
518	*Podolepis jaceoides*	+		
789	**Polycarpon tetraphyllum*		+	
202	*Polyscias sambucifolia*	+		
3839	*Pomaderris angustifolia*		+	
3850	*Pomaderris eriocephala*			+
3865	*Pomaderris prunifolia*			+
3867	*Pomaderris* species A		+	+
1374	*Poranthera microphylla*			+
3892	**Potentilla recta*	+		
2054	*Pratia purpurascens*			+
1965	*Prostanthera lasianthos* var. *subcor*			+
1986	**Prunella vulgaris*	+		+
520	*Pseudognaphalium luteo-album*			+
1561	*Psoralea tenax*		+	
1171	*Pteridium esculentum*	+	+	+
2865	*Pterostylis bicolor*	+		
2886	*Pterostylis mutica*		+	
6899	*Pterostylis* spp.	+		+
1586	*Pultenaea microphylla*			+
1591	*Pultenaea procumbens*		+	
6903	*Pultenaea* spp.	+		+
1600	*Pultenaea subspicata*			+
3773	*Ranunculus amphitrichus*			+
3781	*Ranunculus inundatus*	+		+
3782	*Ranunculus lappaceus*	+	+	

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
3790	*Ranunculus pimpinellifolius*	+	+	
3791	*Ranunculus plebeius*		+	+
3794	*Ranunculus pumilio*	+		
3798	*Ranunculus sessiliflorus* var. *sessi*		+	
6908	*Ranunculus* spp.			+
3802	**Reseda luteola*		+	
3013	*Rhytidosporum procumbens*			+
6934	*Rorippa* spp.	+		
3894	**Rosa rubiginosa*	+	+	+
3901	*Rubus parvifolius*	+	+	+
6938	**Rubus* spp.	+	+	+
3549	*Rumex brownii*	+	+	
3551	**Rumex crispus*	+		
3552	*Rumex dumosus*		+	
6940	*Rumex* spp.		+	+
790	**Sagina apetala*	+		
6948	**Salix* spp.	+		
1990	**Salvia verbenaca*	+	+	+
3911	**Sanguisorba minor* ssp. *muricata*	+		+
4103	*Schizaea bifida*			+
1134	*Schoenoplectus validus*	+		
1135	*Schoenus apogon*	+	+	+
1139	*Schoenus evansianus*			+
1144	*Schoenus maschalinus*	+		
794	*Scleranthus biflorus*	+	+	+
795	*Scleranthus diander*	+	+	+
4435	*Scleranthus fascicularis*	+		
6974	*Scleranthus* spp.	+		
1669	*Sebaea ovata*		+	
537	*Senecio hispidulus* var. *hispidulus*		+	+
539	*Senecio lautus* ssp. *alpinus*			+
545	*Senecio linearifolius*	+		
6988	*Senecio* spp.		+	+
553	*Senecio tenuiflorus*	+		+
3951	**Sherardia arvensis*		+	+
800	**Silene gallica*			+
561	**Silybum marianum*	+	+	
563	*Solenogyne dominii*	+	+	+
564	*Solenogyne gunnii*	+	+	+
7006	*Solenogyne* spp.			+
568	**Sonchus asper* ssp. *glaucescens*		+	+
7018	*Spergularia* spp.	+	+	
4236	*Stackhousia monogyna*	+	+	+
811	*Stellaria angustifolia*			+
813	*Stellaria flaccida*	+		+
815	**Stellaria media*			+
818	*Stellaria pungens*	+	+	+
3458	*Stipa bigeniculata*	+	+	
3459	*Stipa blackii*	+	+	+
3461	*Stipa flavescens*	+		
3462	*Stipa mollis*		+	
3472	*Stipa rudis*	+		
3475	*Stipa scabra*	+	+	+
7035	*Stipa* spp.	+	+	+
3479	*Stipa stuposa*	+		+
573	*Stuartina muelleri*		+	
4265	*Stylidium graminifolium*			+
7040	*Styphelia* spp.		+	
1613	*Swainsona sericea*	+	+	+

Sp. Number	Species	Monaro Plains	Mountain Valleys	Hoskins/ Nerriga Hills
577	*Taraxacum officinale	+	+	+
7052	Taraxacum spp.	+		
4309	Tetratheca bauerifolia	+		+
4318	Tetratheca thymifolia			+
7066	Thelymitra spp.			+
3483	Themeda australis	+	+	+
101	Thysanotus patersonii		+	+
580	*Tragopogon porrifolius	+	+	
106	Tricoryne elatior		+	+
1620	*Trifolium angustifolium		+	
1621	*Trifolium arvense	+	+	+
1623	*Trifolium cernuum	+	+	
1625	*Trifolium fragiferum		+	
1631	*Trifolium repens	+	+	+
7088	*Trifolium spp.	+	+	+
1635	*Trifolium subterraneum	+	+	+
582	Triptilodiscus pygmaeus	+	+	+
4319	Typha domingensis	+		
7112	Vallisneria spp.	+		
1738	Velleia paradoxa	+		+
4438	*Vellereophyton dealbatum			+
4158	*Verbascum thapsus ssp. thapsus	+	+	
4159	*Verbascum virgatum		+	
4346	*Verbena bonariensis			+
4163	Veronica calycina		+	+
4164	Veronica gracilis	+		
4169	Veronica plebeia		+	+
1645	*Vicia sativa			+
7120	*Vicia spp.	+		
178	*Vinca major		+	
4361	Viola betonicifolia	+	+	+
4371	Viola hederacea	+		+
591	Vittadinia cuneata var. cuneata	+	+	+
600	Vittadinia muelleri	+	+	+
7127	Vittadinia spp.	+		
601	Vittadinia sulcata			+
3496	*Vulpia bromoides		+	
3500	*Vulpia myuros		+	+
7129	Vulpia spp.		+	+
749	Wahlenbergia communis	+	+	+
753	Wahlenbergia gracilis	+	+	+
756	Wahlenbergia luteola	+		
759	Wahlenbergia planiflora			+
7130	Wahlenbergia spp.	+	+	+
761	Wahlenbergia stricta	+	+	+
895	Wurmbea dioica ssp. dioica	+	+	+
4392	Xanthorrhoea concava			+
7141	Xanthorrhoea spp.			+

Appendix 1E

Vascular plant species recorded from the 32 lists taken in Spread III from the Endrick River to Wilton.

+ indicates species recorded

* indicates introduced species

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
1320	*Abrophyllum ornans*		-	
2129	*Abutilon oxycarpum*		-	
2181	*Acacia binervata*	+	-	+
2185	*Acacia brownii*			+
2187	*Acacia buxifolia*			+
2192	*Acacia cognata*	+		
2201	*Acacia decora*	+		
2202	*Acacia decurrens*	+		+
2206	*Acacia dorothea*	+		
2208	*Acacia elata*			+
2211	*Acacia elongata*	+		
2212	*Acacia falcata*		-	
2213	*Acacia falciformis*	+	-	
2215	*Acacia filicifolia*	+	-	
2228	*Acacia implexa*	+		+
2230	*Acacia irrorata*	+	-	+
2239	*Acacia leprosa*	+		
2244	*Acacia linifolia*			+
2245	*Acacia longifolia*	+	-	+
2249	*Acacia maidenii*		-	+
2250	*Acacia mearnsii*	+	+	+
2251	*Acacia melanoxylon*		-	+
2255	*Acacia myrtifolia*	+	-	+
2257	*Acacia obtusata*	+		+
2258	*Acacia obtusifolia*	+		+
2263	*Acacia parramattensis*		-	+
2266	*Acacia penninervis*	+		
2281	*Acacia stricta*		+	
2282	*Acacia suaveolens*	+	+	+
2284	*Acacia subtilinervis*	+		
2286	*Acacia terminalis*	+		+
2290	*Acacia ulicifolia*	+	+	+
2684	*Acianthus fornicatus*	+		+
2328	*Acmena smithii*		+	+
3953	*Acronychia oblongifolia*		+	
112	*Actinotus helianthi*			+
113	*Actinotus minor*	+		+
7	*Adiantum aethiopicum*	+	+	+
9	*Adiantum formosum*		+	
10	*Adiantum hispidulum*		+	
252	**Ageratina adenophora*		+	+
253	**Ageratina riparia*		+	
1925	*Ajuga australis*		+	
6035	*Ajuga* spp.	+		
4079	*Alectryon subcinereus*		+	
29	*Alisma plantago-aquatica*		+	
825	*Allocasuarina distyla*	+		+
828	*Allocasuarina littoralis*	+	+	+
830	*Allocasuarina nana*	+		
831	*Allocasuarina paludosa*	+		+
833	*Allocasuarina torulosa*			+
3821	*Alphitonia excelsa*		+	
42	*Alternanthera denticulata*		+	
1330	*Amperea xiphoclada*	+	+	+
3063	*Amphipogon strictus* var. *strictus*	+		
2088	*Amyema congener* ssp. *congener*	+	+	
2089	*Amyema gaudichaudii*		+	
2092	*Amyema pendulum*	+		+
3065	**Andropogon virginicus*		+	
898	*Aneilema acuminatum*		+	

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
2336	*Angophora floribunda*	+	+	+
3066	*Anisopogon avenaceus*	+		+
613	**Anredera cordifolia*		+	
1403	*Aotus ericoides*	+	+	+
946	*Aphanopetalum resinosum*	+		
206	**Araujia hortorum*		+	
3080	*Aristida ramosa*			+
3081	*Aristida vagans*	+		+
1162	*Arthropteris tenella*		+	
235	*Asplenium flabellifolium*	+	+	
6109	*Asplenium spp.*		+	
189	*Astrotricha latifolia*		+	+
193	*Astrotricha longifolia*	+		
0612	*Azolla pinnata*		+	
2341	*Backhousia myrtifolia*		+	+
2342	*Baeckea brevifolia*	+		
2344	*Baeckea densifolia*	+		
2346	*Baeckea diosmifolia*	+		
2348	*Baeckea imbricata*	+		+
1331	*Baloghia inophylla*		+	
3594	*Banksia cunninghamii*			+
3596	*Banksia ericifolia*	+		+
3600	*Banksia marginata*			+
3601	*Banksia oblongifolia*	+		+
3602	*Banksia paludosa*			+
3604	*Banksia serrata*	+		+
3607	*Banksia spinulosa*	+		+
616	*Bauera rubioides*	+		+
272	*Bedfordia arborescens*	+		
273	**Bidens pilosa*			+
2994	*Billardiera scandens*	+		+
631	*Blechnum cartilagineum*	+	+	+
637	*Blechnum nudum*		+	
639	*Blechnum penna-marina*		+	
3964	*Boronia floribunda*			+
3966	*Boronia ledifolia*			+
3971	*Boronia parviflora*	+		
3978	*Boronia subulifolia*	+		
1410	*Bossiaea ensata*	+	+	+
1412	*Bossiaea heterophylla*	+	+	+
1416	*Bossiaea obcordata*	+	+	+
1420	*Bossiaea rhombifolia*			+
1422	*Bossiaea scolopendria*	+		+
3103	*Bothriochloa macra*			+
4242	*Brachychiton acerifolius*		+	
1236	*Brachyloma daphnoides*			+
310	*Bracteantha bracteata*	+		+
1340	*Breynia oblongifolia*		+	+
1	*Brunoniella australis*			+
2	*Brunoniella pumilio*		+	+
893	*Burchardia umbellata*	+		+
3005	*Bursaria spinosa*			+
91	*Caesia parviflora*			+
2355	*Callistemon citrinus*	+		+
2357	*Callistemon linearis*			+
2362	*Callistemon salignus*		+	
2365	*Callistemon subulatus*	+		
958	*Callitris rhomboidea*	+		
2734	*Calochilus paludosus*	+	+	
1172	*Calochlaena dubia*	+	+	+

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
2366	*Calytrix tetragona*	+		
2331	*Carex appressa*		+	+
997	*Carex longebrachiata*		+	
1001	*Carex tereticaulis*		+	
838	*Cassine australis*		+	
333	*Cassinia aculeata*	+		
0343	*Cassinia quinquefaria*	+		
345	*Cassinia trinerva*		+	+
2004	*Cassytha glabella*	+		+
2006	*Cassytha pubescens*	+		+
835	*Casuarina cunninghamiana ssp. cun*		+	+
836	*Casuarina glauca*			+
1004	*Caustis flexuosa*	+		+
1005	*Caustis pentandra*			+
1008	*Caustis recurvata*			+
1662	*Centaurium spicatum*			+
122	*Centella asiatica*	+		
843	*Centrolepis fascicularis*	+	+	
949	*Ceratopetalum apetalum*		+	+
4180	*Cheilanthes sieberi ssp. sieberi*	+	+	+
886	*Chloanthes stoechadis*	+		+
4068	*Choretrum candollei*	+		+
360	*Chrysocephalum apiculatum*			+
2008	*Cinnamomum oliveri*		+	
4381	*Cissus antarctica*		+	
4382	*Cissus hypoglauca*		+	+
3007	*Citriobatus pauciflorus*		+	+
1816	*Citronella moorei*		+	
1348	*Claoxylon australe*		+	
3765	*Clematis aristata*		+	+
3767	*Clematis glycinoides*		+	
4340	*Clerodendrum tomentosum*		+	+
3510	*Comesperma ericinum form A*			+
901	*Commelina cyanea*		+	+
4245	*Commersonia fraseri*		+	+
3613	*Conospermum longifolium*			+
3614	*Conospermum taxifolium*			+
3615	*Conospermum tenuifolium*			+
1701	*Coopernookia barbata*			+
3925	*Coprosma quadrifida*	+	+	
3988	*Correa reflexa var. reflexa*			+
936	*Crassula sieberiana*	+		+
1350	*Croton verreauxii*		+	
3989	*Crowea exalata*	+		
3825	*Cryptandra amara*			+
2009	*Cryptocarya glaucescens*		+	+
2010	*Cryptocarya microneura*		+	+
2759	*Cryptostylis erecta*	+	+	
2762	*Cryptostylis subulata*	+		
959	*Cyathea australis s.l.*		+	+
961	*Cyathea leichhardtiana s.l.*		+	
1012	*Cyathochaeta diandra*	+	+	+
2763	*Cymbidium suave*	+	+	
3143	*Cynodon dactylon*	+	+	+
1020	*Cyperus difformis*		+	
1022	**Cyperus eragrostis*		+	
1043	*Cyperus polystachyos*		+	
1704	*Dampiera purpurea*			+
1705	*Dampiera scottiana*		+	
1706	*Dampiera stricta*	+		+

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
3161	*Danthonia linkii var. linkii*			+
3163	*Danthonia longifolia*	+	+	+
2375	*Darwinia grandiflora*			+
2379	*Darwinia taxifolia ssp. macro.*	+		
1163	*Davallia pyxidata*		+	
1434	*Daviesia acicularis*		+	+
1435	*Daviesia alata*	+		
1437	*Daviesia corymbosa*			+
1439	*Daviesia latifolia*		+	
1443	*Daviesia mimosoides*			+
1447	*Daviesia ulicifolia*		+	
2769	*Dendrobium linguiforme*	+		
4327	*Dendrocnide excelsa*		+	
1450	*Desmodium brachypodum*		+	
1452	*Desmodium varians*		+	+
2974	*Dianella caerulea*	+	+	+
2977	*Dianella longifolia var. long.*		+	+
2982	*Dianella revoluta*			+
3211	*Dichelachne micrantha*	+	+	+
3213	*Dichelachne rara*	+	+	+
915	*Dichondra repens*	+	+	+
916	*Dichondra species A*	+		
1173	*Dicksonia antarctica*		+	
1458	*Dillwynia floribunda*			+
1460	*Dillwynia juniperina*	+		
1464	*Dillwynia ramosissima*	+	+	+
1465	*Dillwynia retorta*			+
1466	*Dillwynia sericea*			+
1222	*Diospyros australis*		+	
1223	*Diospyros pentamera*		+	
608	*Diplazium australe*		+	
2790	*Diuris maculata*	+		+
2796	*Diuris punctata var. punctata*	+		
6394	*Diuris spp.*		+	
4089	*Dodonaea multijuga*	+		
4094	*Dodonaea triquetra*	+		+
4100	*Dodonaea viscosa*		+	
641	*Doodia aspera*	+	+	+
2303	*Doryphora sassafras*		+	
1210	*Drosera peltata*			+
1211	*Drosera pygmaea*	+		+
1212	*Drosera spatulata*			+
4196	*Duboisia myoporoides*		+	
3239	*Echinopogon caespitosus*	+	+	+
3243	*Echinopogon ovatus*	+		+
658	*Ehretia acuminata var. acuminata*		+	
863	*Einadia hastata*		+	
1225	*Elaeocarpus kirtonii*		+	
1227	*Elaeocarpus reticulatus*	+		+
4329	*Elatostema reticulatum var. ret.*		+	
1058	*Eleocharis acuta*		+	
3834	*Emmenosperma alphitonioides*		+	
3803	*Empodisma minus*	+	+	+
2014	*Endiandra sieberi*		+	
3256	*Entolasia marginata*		+	+
3257	*Entolasia stricta*	+	+	+
1242	*Epacris calvertiana*	+		
1243	*Epacris coriacea*			+
1249	*Epacris longiflora*			+
1252	*Epacris microphylla*	+		+

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
1254	*Epacris obtusifolia*	+		
1255	*Epacris paludosa*			+
1257	*Epacris pulchella*			+
1259	*Epacris purpurascens*			+
3260	*Eragrostis brownii*	+	+	+
3265	*Eragrostis leptostachya*	+		+
406	*Erigeron species B (aff. pappo.)*		+	
3991	*Eriostemon australasius ssp. aust*			+
4002	*Eriostemon scaber*	+		
2384	*Eucalyptus agglomerata*	+		
2388	*Eucalyptus amplifolia*		+	
2402	*Eucalyptus bosistoana*			+
2415	*Eucalyptus consideniana*	+		
2419	*Eucalyptus crebra*			+
2422	*Eucalyptus cypellocarpa*	+		
2429	*Eucalyptus dendromorpha*	+		
2432	*Eucalyptus dives*	+		
2434	*Eucalyptus eugenioides*	+	+	+
2436	*Eucalyptus fastigata*	+	+	
2440	*Eucalyptus fibrosa*			+
2443	*Eucalyptus globoidea*		+	+
2446	*Eucalyptus gummifera*	+	+	+
2450	*Eucalyptus imitans*	+	+	
2456	*Eucalyptus langleyi*	+		
2459	*Eucalyptus ligustrina*	+		+
2460	*Eucalyptus longifolia*	+	+	+
2464	*Eucalyptus maculata*	+	+	
2466	*Eucalyptus mannifera*	+		
2471	*Eucalyptus moluccana*			+
2473	*Eucalyptus muelleriana*	+		
2474	*Eucalyptus multicaulis*	+		
2479	*Eucalyptus obliqua*	+		
2480	*Eucalyptus oblonga*			+
2487	*Eucalyptus paniculata*		+	+
2493	*Eucalyptus pilularis*		+	+
2494	*Eucalyptus piperita*	+		+
2504	*Eucalyptus punctata*	+		+
2505	*Eucalyptus quadrangulata*		+	+
2506	*Eucalyptus racemosa*			+
2508	*Eucalyptus radiata*	+		
2512	*Eucalyptus resinifera*			+
2516	*Eucalyptus robusta*		+	
2522	*Eucalyptus saligna*		+	+
2523	*Eucalyptus scias ssp. callimastha*	+		
2526	*Eucalyptus sclerophylla*	+	+	+
2528	*Eucalyptus sideroxylon*			+
2529	*Eucalyptus sieberi*	+		+
2530	*Eucalyptus smithii*	+		+
2531	*Eucalyptus sparsifolia*			+
2536	*Eucalyptus stricta*	+		+
2539	*Eucalyptus tereticornis*		+	+
2541	*Eucalyptus triflora*	+		
2544	*Eucalyptus viminalis*	+		+
1382	*Eupomatia laurina*		+	
78	*Euroschinus falcata var. falcata*		+	
2103	*Eustrephus latifolius*		+	+
4071	*Exocarpos cupressiformis*	+	+	+
4073	*Exocarpos strictus*	+		+
2307	*Ficus coronata*		+	
2309	*Ficus macrophylla ssp. macro.*		+	

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
2312	*Ficus rubiginosa*	+	+	
2313	*Ficus superba var. henneana*		+	
1692	*Fieldia australis*		+	
1826	**Freesia hybrid*		+	
1076	*Gahnia clarkei*	+		+
1078	*Gahnia filifolia*	+		
1081	*Gahnia melanocarpa*			+
1083	*Gahnia radula*			+
1084	*Gahnia sieberiana*			+
1085	*Gahnia subaequiglumis*	+		
2104	*Geitonoplesium cymosum*		+	+
2723	*Geranium homeanum*		+	+
1694	*Gleichenia dicarpa*	+		+
1359	*Glochidion ferdinandi*		+	
1476	*Glycine clandestina*	+	+	+
1479	*Glycine tabacina*			+
417	*Gnaphalium involucratum*			+
422	*Gnaphalium sphaericum*			+
1480	*Gompholobium glabratum*	+	+	
1481	*Gompholobium grandiflorum*	+	+	
1483	*Gompholobium latifolium*			+
1485	*Gompholobium pinnatum*	+		
1488	*Gompholobium virgatum var. asp.*	+		
1753	*Gonocarpus micranthus*	+		+
1756	*Gonocarpus tetragynus*	+		+
1757	*Gonocarpus teucrioides*	+		+
1709	*Goodenia bellidifolia*	+		+
1714	*Goodenia glomerata*	+		
1718	*Goodenia hederacea*	+	+	+
1722	*Goodenia heterophylla*	+		
1724	*Goodenia ovata*	+	+	+
1725	*Goodenia paniculata*			+
3620	*Grevillea arenaria*	+		
3626	*Grevillea baueri*	+		
3624	*Grevillea baueri ssp. asperula*	+		
3630	*Grevillea buxifolia*			+
3635	*Grevillea diffusa*			+
3642	*Grevillea linearifolia*	+		
3651	*Grevillea mucronulata*			+
3657	*Grevillea oleoides*			+
3663	*Grevillea sericea*			+
4101	*Guioa semiglauca*		+	
1086	*Gymnoschoenus sphaerocephalus*		+	
184	*Gymnostachys anceps*		+	
1746	*Haemodorum planifolium*	+		+
3671	*Hakea dactyloides*	+	+	+
3674	*Hakea gibbosa*			+
3679	*Hakea salicifolia*			+
3680	*Hakea sericea*	+		+
3682	*Hakea teretifolia*	+		+
1492	*Hardenbergia violacea*	+	+	+
2304	*Hedycarya angustifolia*		+	
432	*Helichrysum collinum*		+	
433	*Helichrysum elatum*	+		+
435	*Helichrysum rutidolepis*	+		+
1926	*Hemigenia purpurea*			+
1176	*Hibbertia aspera*	+	+	+
1182	*Hibbertia dentata*			+
1184	*Hibbertia empetrifolia*	+		+
1188	*Hibbertia monogyna*	+	+	

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
1189	*Hibbertia nitida*			+
1194	*Hibbertia riparia*	+	-	+
1197	*Hibbertia scandens*		+	+
1199	*Hibbertia serpyllifolia*	+		
2134	*Hibiscus heterophyllus ssp. hete.*		-	
1166	*Histiopteris incisa*		-	
1496	*Hovea linearis*	+		+
2139	*Howittia trilocularis*	+		
4355	*Hybanthus monopetalus*		-	+
4358	*Hybanthus vernonii*	+		+
138	**Hydrocotyle bonariensis*		-	
139	*Hydrocotyle geranifolia*	+		
140	*Hydrocotyle laxiflora*	+		
141	*Hydrocotyle peduncularis*		-	+
0142	*Hydrocotyle tripartita*	+		
4359	*Hymenanthera dentata*		+	
1797	*Hymenophyllum cupressiforme*	+	-	
889	*Hypericum gramineum*	+	+	+
3804	*Hypolaena fastigiata*	+		
1809	*Hypoxis hygrometrica*		+	
3307	*Imperata cylindrica var. major*	+	-	+
1503	*Indigofera australis*	+	-	+
3308	*Isachne globosa*		-	
1094	*Isolepis inundata*		-	
3685	*Isopogon anemonifolius*	+		+
2041	*Isotoma axillaris*	+		
1505	*Jacksonia scoparia*		-	
1875	*Juncus continuus*		+	+
1908	*Juncus usitatus*		+	+
1506	*Kennedia prostrata*		+	
1508	*Kennedia rubicunda*		+	+
2548	*Kunzea ambigua*	+	+	+
2549	*Kunzea cambagei*			+
2550	*Kunzea capitata*			+
3690	*Lambertia formosa*	+		+
4342	**Lantana camara*		+	
4250	*Lasiopetalum ferrugineum*			+
97	*Laxmannia gracilis*	+		
1104	*Lepidosperma concavum*	+		
1106	*Lepidosperma elatius*			+
1108	*Lepidosperma filiforme*	+		
1113	*Lepidosperma laterale*	+	+	+
1114	*Lepidosperma limicola*	+		
1116	*Lepidosperma neesii*	+		+
1120	*Lepidosperma urophorum*			+
3805	*Leptocarpus tenax*	+	+	+
4074	*Leptomeria acida*			+
2558	*Leptospermum arachnoides*	+		+
2560	*Leptospermum brevipes*	+		
2565	*Leptospermum emarginatum*	+		
2566	*Leptospermum epacridoideum*	+		
2568	*Leptospermum juniperinum*	+	+	+
2570	*Leptospermum lanigerum*	+		+
2573	*Leptospermum morrisonii*	+	+	
2578	*Leptospermum parvifolium*	+		+
2584	*Leptospermum polygalifolium*	+	+	+
2585	*Leptospermum rotundifolium*	+		
2587	*Leptospermum scoparium*			+
2588	*Leptospermum sejunctum*	+	+	
2591	*Leptospermum squarrosum*			+

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
2594	*Leptospermum trinervium*	+		+
3806	*Lepyrodia anarthria*	+		
3809	*Lepyrodia scariosa*	+	+	+
1511	*Lespedeza juncea ssp. sericea*		+	
1263	*Leucopogon amplexicaulis*			+
1268	*Leucopogon esquamatus*			+
1271	*Leucopogon fraseri*	+		
1274	*Leucopogon juniperinus*	+	+	+
1276	*Leucopogon lanceolatus*			+
1281	*Leucopogon microphyllus*		+	+
1284	*Leucopogon neo-anglicus*	+		
1287	*Leucopogon setiger*			+
1288	*Leucopogon virgatus*			+
1838	*Libertia paniculata*		+	
2038	*Lindsaea linearis*	+		+
2039	*Lindsaea microphylla*	+	+	
2830	*Liparis reflexa*	+		
1290	*Lissanthe strigosa*	+	+	+
2015	*Litsea reticulata*		+	
205	*Livistona australis*		+	+
2073	*Lomandra confertifolia*	+		+
2078	*Lomandra filiformis*	+	+	+
2080	*Lomandra glauca*	+		+
2081	*Lomandra gracilis*			+
2082	*Lomandra longifolia*	+	+	+
2083	*Lomandra micrantha ssp. tuber.*	+		+
2085	*Lomandra multiflora ssp. multi.*	+	+	+
2086	*Lomandra obliqua*		+	+
3692	*Lomatia ilicifolia*	+		
3694	*Lomatia silaifolia*			+
2107	*Lycopodium deuterodensum*	+		+
2314	*Maclura cochinchinensis*		+	
4411	*Macrozamia communis*	+		
2316	*Malaisia scandens ssp. scandens*		+	
211	*Marsdenia flavescens*		+	
212	*Marsdenia rostrata*		+	+
213	*Marsdenia suaveolens*		+	
2599	*Melaleuca decora*		+	+
2603	*Melaleuca linariifolia*	+	+	+
2604	*Melaleuca nodosa*			+
2609	*Melaleuca squarrosa*			+
2610	*Melaleuca styphelioides*		+	
2611	*Melaleuca thymifolia*	+	+	
2159	*Melia azedarach*		+	
1292	*Melichrus urceolatus*			+
4006	*Melicope micrococca*		+	
1362	*Micrantheum ericoides*	+	+	
3326	*Microlaena stipoides*	+	+	+
3560	*Microsorum scandens*		+	
2835	*Microtis unifolia*	+		+
1538	*Mirbelia rubiifolia*	+		+
1539	*Mirbelia speciosa ssp. speciosa*			+
2065	*Mitrasacme polymorpha*	+		+
1296	*Monotoca scoparia*			+
3939	*Morinda jasminoides*		+	+
2101	*Muellerina eucalyptoides*	+		
2320	*Myoporum acuminatum*		+	
219	**Myrsiphyllum asparagoides*		+	
2644	*Notelaea longifolia*		+	+
2649	*Notelaea venosa*	+	+	

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
4378	*Notothixos subaureus*			+
2637	*Olax stricta*	+		+
472	*Olearia argophylla*		+	
483	*Olearia microphylla*	+	+	+
0497	*Olearia tomentosa*		+	
498	*Olearia viscidula*	+		
1365	*Omalanthus populifolius*		+	+
4076	*Omphacomeria acerba*			+
3941	*Opercularia aspera*	+		+
3944	*Opercularia varia*	+	+	+
3335	*Oplismenus aemulus*	+	+	+
3336	*Oplismenus imbecillis*		+	+
149	*Oschatzia cuneifolia*			+
2936	**Oxalis corniculata*		+	
2941	*Oxalis perennans*	+		
1546	*Oxylobium ilicifolium*	+		+
503	*Ozothamnus argophyllus*		+	
506	*Ozothamnus diosmifolius*	+	+	+
2305	*Palmeria scandens*		+	
622	*Pandorea pandorana*		+	+
3357	*Panicum simile*		+	+
2299	*Pararchidendron pruinosum var. pr*		+	
175	*Parsonsia brownii*	+		
177	*Parsonsia straminea*	+	+	+
3366	*Paspalum distichum*		+	
3370	**Paspalum urvillei*	+	+	+
2960	*Passiflora herbertiana ssp. herb.*			+
1841	*Patersonia glabrata*	+		+
1843	*Patersonia sericea*	+	+	+
1817	*Pennantia cunninghamii*		+	
3373	**Pennisetum clandestinum*		+	+
2965	*Peperomia leptostachya*		+	
2966	*Peperomia tetraphylla*		+	
3533	*Persicaria decipiens*		+	
3699	*Persoonia bargoensis*			+
3710	*Persoonia juniperina*	+		
3711	*Persoonia lanceolata*	+		+
3715	*Persoonia laurina*			+
3717	*Persoonia levis*	+		+
3718	*Persoonia linearis*	+		+
3730	*Persoonia mollis*			+
3721	*Persoonia mollis ssp. budawang.*	+		
3724	*Persoonia mollis ssp. leptophylla*	+		
3728	*Persoonia mollis ssp. nectens*	+		+
3737	*Persoonia pinifolia*			+
3743	*Petrophile pedunculata*	+		+
3744	*Petrophile pulchella*	+		+
3745	*Petrophile sessilis*			+
4010	*Phebalium diosmeum*	+		
4028	*Philotheca salsolifolia*	+		
3388	*Phragmites australis*		+	
1367	*Phyllanthus gasstroemii*		+	
1369	*Phyllanthus hirtellus*	+	+	+
1551	*Phyllota grandiflora*			+
1553	*Phyllota phylicoides*	+		
4298	*Pimelea ligustrina*	+	+	+
4303	*Pimelea linifolia*	+		+
2990	*Piper novae-hollandiae*		+	
3010	*Pittosporum revolutum*			+
3011	*Pittosporum undulatum*	+	+	+

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
4102	*Planchonella australis*		+	
1558	*Platylobium formosum*	+		+
152	*Platysace ericoides*	+	+	+
153	*Platysace lanceolata*	+		+
154	*Platysace linearifolia*	+		+
155	*Platysace stephensonii*	+		
1950	*Plectranthus parviflorus*	+	+	
3392	*Plinthanthesis paradoxa*			+
3395	*Poa affinis*	+		+
3408	*Poa labillardieri*	+	+	+
3419	*Poa sieberiana*	+		+
3503	*Podocarpus elatus*		+	
903	*Pollia crispata*		+	
1321	*Polyosma cunninghamii*		+	
197	*Polyscias elegans*		+	
198	*Polyscias murrayi*		+	+
202	*Polyscias sambucifolia*	+	+	
3840	*Pomaderris aspera*		+	
3851	*Pomaderris ferruginea*			+
3945	*Pomax umbellata*	+		+
1373	*Poranthera ericifolia*	+	+	+
1374	*Poranthera microphylla*	+	+	
2054	*Pratia purpurascens*	+	+	+
1960	*Prostanthera incana*	+		
1966	*Prostanthera lasianthos*		+	+
1967	*Prostanthera linearis*	+		
3	*Pseuderanthemum variabile*		+	+
520	*Pseudognaphalium luteo-album*		+	
3946	*Psychotria loniceroides*		+	
1171	*Pteridium esculentum*	+	+	+
2868	*Pterostylis concinna*	+		
2869	*Pterostylis curta*	+		
2879	*Pterostylis grandiflora*			+
2884	*Pterostylis longifolia*	+		+
2888	*Pterostylis nutans*	+		
1127	*Ptilanthelium deustum*	+		+
1563	*Pultenaea aristata*			+
1566	*Pultenaea blakelyi*	+	+	+
1570	*Pultenaea daphnoides*	+		
1571	*Pultenaea dentata*	+		
1572	*Pultenaea divaricata*	+		
1574	*Pultenaea elliptica*	+	+	+
1580	*Pultenaea flexilis*			+
1582	*Pultenaea hispidula*			+
1585	*Pultenaea linophylla*			+
1599	*Pultenaea stipularis*			+
1603	*Pultenaea villosa*	+	+	+
3563	*Pyrrosia rupestris*		+	
3782	*Ranunculus lappaceus*	+	+	
2326	*Rapanea howittiana*		+	+
2327	*Rapanea variabilis*	+	+	+
3801	**Reseda lutea*		+	
3812	*Restio dimorphus*			+
3813	*Restio fastigiatus*	+		
3814	*Restio fimbriatus*	+		+
3815	*Restio gracilis*			+
2617	*Rhodamnia rubescens*		+	+
3013	*Rhytidosporum procumbens*			+
1379	*Ricinocarpos pinifolius*			+
3898	*Rubus hillii*	+	+	

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
3901	*Rubus parvifolius*	+	+	+
3905	*Rubus rosifolius*		+	
4256	*Rulingia hermanniifolia*	+		
4065	*Sambucus australasica*			+
3590	*Samolus valerandi*	+		
4029	*Sarcomelicope simplicifolia*		+	
2164	*Sarcopetalum harveyanum*		+	+
1735	*Scaevola ramosissima*	+		
4337	*Schelhammera undulata*	+		
951	*Schizomeria ovata*		+	
1136	*Schoenus brevifolius*			+
1138	*Schoenus ericetorum*	+		
1145	*Schoenus melanostachys*	+	+	+
1149	*Schoenus turbinatus*			+
1652	*Scolopia braunii*		+	
4176	*Selaginella uliginosa*			+
541	*Senecio lautus ssp. lanceolatus*		+	
545	*Senecio linearifolius*		+	+
1398	**Senna pendula var. glabrata*		+	
560	*Sigesbeckia orientalis ssp. ori.*		+	
1228	*Sloanea australis*		+	
4185	*Smilax australis*		+	+
4186	*Smilax glyciphylla*		+	+
4225	*Solanum prinophyllum*			+
4227	*Solanum pungetium*		+	+
99	*Sowerbaea juncea*	+		+
1607	*Sphaerolobium vimineum*	+		
2913	*Spiranthes sinensis ssp. aust.*	+		
2021	*Spirodela punctata*		+	
1303	*Sprengelia incarnata*			+
4236	*Stackhousia monogyna*	+		
4238	*Stackhousia nuda*	+		+
813	*Stellaria flaccida*		+	
3746	*Stenocarpus salignus*		+	
2165	*Stephania japonica var. discolor*		+	+
1697	*Sticherus flabellatus*			+
1698	*Sticherus lobatus*	+		
3466	*Stipa pubescens*	+		+
3468	*Stipa ramosissima*	+	+	+
3477	*Stipa setacea*			+
2318	*Streblus brunonianus*		+	
4265	*Stylidium graminifolium*	+		+
4266	*Stylidium laricifolium*	+		
4267	*Stylidium lineare*			+
4268	*Stylidium productum*			+
2984	*Stypandra glauca*	+		
1311	*Styphelia tubiflora*			+
3748	*Symphionema paludosum*			+
4270	*Symplocos thwaitesii*		+	
2619	*Syncarpia glomulifera*	+	+	+
2160	*Synoum glandulosum*		+	+
2620	*Syzygium australe*		+	+
4387	*Tasmannia insipida*		+	
3751	*Telopea speciosissima*	+		
1153	*Tetraria capillaris*			+
3481	*Tetrarrhena juncea*	+		+
4318	*Tetratheca thymifolia*	+		+
2915	*Thelymitra carnea*	+		
2921	*Thelymitra ixioides var. ixioides*	+	+	+

Sp. Number	Species	Morton Plateau	Illawarra Coast	Wilton Tableland
2927	*Thelymitra pauciflora*	+		
3483	*Themeda australis*	+	+	+
100	*Thysanotus juncifolius*	+	+	+
104	*Thysanotus tuberosus*	+		
2161	*Toona ciliata*		+	
4325	*Trema aspera*		+	+
1631	**Trifolium repens*		+	
7088	**Trifolium* spp.		+	
1923	*Triglochin procerum*		+	
1314	*Trochocarpa laurina*	+		+
215	*Tylophora barbata*	+	+	+
4335	*Urtica incisa*		+	
2027	*Utricularia dichotoma*	+		
4169	*Veronica plebeia*			+
1649	*Viminaria juncea*	+		+
4361	*Viola betonicifolia*	+		
4371	*Viola hederacea*		+	+
4373	*Viola sieberiana*			+
0597	*Vittadinia hispidula* var. *hispid.*	+		
753	*Wahlenbergia gracilis*	+	+	+
7131	*Watsonia* spp.		+	
2306	*Wilkiea huegeliana*		+	
1315	*Woollsia pungens*			+
4403	*Xanthorrhoea resinifera*			+
170	*Xanthosia pilosa*			+
171	*Xanthosia tridentata*	+	+	+
4407	*Xyris gracilis*	+		+
4408	*Xyris juncea*	+		+
4047	*Zieria smithii*	+	+	+
1650	*Zornia dyctiocarpa* var. *dyctio.*		+	

APPENDIX 2

FAUNA

DATA COLLECTION

Fauna survey work was carried out under the terms of Wildlife Research Permits RP-94-188 and GLE/E 242 issued by the Department of Conservation and Natural Resources and New South Wales National Parks and Wildlife Service respectively.

Survey effort is summarised below.

Table 1. Survey effort for each landscape division of the proposed pipeline.

Section of route	Incidental observations (person-days)	Hair tube days	Spotlight hours	Predator scats analysed
Gippsland Coastal Plains (Longford-Bairnsdale)	7.5	0	1 hrs 50 min	14
Gippsland Coastal Forests (Bairnsdale-Cann Valley)	20.5	250	12 hrs 50 min	53
Cann River Valley (Cann River-Vic/NSW border)	15	662	6 hrs 50 min	35
Monaro Plains (Vic/NSW border-Numeralla River)	18.5	0	0 hr	1
Mountain Valleys (Numeralla River-Hoskinstown)	21.5	480	2 hrs	1
Hoskinstown-Nerriga Hills (Hoskinstown-Endrick River)	46	1520*	5 hrs 55 min	16
Morton Plateau & slopes (Endrick River-Shoalhaven River)	18	95	9 hrs 50 min	7
Illawarra Coastal Plain (Shoalhaven River-Illawarra Escarpment)	21	300	15	6
Wilton Tablelands (Illawarra Escarpment-Wilton)	19	420	7	34
Total	**187**	3727	**62 hr 15 min**	**167**

*number of hair-tube days much higher due to extended length of time between field trips.

Active Searching

The majority of species were detected by direct observation. Birds and frogs were identified by a combination of methods. Birds were usually heard and then visually located. Detailed observations, when necessary, were made with binoculars. The majority of frogs were detected by their calls, and were often caught to confirm their identity. Reptiles were either detected as they foraged or found in refuge sites through active searching: beneath surface rocks and boulders, in the base of grass tussocks, beneath exfoliating tree bark, and beneath hard litter (e.g. fallen timber, corrugated iron, fence posts). Rocks and logs were lifted and animals observed. A few frogs and skinks were detected under debris such as sheets of corrugated iron.

Both direct and indirect evidence of fauna was recorded. Direct evidence of fauna species includes captures, sightings or recording of distinct vocalisations or calls (e.g. birds, frogs and some nocturnal mammals). Indirect evidence of fauna species includes hair or body remains identified from predator scats. The scat samples were analysed by Barbara Triggs (c/o 'Dead Finish' Genoa, Victoria).

Elliott Trapping

Small Elliott traps were set in transects to detect small mammals. Size A and D traps were used. In most instances a trap line consisting of 25 traps was set for a period of three consecutive days. Traps were spaced approximately ten metres apart and baited with a mixture of peanut butter, honey and oats. Leaf litter and foliage was placed into traps to insulate animals from cold. Traps were checked daily-animals, if present, were identified and released. Traps were rebaited when necessary. The number of size A traps varied during the survey because some traps were stolen.

Hair-tubing

Mammals were surveyed using hair tubes (large square section hair-tubes of dimension 100x100 mm and small circular section hair-tubes 30 mm in diameter) baited with a mixture of rolled oats, honey and peanut butter or sardines. One 'tube-night' is equivalent to one hair-tube set in place for one night. Lines of twenty hair tubes were placed on the ground and/or on trees. Hair tubes were spaced approximately 10 m apart.

Pitfall Trapping

Herpetofauna were surveyed at four sites in Spread 2 using pitfall lines. The pitfall lines consisted of a line of 5-10 tins (250 mm diameter and 260 mm deep) set into the ground 5 m apart, with a 'drift' fence (flyscreen mesh or the like, approximately 300 mm high) running between and over the centre of each tin. Animals fall into the tins and are unable to escape. The fence helps to direct animals into the tins.

Artificial Spider Burrows

A technique for detecting the presence of the Southern Lined Earless Dragon is the use of artificial spider burrows constructed out of PVC tubing (Fletcher, pers. comm.). A tube simulating Wolf Spider burrow dimensions (120 mm long x 25 mm diameter) is inserted into a just larger tube set into the ground. To increase naturalness the inside of the inner tube is painted brown and coated with sand. Dragons may utilise the burrows as shelter sites. The burrows are, of course, not a trap, the animals being free to come and go. Burrows were in place at three sites on the Monaro Plains for periods of 10 to 13 days and were checked every few days, in the morning or evening.

Spotlighting

Nocturnal mammals and birds were surveyed by spotlight. This involved the use of 50 watt 12 volt spotlights. Trails and roads were traversed during the night and trees were searched for owls and or possums. Frogs were also detected at night with the aid of spotlights.

Bird Census

All bird species seen during all other field survey activities were recorded.

Frog Call Identification

Frogs were identified from their calls. Calling individuals were located where possible, using triangulation.

Play-back of Tapes

This technique involves playing the pre-recorded sounds of owls through a loud hailer. If the target species is within earshot of the broadcast they may respond by calling. This method relies on the fact that most species of animal are territorial and use calls as a method of defending their territory from conspecifics. Usually three species of owls, the Sooty, Masked and Powerful, are surveyed in this manner (Kavanagh and Peake 1993). In addition, the Barking Owl was surveyed for in this manner in the present survey. This method also involved spotlighting the area immediately after the cessation of the play-back. Owls were also detected by listening for calls. Owls call most frequently at dusk on dark, still, warm nights (Kavanagh and Peake 1993, personal observations).

The presence or absence of several species of rare and endangered passerine birds were gauged by the use of playback. These species included the Striated Fieldwren *(Calamanthus fuliginosus)*, Eastern Bristlebird *(Dasyornis brachypterus)*, Pink Robin *(Petroica rodinogaster)* and the Olive Whistler *(Pachycephala olivacea)*. Surveys for these species were only conducted in Morton National Park and the Wilton Plateau area.

Scat and Owl Pellet Analysis

Carnivorous mammals and owls expel undigested remains of their prey. The faeces of carnivorous mammals contain undigested hair and bones of prey and occasionally their own grooming hairs. These residual hairs can be analysed under a microscope and identified. Hence the scats of carnivorous mammals can indicate both predator and prey species. Owls regurgitate pellets that contain undigested remains of their prey. Such pellets are usually associated with roosting sites.

Identification of Possums by Tree Incisions

The identification of trees incised by Yellow-bellied Gliders is considered to be the most appropriate method for assessing the presence of this species in large areas of forest (Goldingay & Kavanagh 1991). When sap feeding Yellow-bellied Gliders make distinctive v-shaped incisions on the trunks of food trees (Goldingay & Kavanagh 1991). These incisions provide an indication of the presence of this possum in the immediate area (G. Daly, pers. obs.). No other animal marks eucalypts in this way. Therefore, the detection of trees which bear these marks can be used as a simple way of determining the presence of the Yellow-bellied Glider (R. Goldingay pers. comm., Daly pers. obs.). Sugar Gliders also incise gum trees (Strahan 1992). In the study area the Sugar Glider has a preference for Red Bloodwood (G. Daly, pers. obs.). Sugar Gliders make distinctive horizontal incisions on Red

Bloodwoods. The presence of these incisions is a reliable method of assessing the presence of these species in an area.

Records From Other Sources

Fauna records from a one kilometre corridor on either side of the proposed pipeline were obtained from the Department of Conservation and Natural Resources, Atlas of Victorian Wildlife, from New South Wales National Parks and Wildlife Service and from a review of the literature including: Antcliff (1993), Barker (1994), Barratt (1994), Coles (1993), Daly (1995a,b,c), Goldingay (1994), Murphy (1994), Quality Environmental Management (1992), Robinson (1987), The Budawang Committee (1987), Wollongong City Council (1995) and Wong (1993).

HABITAT ASSESSMENT

Habitat assessment was undertaken for terrestrial vertebrate fauna. The methods used are outlined below.

A habitat type is generally formed by floristic and structural features of the vegetation which provide a set of resources to support a community of fauna species. In general, habitat types correspond to vegetation communities, however habitats may be defined by other physical attributes of the landscape. Many fauna species move between habitats or utilise more than one habitat.

Habitat quality was assessed using the following descriptive criteria:

High

Ground flora contains a high number of indigenous species; vegetation community structure, ground log and/or litter layer intact and undisturbed; high level of breeding, nesting, feeding and roosting resources available; high richness and diversity of native fauna species.

Moderate

Ground flora contains a moderate number of indigenous species; vegetation community structure, ground log and/or litter layer moderately intact and undisturbed; moderate level of breeding, nesting, feeding and roosting resources available; moderate richness and diversity of native fauna species.

Low

Ground flora contains a low number of indigenous species, vegetation community structure, ground log and/or litter layer disturbed and modified; low level of breeding, nesting, feeding and roosting resources available; low richness and diversity of native fauna species.

CLASSIFICATION

Common names and scientific names for mammals are from Strahan (1983), except for bats which are from Richards *et al.* (1993) and recent reclassification of certain species of bat (R Coles pers. comm.). Common and scientific names for birds are from Emison *et al.* (1987) and Christides and Boles (1994). Common and scientific names for reptiles and amphibians are from Cogger (1992), Ehmann (1992), Tyler (1992) and the Atlas of Victorian Wildlife, with adherence to the recent revision for the genus *Pseudemoia* by Hutchinson and Donellan (1992).

DEFINING SIGNIFICANT SPECIES

Within a given geographic context (Australia, Victoria/New South Wales, region, locality) a species has a particular conservation status (extinct, endangered, vulnerable, rare). These conservation status levels are based on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Animals (IUCN 1988) and are used to assess significance. Therefore species of national, state, regional and local conservation significance are those which are considered to be endangered, vulnerable or rare nationally, within a state, within a region or within a local area.

The national and state ratings for significant species were taken from published lists which are recognised by the scientific community as well as by government bodies. Because new biological information on some species is now available and lists are only published periodically, it is sometimes necessary to update significance ratings.

National significance is assessed using the following listings: IUCN (1988), ANZECC (1991) and species listed under Schedule 1 of the (Commonwealth) Endangered Species Protection (ESP) Act 1992.

State significance is assessed using recognised listings: CNR (1995), species listed as threatened under Schedule 2 of the (Victorian) Flora and Fauna Guarantee (FFG) Act 1988 and under Schedule 12 of New South Wales.

Regional significance for fauna is assessed by referring to relevant government reports, by consulting experts familiar with the area, referring to the literature, and by drawing upon previous field experience of the Consultants.

RESULTS

A list of the native and introduced vertebrate fauna recorded from the study area is contained in Appendix 2a.

Significant Species

Several species of fauna were identified within, or in the vicinity of, the corridor during the study as having **national**, **state**, or **regional** significance. These are listed below.

National Significance

Mammals

Long-footed Potoroo

This cat-sized mammal is a member of one of the small-kangaroo families which feeds on underground fungi associated with eucalypt forest. Its distribution is largely determined by that of its food and potential refuges from predators. These habitat requirements are provided by moist gullies and their associated slope vegetation. As habitat may become unsuitable for the growth of fungi and the turnover of potoroo sub-populations appears to be high, large areas may be required to support a viable population of this species. The Long-footed

Potoroo is of national significance (CONCOM 1991) as it is rare and an action plan has been prepared for its conservation (Thomas 1991). Its distribution is restricted to part of East Gippsland and a small adjacent area in New South Wales. The Long-footed Potoroo is found along the pipeline route in suitable habitat between Cabbage Tree Creek and Lind National Park. The pipeline mostly follows existing easement in this area. The potential impact of the proposed pipeline will be in the introduction of predators, road fatalities and the destruction of Riparian habitat. Extreme care should be taken in crossing Riparian Woodland/Forests as this is their preferred habitat and may be used as a corridor between adjacent suitable habitat which has been separated by the existing easement. The long-term impact on this species by the pipeline will be minimal as long as the pipeline and its construction remain restricted to the existing easement in this area and any damaged Riparian habitat is allowed to regrow.

Birds

Hooded Plover

The Hooded Plover inhabits coastal sand dunes, beaches and coastal lakes where it feeds on insects trapped by waves. It is found alone or in small groups and nests on foreshore dunes. This plover disturbs easily and its decline is probably due to the increased presence of, and disturbance by human activity on beaches and predation by cats and foxes (Schulz and Bamford 1987). This species is regarded as vulnerable in Victoria (CNR 1995) and is listed under the FFG Act. There is a single record of the Hooded Plover in the Colquhuon State Forest and a second in forest east of Tostaree. It is unlikely that the proposed pipeline will adversely affect this species.

Swift Parrot

This gregarious parrot breeds in eucalypt forests in eastern and northern Tasmania and over-winters in south-eastern mainland Australia (Garnet 1992). On the mainland Swift Parrot movements are little understood. Gibson (1989) states that this species is nomadic, and dependent on the distribution of wintering flowering plants and lerps associated with psyllid infestations found in flowering eucalypts and banksias. Its decline is probably due to a loss of breeding habitat in Tasmania and a reduction of feeding habitat on the mainland; the replacement of extensive woodland areas with fragmented "edge" habitats easily dominated by aggressive bird species has contributed to their decline. Resource-rich trees such as Red Ironbark and Mountain Grey Gum are important food sources. Emison *et al.* (1987) considered the Snowy and Tambo River valleys as important corridors for this species to move north into habitat in New South Wales. There are records of the Swift Parrot between Bairnsdale and Bellbird Creek in the Gippsland Coastal Plains section of the pipeline route. The majority of sightings in the northern section of the study area has been of birds in coastal eucalypt forest (NPWS NSW Database). No action plan has been prepared for the Swift Parrot.

Regent Honeyeater

This honeyeater occurs in temperate woodlands and open forest in south-eastern Australia (Garnett 1992). In New South Wales it also uses riparian forests of River Oak *Casuarina cunninghamiana*. This medium-sized honeyeater is found in small nomadic flocks whose movements are dependent on the distribution of nectar, insects and fruit. Individuals of the species appear to return to regions, sites and tree species that provide reliable nectar flows (Garnett 1992). It prefers box-ironbark forest and woodland of the western slopes and is attracted to Red Ironbark trees. A large proportion of this habitat has been cleared for agriculture with the remnants frequently on the least fertile sites and the species has resultingly suffered a significant distribution reduction. In New South Wales it is occassionally at Nowra, and adjacent to Seven Mile Beach National Park (Ms D. Wright pers. comm.). This species is expected to occur in vegetation on the banks of the Shoalhaven River on occasion. An FFG Action plan has been prepared in Victoria for this endangered species. The potential impact of the pipeline on this species should be minimal as the route follows existing easement through much of its habitat but the impact will be lessened by retaining any resource-rich trees encountered along the route.

Reptiles

Striped Legless Lizard

This nationally vulnerable species occupies a range of grassland habitats in Victoria, N.S.W. and the A.C.T. The species utilises grass tussocks and surface rocks for shelter and is believed to shelter in underground burrows during cooler months (Kukolic, pers. comm.). While the species has no clear association with grassland of a particular structure or floristic compostion, the distribution and abundance of the species is influenced by past and recent agricultural land uses including ploughing and pasture improvement (Dorrough, 1995). Grazing does not appear to have a long term impact on the species' distribution. Not suprisingly, many of the areas in which the species occurs are also well preserved grassland remnants.

The Striped Legless Lizard was detected at only one site during this survey. Five animals were found under rocks in remnant grassland south of Cooma on the Monaro Plains. This find has considerable scientific and conservation significance as the species has not been recorded on the Monaro Plains since 1888 (Shea, 1993). Recent surveys of an additional eleven sites on the Monaro Plains which were believed to be suitable for this species recorded no Striped Legless Lizards (Osborne, 1994).

Southern Lined Earless Dragon

The Southern Lined Earless Dragon occupies remnant grasslands in south-eastern Australia, preferring those dominated by short perennial grasses with scattered taller tussocks (Smith, 1994). The species utilises these areas for foraging, perching on the taller tussocks and preying on diurnally active invertebrates in a sit-and-wait style (Smith, 1994). The species has been found to shelter in tussocks, under rocks, and within wolf spider burrows (Langston, pers. comm.).

This sub-species is known from only a few localities in the A.C.T. and N.S.W. (Osborne pers. comm.). In Victoria the sub-species is listed as endangered (CNR 1995) and while not formally listed in New South Wales is considered to be threatened (Osborne *et. al.* 1993). The Earless Dragon was considered extinct in the A.C.T. until the recent discovery of four localised populations (Osborne *et. al.* 1993). The distribution of the sub-species in New South Wales is poorly known although, it has been recently collected from three remnant grassland sites on the Monaro Plains (Osborne pers. comm.) and was also found at an additional site during this survey. Most sites where Earless Dragons have been collected in the A.C.T. and N.S.W. have had no history of intensive agricultural land use (Dorrough pers. obs.). Relatively undisturbed temperate primary grasslands are now considered uncommon (Benson, 1994). Furthermore, recent research has suggested this sub-species should be raised to species status (Smith, 1994), and once this has formally been recognised, conservation of the species will have national significance (Cooper, pers. comm.). Therefore, while not formally listed, a precautionary approach was adopted for the Earless Dragon and the sub-species was considered to be nationally significant.

Broad-headed Snake

The habitat requirements of the Broad-headed Snake overlap those of the Brush-tailed Rock-wallaby, that is, north-facing sandstone escarpments which have woodland on the top of the escarpment (Daly, pers obs). The species is saxicoline, being found under flat pieces of tight fitting sandstone that sit on the parent rock (Daly, pers obs). The Broad-headed Snake appears to specifically select rocks that have no soil or organic debris under them (Daley, pers obs). Shine (1983) examined Museum specimens and found that these snakes eat skinks, geckos and occasionally frogs. There are few published references on their ecology and habitat requirements.

Bulee Gap, Tianjara Falls and the area adjacent to the Shoalhaven River are areas crossed by the proposed route and support potential habitat for Broad-headed Snakes. The Tianjara Falls area was a favoured haunt for amateur herpetologists some twenty years ago. Inspection of this site during the present survey revealed that there has been extensive damage to the rocks on the escarpment adjacent to the falls. Similarly, inspection of the southern escarpment of the Shoalhaven River revealed that rock collectors have removed large quantities of loose rock for landscaping purposes. This was indicated by the lighter coloured patches on the parent rock.

State Significance

Mammals

Spot-tailed Quoll

This species is the largest extant marsupial carnivore on the mainland, being the size of a domestic cat at maturity. The Spot-tailed Quoll is a nocturnal predator hunting a variety of prey from birds and small arboreal mammals to reptiles and insects. The range of this species has halved in the last 150 years (Mansergh 1984), and the Scientific Advisory Committee of the FFG hold it to be "in a demonstrable state of decline". It inhabits a range of forest types from closed forest to woodland, and also occasionally coastal heathland, although it is most abundant in wetter forests. It is an opportunistic predator of small to medium-sized ground mammals, birds and arthropods and is also a scavenger. The reasons for the decline of this species are probably habitat destruction, poisoning and competition from introduced predators. It is regarded as Vulnerable in both Victoria and New South Wales, and listed under both the FFG Act in Victoria and the Schedule 12 Act in New South Wales. An FFG Action Plan has been prepared. In Victoria this species has been recorded on the route corridor near Bellbird Creek and in the Noorinbee Forest Block west of Cann River. In New South Wales this species is regularly observed along the Cambewarra Range and the Saddleback area west of Kiama (Daly pers. obs; H. Jones pers. comm.). During this survey a Tiger Quoll print was located in a sandy cave at Bulee Gap.

Brush-tailed Phascogale

This small carnivorous marsupial is an active and mobile nocturnal predator that occupies large home ranges and consequently is present in low densities where it does occur. It is classified as rare in Victoria (CNR 1995) and as vulnerable in New South Wales (Schedule 12). Brush-tailed Phascogales may occur where high quality Dry Forest and Woodland habitat still exists as large and continuous areas. Kennedy (1920) gives an estimated decline of 10-50 % in geographic range since the commencement of settlement by Europeans. The decline of this species is probably due indirectly to habitat loss as a result of clearing, goldmining and grazing and directly to predation by cats. The single record in the study area is from just west of Bairnsdale in 1957. It is unlikely this species still exists here as all suitable habitat has been transformed into improved pasture. No action or management plan has been prepared for this species in Victoria. In New South Wales there are no confirmed records of this species in the Illawarra although the vegetation, altitude and diversity of the vegetation in the study area indicate the possible presence of this species. Information on wild populations of Brush-tailed Phascogales is difficult to obtain (Tanton 1994).

White-footed Dunnart.

Records for the White-footed Dunnart in the study are from heath at Bherwerre Peninsula (King 1980) and Spotted Gum forest at Bugong (Daly and Murphy 1995) and wet sclerophyll/rainforest at Mount Keira Scout Camp (Robinson 1987). Lunney *et al.* (1986) located a single specimen in the Bega region of southern NSW on a treeless ridge next to Silvertop Ash *Eucalyptus sieberi* forest. The Illawarra represents the northern limit of the distribution of this species (King 1980).

Southern Brown Bandicoot

This bandicoot is reputed to be trap-shy. It once occupied the Murray-Darling basin and was abundant in the Bega District on the New South Wales coast at the turn of the century (Lunney & Leary 1988). There are few records for this bandicoot in New South Wales, however the New South Wales National Parks and Wildlife Service database indicates several records in the Shoalhaven area. Southern Brown Bandicoots have been located at Beecroft Peninsula and Cambewarra Road (M. Fortescue pers. comm.) and Morton National Park (NPWS Database). Lunney and Barker (1986) only located this species at Bega as hair in one of 2249 predator scats. In Victoria Southern Brown Bandicoots preferred habitat is lowland sites within 50 km of the coast which support sclerophyllous woodlands and forests, and heathlands growing on siliceous sandy soils (Opie *et al.* 1990). Heath and woodland with a heath understorey represent suitable habitat for this species.

Yellow-bellied Glider

The Yellow-bellied Glider is listed as 'vulnerable and rare' in New South Wales This social, arboreal mammal prefers forest that possesses a tree species which can be excised for sap. They also require the forest to have sufficient species diversity so that a winter flowering eucalypt is present (Kavanagh 1987) as the sap of eucalypts forms a central part of their diet (Goldingay 1987, 1991). A previous study had indicated that Yellow-bellied Gliders in the Shoalhaven area show a preference for the Grey Gum, *Eucalyptus punctata* for sap feeding (Goldingay 1991) and Grey Gums that were incised by Yellow-bellied Gliders have been located throughout the study site. The north Nowra area has many Yellow-bellied Gliders as indicated by incised grey gums and by the observation of several animals during spotlighting. The habitat corridor for this species includes the eucalypt forests adjacent to the escarpments of the Shoalhaven River (QEM 1993). The Yellow-bellied Glider has been located in the Shoalhaven River area. Within the boundaries of this municipality the preferred habitat of this species is Grey Gum forest but it has also been located in Spotted Gum forest (Daly pers. obs.). The Grey Gum is a highly preferred species that is used for sap feeding by this glider while the Spotted Gum provides an important source of nectar and pollen (Goldingay 1990, 1991).

Squirrel Glider

Studies on the Squirrel Glider indicate that it inhabits sclerophyll forest composed of mixed-species stands including gum bark and high nectar-producing species, some which flower in winter (Menkhorst *et al.* 1988). Dietary studies indicate a preference for insect larvae and plant exudates, especially *Eucalyptus* sap and *Acacia* gum (Menkhorst & Collier 1987). Robinson (1987) detected this species close to Morton National Park. The study area has the species mix of *Eucalyptus* species that constitute suitable habitat for Squirrel Gliders. The Squirrel Glider is listed as 'rare' in Victoria (but not found within this study area) and as 'vulnerable and rare' in New South Wales.

Koala

This large arboreal folivore was once widespread in eastern Australia but its range has since declined. It is restricted to areas where suitable eucalypt trees occur as a food source. Koalas are solitary and individuals are dispersed throughout suitable forests. The Koala has lost such a significant amount of its habitat in NSW that in 1995 a separate State Environmental Planning Policy (SEPP) was introduced to aid the conservation of the species. In the northern section of the proposed pipeline the following Local Governments are involved: Shellharbour, Shoalhaven and Wollongong (SEPP). Within the study area in NSW, the Koala has been recorded just south of Nimmitabel and near Manor.

Long-nosed Potoroo

Strahan (1992) stated that the habitat of the Long-nosed Potoroo is cool rainforest and wet sclerophyll forest with a dense ground cover in coastal south-eastern Australia. There are few records of this species in the region. The most appropriate habitat for the Long-nosed Potoroo is the rainforests and wet sclerophyll forests of the coastal escarpment. The habitat in sections of the study area corresponds with that which is preferred by this species. This species has been recorded at Mount Keira in 1965 (Robinson 1988), Foxground (Mr H. Jones pers. comm. 1993) and trapped at Barren Grounds Nature Reserve (Ms D. Andrews NPWS pers. comm.). The lack of records of this species in the Illawarra may be partially a result of the difficulty of detecting this species. The Long-nosed Potoroo has been found to persist in isolated forest fragments (< 80 ha in size) at Naringal, Victoria (Bennett 1987).

Eastern Horseshoe Bat

The Eastern Horseshoe Bat is found along the coastal region of eastern Australia. It is known in Victoria only from the Eastern Highlands and East Gippsland. This cave-dwelling species flies slowly and hunts low to the ground or over water (Hall and Richards 1979). This bat is classified as having restricted colonial breeding or roosting sites in Victoria (CNR 1995). Their distribution (especially in the south) is constrained mainly by the availability of warm humid caves. The largest Victorian colony of Eastern Horseshoe Bat maternity caves have been protected by CNR in a Special Protection Zone, which is located less than 10 km south of the current route in the Colquhuon State Forest.

Common Bent-winged Bat

This medium-sized insectivorous bat has restricted colonial breeding sites and is considered to be at risk in both New South Wales ('vulnerable and rare') and Victoria ('restricted, colonial species). It occurs in eastern, south-eastern and north-western Australia, preferring well-timbered valleys where it generally feeds above the tree canopy. It is a highly mobile species which roosts in caves, mines and rock shelters (Hall and Richards 1979, Hall, Young and Spate 1975). In the summer months, females from widespread populations aggregate at a limited number of cave breeding sites, forming large maternity colonies. One of the two such breeding sites recorded in Victoria is approximately 10 km from the pipeline route near Nowa Nowa (Menkhorst and Lumsden 1995). This bat has been commonly recorded in the

Colquhuon and Lake Tyers State Forests in the Gippsland Coastal Plains. One of the two large maternity caves in Victoria has been protected by CNR in a Special Protection Zone which is located less than 10 km south of the current route in the Colquhuon State Forest. In northern New South Wales, the sandstone escarpment existing in the Shoalhaven area provides excellent bat habitat. Recent surveys have located this species at several sites adjacent to the Shoalhaven River (Daly 1995e). The closest record to the proposed pipeline route is Bangalee Reserve, four kilometres to the west.

Large-footed Myotis

This medium-sized insectivorous bat species is classified as rare by CNR (1995) and many apparently suitable sites have not been found to contain this species. The Large-footed Myotis occurs in northern, eastern and southern coastal Australia. It inhabits a wide range of vegetation communities, always associated with permanent, usually slow-flowing water bodies. It has been recorded at a relatively small number of localities across lowland Victoria, usually below 300m. Individuals roost in colonies in caves, mines, disused tunnels or dense vegetation and forage at night over bodies of fresh water, "raking" the surface with its enlarged hindfeet to catch aquatic insects and small fish (Lumsden and Menkhorst 1995). No action or management plan has been formulated for this bat in either Victoria or New South Wales. It has been recorded in the study area west of Cann River. One specimen was detected along the Shoalhaven River during March 1995 (Daly and Murphy 1995). This represents the first record of this species along the lower reaches of this river. Previous records indicate that the species has been recorded on the Shoalhaven at Ballalaba Bridge (NPWS 1994). It is most probable that small colonies of this bat roost beside the Shoalhaven where rocky areas of steep slope form the bank of the river (Dr R Coles pers. comm.). Further work is required to locate these roost sites so that an adequate census of the population size of this species of bat in this region can be assessed. This species will be adversely affected by habitat destruction and sedimentation of its foraging areas and it is important to protect riparian vegetation and water quality.

Eastern Broad-nosed Bat

In Victoria this small insectivorous bat has been mostly recorded from East Gippsland and the Eastern Highlands. It is mostly found in mixed species forests characteristically containing one or more stringbark species: *E. baxteri, E. sieberi* or *E. obliqua*. The relatively few records made of this species since it was given specific status (Kitchener and Caputi 1985) and the accordingly little known of its ecology has led to its conservation status of 'insufficiently known' in Victoria (CNR 1995). Individuals roost in tree hollows or buildings and catch their insect prey in the air (Lumsden and Bennett 1995). Within the study corridor it has been recorded between Nowa Nowa and Noorinbee North, with most observations occurring in the Reed Bed Creek to Noorinbee area.

Smoky Mouse

The Smoky Mouse is a dark, grey, small, rat-sized rodent that occurs patchily over a wide area of Victoria in a range of habitats, from montane and subalpine heath to open forest and woodland. They are considered rare in Victoria where they are apparently endemic (CNR 1995). Their small populations sizes, and successional changes in the vegetation that rapidly change the suitability of habitat patches (Menkhorst 1995) render them vulnerable to local extinctions. They feed on a wide variety of seeds, berries, and underground fungi as well as insects when they are readily available (Cockburn 1981). Within the vicinity of the study area they have been recorded just north of Bairnsdale (Norris *et al.* 1983).

Birds

Blue-billed Duck

This duck is mostly found in south eastern and south western Australia and is listed as 'rare' in Victoria (CNR, 1995) and 'vulnerable and rare' in New South Wales (Schedule 12). It usually inhabits permanent lakes and swamps and is rarely found on salt water or farm dams (Emison *et al.* 1987). The Blue-billed Duck feeds on invertebrates and plants which it obtains by dabbling on the surface and diving. In winter this duck forms flocks which disperse to smaller densely vegetated swamps to breed in spring (Blakers *et al.* 1984). It was recorded east of the Perry River and in the Colquhuon State Forest in the study area. The pipeline is likely to have a minimal impact on this species but care should be taken where the route crosses wetland habitat.

Freckled Duck

Populations of this duck are mainly confined to inland south-eastern and south-western Australia. It inhabits a range of temporary and permanent wet habitats including open lakes, swamps with thick vegetation or scrub. Most of the mortality in this species is directly attributable to shooting in the duck shooting season despite its protected status as a rare and restricted species in Victoria (CNR 1995). There is a single record of the Freckled Duck in the study corridor east of Sale. The pipeline is likely to have a minimal impact on this species but care should be taken where the route crosses wetland habitat.

Cape Barren Goose

This large grey goose is distributed in south-eastern and south-western Australia and Tasmania. It breeds on smaller islands, and young disperse to larger islands and the mainland. The Cape Barren Goose grazes on grasses and legumes and as a result has benefitted from agriculture. In Victoria it is rare and restricted in its distribution (CNR 1995). It has been recorded in the Heart Morass, and in the vicinity of the Avon River. The proposed pipeline is unlikely to have a major impact on this species.

Great Egret

This cosmopolitan egret inhabits shallow swamps, flood plains and the edges of streams and channels. It is usually occurs alone but flocks can congregate as it preys on invertebrates, frogs and fish. This species has benefitted from agricultural and irrigation practices and this is confirmed by the many non-breeding records of this species along the pipeline corridor. The Great Egret is listed as a restricted, colonial breeder in Victoria (CNR 1995) and it has been recently observed breeding in the Dowd's Morass area. Reproduction is affected by disturbance and habitat destruction but it is unlikely that this breeding will be greatly affected by the pipeline.

Australasian Bittern

The Australian Bittern appears to be nomadic where it is found in south eastern and south western Australia and also in New Zealand. It occurs alone or in loose groups in extensive dense reedbeds or along the edges of swamps as it feeds on insects, fish and aquatic invertebrates (Marchant and Higgins 1990, Emison *et al.* 1987). Some individuals breed in loose colonies while others are territorial nesters. This species has been recorded in Gippsland east of the Perry River, west of Orbost, in the Colquhuon State Forest, and near

Nowa Nowa on the pipeline corridor. The Australasian Bittern is considered 'insufficiently known' in Victoria(CNR 1995).

Royal Spoonbill

This Spoonbill is mostly found in groups in eastern and northern Australia with occasional records from south-western Australia. In these areas it inhabits inland and coastal shallow water and mud flats where it feeds on fish and invertebrates. The Royal Spoonbill is listed as a 'restricted, colonial breeder' in Victoria (CNR 1995). There are many feeding records of this species along the pipeline route and a recent record of it breeding in the vicinity of Dowd's Morass. Generally, breeding in this species may be adversely affected by disturbance and habitat destruction, but it is unlikely that the proposed pipeline will greatly affect reproduction in this species.

Square-tailed Kite

The endemic Square-tailed Kite is found generally in mainland Australia except rarely in the inland or South Australia (Blakers *et al.* 1984). The Square-tailed Kite has been recorded in coastal and subcoastal forests and woodlands, and inland riverine woodlands (Debus & Czechura 1989; Debus 1990, 1991). This kite soars alone above or just below the tree canopy searching for insects, reptiles and birds on which to feed (Garnett 1992). The home range of the Square-tailed Kite is considerable and covers several thousand hectares (Daly, pers. obs.). This species is classified as 'vulnerable' in Victoria (CNR 1995) with East Gippsland regarded as an important area of its range (Emison *et al.* 1987). It is also listed under Schedule 12 as 'vulnerable and rare' in New South Wales. Clearance of habitat for agriculture or plantation timber is the major cause of impact on populations. Within the study corridor it has been recorded in the Colquhuon State Forest, Lake Tyers Park and west of Newmerella. A pair of birds nested in Bangalee Reserve during late 1994 (Daly pers. obs.) some four kilometres west of the proposed pipeline route. This pair was recorded at various sites in Nowra over the summer of 1995 (Daly unpublished data.). Habitat destruction should be minimised in these areas to reduce any impact of the pipeline on this species.

White-bellied Sea-Eagle

This large soaring raptor is distributed throughout India, south-east Asia, New Guinea and Australia. Here, it lives along the coasts and along inland rivers and lakes, particularly in the east of the country. The White-bellied Sea-Eagle preys on birds, reptiles and carrion and has been also known to take bandicoots (Blakers *et al.* 1984). This eagle is listed as 'rare' in Victoria (CNR 1995). Breeding pairs are thought to be sedentary and there are traditional breeding areas although several different nest sites may be used within such an area. There are regular breeding records in the Nowa Nowa area. The White-bellied Sea-Eagle has also been observed between Bairnsdale and Cann River including in the Colquhuon State Forest, Mount Raymond, West Cann and Lake Tyers Park areas. Habitat destruction should be minimised over its range, particularly in the Colquhoun and Nowa Nowa areas.

Grey Goshawk

This large, almost pure white raptor is found in New Guinea, eastern and northern Australia and Tasmania. It preys on other birds but has also been known to eat insects, rabbits and carrion. While it may live in open habitat, it requires forest in which to breed. The Grey Goshawk is a relatively sedentary species which occurs in low density within its range. It is classified as 'rare and restricted' in Victoria (CNR 1995), with the clearing of forests and human persecution being the major impacts on populations. In Victoria there are many records from near Nowa Nowa and also records from the Colquhuon State Forest, Reed Bed Creek, and Snowy River areas. The Grey Goshawk is adversely affected by the destruction of its forest habitat. The potential impact of the pipeline will be due to habitat destruction and this should be minimised in the area of its known range.

Grey Falcon

The Grey Falcon is a raptor of inland Australia where it is found in grasslands, open woodlands and shrublands (Blakers *et al.* 1984). They nest in trees and eat birds and other small vertebrates which they usually locate and catch by flying low and fast over the ground (Emison *et al.* 1987). The Grey Falcon is listed as 'vulnerable' (CNR 1995). There is one anomalous record from the Colquhuon State Forest near Nowa Nowa along the proposed route. The proposed pipeline is unlikely to have a major impact on this species.

Black Falcon

Most Black Falcons can be found in inland Australia where they inhabit eucalypt woodland and breed mostly along watercourses (Blakers *et al.* 1984). They usually prey on birds but, other small vertebrates will also be consumed (Emison *et al.* 1987). There is some indication that they move large distances either as nomads or in regular migratory movements (Blakers *et al.* 1984). This raptor is considered 'rare and restricted' in Victoria (CNR 1995). Individuals have been recorded near the Perry River and in the Colquhuon State Forest. It is unlikely that the proposed pipeline will adversely affect this species.

Lewin's Rail

Lewin's Rails are found in Indonesia and New Guinea as well as in Australia. In this country they are distributed in eastern coastal areas with most individuals recorded from Victoria and Tasmania (Blakers *et al.* 1984). Individuals inhabit and nest in densely vegetated swamps and the associated feeder streams where they feed on invertebrates (Emison *et al.* 1987). Lewin's Rails are very secretive and hence rarely recorded (Kemp *et al.* 1993). There is a single observation in the Colquhuon-Nowa Nowa area in the study corridor.

Baillon's Crake

This crake is found in Africa, Europe, Asia, New Guinea and Australia, where it lives in swamps, on the edge of reed beds, and in moderately dense vegetation where floating vegetation is common (Blakers *et al.* 1984). It feeds on insects and seeds in shallow water and is thought to undergo a north-south winter-summer migration. Baillon's Crake is considered insufficiently known in Victoria (CNR 1995). It has been recorded from east of the Perry River, Nowa Nowa, Colquhuon State Forest and the West Cann in the study area.

Eastern Curlew

This bird breeds in eastern Russia and northern China and migrates to coastal Australia in the non-breeding season. It inhabits mud flats and tidal estuaries where it feeds on invertebrates such as crabs. In Victoria the Eastern Curlew is 'rare and restricted' (CNR 1995). Its decline is probably a result of human disturbance to its feeding and roosting areas. The Eastern Curlew has been recorded from the Colquhuon State Forest and near Nowa Nowa. This species is unlikely to be greatly affected by the proposed pipeline.

Whiskered Tern

This tern inhabits fresh or salt water, intermittent or permanent swamps and lagoons and migrates north in the non-breeding season. It breeds in Eurasia, Africa and Australia with one subspecies breeding only in Australia. The Whiskered Tern is regarded as a restricted, colonial breeder (CNR 1995), with colonies forming when floods occur. There is a single record of the Whiskered Tern breeding in the Heart Morass in the Gippsland Coastal Plains area at the beginning of this century. It is considered unlikely that the proposed pipeline will affect breeding in this species.

Glossy Black Cockatoo

The main habitat of the eastern subspecies of Glossy Black Cockatoo is eucalypt woodlands and forest with casuarinas (Garnett 1992). Casuarinas form the major component of the Glossy Black Cockatoo's diet (Garnett 1992). This species is listed as 'vulnerable' in Victoria (CNR 1995) and as 'vulnerable and rare' in New South Wales (Schedule 12). In Victoria it has been recorded from near Newmerella, Mt Raymond Forest Park, and near Bellbird Creek. Bulee Gap has a large population of Black She-oak and on the western edge of Bulee Gap numerous casuarina cones were detected which had recently been cracked by cockatoos for seed. It is most likely that Glossy Black Cockatoos utilise this site. In the North Nowra area a group of Glossy Black Cockatoos were located feeding on the seeds of black she-oak and would have foraged within the study area.

Turquoise Parrot

The Turquoise Parrot has a distribution that extends from southern Queensland to northern Victoria (Crome and Shields 1992). They are often detected at the edge of forests in native grassland and open woodland (Crome and Shields 1992; Blakers *et al.* 1984). Gibson (1989) states that this species is sedentary. This species spends much time on the ground, feeding on seeds, mainly of native grasses but also utilising some introduced plants and native shrubs (Crome and Shields 1992). The Turquoise Parrot is listed in both Victoria ('rare', CNR 1995) and New South Wales ('vulnerable and rare', Schedule 12). In Victoria, it was recorded in Lake Tyers State Park, and in forest west of Newmerella. The records held by the NPWS of NSW of the occurrence of this species in the northern study area indicate a more scattered distribution. Several sightings have been made around Nowra and it is plausible that the species still exists in this area, although further surveys would be needed to ascertain this.

Ground Parrot

The Ground Parrot is found in restricted areas within south-eastern and south-western Australia and Tasmania (Blakers *et al.* 1984). They are granivores (McFarland 1989; Bryant 1991) and have specialised requirements (Baker and French 1995). Baker and French (1995) state that Ground Parrots have a density of approximately 2-3 birds per 10 hectares. The habitat utilised by Ground Parrots is fire prone. Meredith and Jaremovic (1990) suggest that after a fire Ground Parrot populations go through a five phase cycle. In the first phase, immediately after fire animals are absent but recolonise in the second phase. In the third phase the number of Ground Parrots rise and plateau. In the fourth phase Ground Parrot numbers decline until the fifth stage where no Ground Parrots exist because the habitat has altered such that it is unsuitable for the species. Baker and French (1995) state that not all Ground Parrot habitat necessarily goes through the fourth and fifth stages outlined above. This parrot species has been listed as 'rare' in Victoria (CNR 1995) and 'vulnerable and rare' in New South Wales (Schedule 12). In Victoria it has been recorded in the study area in the vicinity of Reed Bed Creek. Further north in the Illawarra / Shoalhaven, the Ground Parrot is known from disjunct populations which occur at Bherwerre Peninsula, Barren Grounds Nature Reserve and Morton National Park (Daly pers. obs., J. Baker pers. comm. and Thackway *et al.* 1985). The population at Barren Grounds Nature Reserve has been studied by Jordon (1987), Wall (1989) and Baker and Whelan (1994). In the Illawarra/Shoalhaven Ground Parrots are found in coastal and near coastal heath and swampy heath (Daly pers. obs.).

Powerful Owl

Breeding pairs of our largest owl occupy large permanent territories (up to 1000 ha) preferably including gullies in foothill and coastal forests. Their distribution is dependent on the density of suitable nest hollows, roost sites and food (Seebeck 1976). This species preys primarily on arboreal mammals but also takes birds, insects and terrestrial mammals (Kavanagh 1988, 1990). The Powerful Owl inhabits both wet and dry eucalypt forest (Garnett 1992). It is a vulnerable species of state significance in both Victoria and New South Wales because of its restricted distribution and the continuing loss of mature forest habitat. However, no action plan has been prepared for this species. In Victoria individuals have been recorded in suitable habitat between Nowa Nowa and Lind National Park in the Gippsland Coastal Forests area. Powerful Owls have been located in various sites in the north Nowra area (Daly 1995 a,b,c; Murphy 1994).

Barking Owl

Pairs are sedentary and occupy large territories in dry woodlands and forests and in wooded farmlands they utilise tree hollows for nesting and roosting. Barking Owls are nocturnal hunters, taking mammals, birds and insects on the wing, in trees and on the ground. Habitat fragmentation is the primary reason for the decline of this species. No Action Plan has been prepared for this species. There is a single record of this species in the study area east of the Perry River in the Gippsland Coastal Plains. It is unlikely that the proposed pipeline will have a major impact on this species.

Sooty Owl

The Sooty Owl is found in suitable but restricted areas in eastern coastal Australia. Individuals require mature forests both for feeding and for nesting hollows and feed mainly on arboreal mammals. This owl has a large exclusive home range of up to 800 ha for a pair. A survey of this species' habitat requirements on the far south coast of New South Wales indicates that it prefers low altitudes (< 300 metres), sheltered south-east facing sites which contain rainforest with a dense understorey layer (Kavanagh & Peake 1993). It is listed as 'rare and restricted' in Victoria (CNR 1995) and as 'rare and vulnerable' in New South Wales (Schedule 12). The habitat requirements of this species in East Gippsland are not fully understood, but they are generally associated with the wetter forests such as the warm temperate rainforest in the Cann River Valley. Sooty Owls have been recorded in suitable habitat in the area between Newmerella and Club Terrace (Gippsland Coastal Forest area). In northern New South Wales the study corridor has vegetation which corresponds with this habitat type along the northern edge of the Shoalhaven River (Daly 1995 c), the upper elevations of Foxground and Saddleback Mountain and the escarpment behind Wollongong. Garnett (1992) suggests that habitat fragmentation and the loss of old-growth elements may affect this species.

Masked Owl

Like the Powerful and Barking Owls, the Masked Owl requires large expanses of open and wooded habitat to meet hunting, roosting and nesting requirements. Debus (1993) stated that this species is "...an opportunistic generalist, widespread in coastal and sub-coastal open forests and woodlands". Its diet is varied but the species prefers terrestrial vertebrates. Individuals are dependant on old hollow eucalypts for breeding. Estimates of the Masked Owl's home range varies from 400-500 hectares to at least 1 km across in one direction (Debus 1993). Habitat fragmentation is the main cause of the decline of this species. The Masked Owl is listed as 'rare' in Victoria (CNR 1995) and as 'vulnerable and rare' in New South Wales (Schedule 12). Individuals have been recorded along the pipeline route between Bairnsdale and Orbost. A pair of Masked Owls have been detected four kilometres to the west of the proposed pipeline route at Bangalee Reserve.

Eastern Bristlebird

The Eastern Bristlebird is found in a restricted area of south eastern Australia where it is primarily associated with coastal heath (Blakers *et al.* 1984). This species is listed as 'vulnerable and rare' in New South Wales (Schedule 12). Populations of Eastern Bristlebirds in southern New South Wales have been recently studied by Baker (Baker 1995, Baker and French 1994, Baker unpublished report). The largest populations in the state are at Bherwerre Peninsula (Jervis Bay) and the Budderoo National Park (west of Kiama) (Barker unpublished report). There have been no recent records of this species in Morton National Park (Baker unpublished report) until our spring survey when an individual was detected along the pipeline route in Morton National Park west of Sassafras.

Striated Fieldwren

The Striated Fieldwren is distributed widely in southern Australia and is listed as 'vulnerable and rare' in New South Wales (Schedule 12). It lives in samphire, saltbush and heath habitats (Blakers *et al.* 1984). In the Shoalhaven the location of populations of Striated Fieldwrens correspond to areas of heath which is adjacent to depauperate silvertop ash forest (Daly pers. obs.). In New South Wales the Striated Fieldwren occupies similar habitat to that used by the Ground Parrot and the Eastern Bristlebird (Tanton 1994). However, there are no records of the Striated Fieldwren in coastal heath at Beecroft and Bherwerre Peninsulas where the Bristle Bird and Ground Parrot coexist (Jervis Bay National Park) (Coyne *et al.* 1979, J. Baker pers. comm.). The north-eastern limit of this species occurs in Morton National Park in the upper Clyde River (Morris *et al.* 1981, Schodde and Tidemann 1993), although it was recorded at Botany Bay in 1979 (Morris *et al.* 1981). It has previously been recorded in the path of the proposed pipeline in Morton National Park close to Tianjara Falls (D. Wright pers. comm.).

Pink Robin

This aerial insectivore is restricted to southern mainland Australia and Tasmania. Individuals live in rainforest and eucalypt forest, particularly gullies (Blakers *et al.* 1984). The Pink Robin is listed under Schedule 12 as 'vulnerable and rare' in New South Wales. It is adversely affected by clearfelling of its forest habitat. It has been recorded in the Morton Plateau area within the study corridor.

Olive Whistler

The Olive Whistler is restricted to high altitude rainforest and eucalypt forest in southern coastal Australia and Tasmania (Blakers *et al.* 1984). This bird forages for insects mostly in the ground. In New South Wales the Olive Whistler is considered 'vulnerable and rare' (Schedule 12). It has been recorded near the New South Wales and Victorian border (N.S.W. National Parks and Wildlife Service Database) and was observed during this survey between Morton Plateau and Wilton Tablelands.

Other significant bird species

The following birds are listed as species which nest or roost in restricted areas in colonies (CNR 1995; FFG). Fairy Prion, Black-faced Shag, Pied Cormorant, Darter, Australasian Gannet, Australian Pelican, Caspian Tern, Crested Tern, Pacific Gull, Glossy Ibis, Little Egret, Rufous Night Heron. There are general observations but no breeding records for these species within a 2 km corridor of the proposed pipeline and it is unlikely that the pipeline will directly affect these species adversely.

Reptiles

Swamp Skink

The Swamp skink occurs exclusively in densely vegetated swampy and saltmarsh habitats throughout southern coastal Victoria. Its range possibly extends into South Australia and south-east New South Wales. Within Victoria most individuals are observed in western areas. It is classified as 'rare' in Victoria (CNR 1995) due to its confinement to a geographically disjunct habitat type which has an occurrence characterised by small size and relative isolation. It may be locally common within areas of suitable habitat. There is a single record of this species from the Noorinbee area ie between Reed Bed Creek and the Cann Valley on the pipeline route.

Heath Monitor

This species has a distribution that ranges from south-west Western Australia along the coast to South Australia, Victoria and NSW (Cogger 1992). Currently the population within NSW is considered to be isolated from that of the other states (Cogger 1992) and is considered 'vulnerable and rare' (Schedule 12). Within NSW the species has been found from just north of the Hawkesbury River to Cooma (Swan 1990, Shea 1994). Heath Monitors prefer sclerophyll forest and heathlands (Swan 1990) and have a large home range (between 1.7-43.7 ha (Green and King 1993). Eggs are laid in termite mounds and it has been suggested that the female returns to the oviposition site and digs out the eggs to release the fully developed young (Ehmann *et al.* 1991). Hence termite mounds are a critical component of the habitat of this species. Heath Monitors have been found in Morton National Park (AM record). A monitor which resembled a Heath Monitor was observed west of Sassafras (G. Daly pers. obs.). During the spring survey a road-killed specimen was found on the pipeline route between the Endrick River and Bulee Gap. The species is also expected to occur along the pipeline route on lands managed by Sydney Water.

Tree Goanna

This species of monitor is widespread but patchily distributed in Victoria (AVW in Kemp *et al.* 1993). The low altitude forests of East Gippsland are an important stronghold of this species. The Tree Goanna is reliant on tree-hollows and logs for shelter. As a result the major impact on this species is the destruction of forests which contain mature, hollow-bearing trees for timber harvesting, plantations or agriculture (Wilson and Knowles 1988).

Southern Water Skink Group

The Southern Water Skink is distributed in south eastern Australia with isolated populations in South Australia. This active diurnal skink is commonly encountered along small streams where it basks on logs and rocks (Cogger 1994). In Victoria (CNR 1995) listed this species as 'insufficiently known'. It has been recorded in the study corridor by our surveys and the Atlas of Victorian Wildlife in the Gippsland Coastal Forests and Cann River Valley areas.

Little Whip Snake

This small nocturnal snake inhabits grasslands and open woodlands in south-eastern Australia (Jenkins and Bartell, 1980). The species appears to shelter under logs or rocks during the day and at night forages on small skinks (Jenkins and Bartell, 1980). Prior to this survey the Little Whip Snake was known from only one locality in N.S.W. (Longmore, pers. comm.). During this survey the species was caught in pit traps adjacent to the proposed route in woodland south of Bungendore. While the species may be shown to be more widely distributed in N.S.W. this site currently must be considered of extreme importance for the species' conservation in N.S.W.

Amphibians

Green and Golden Bell Frog

Green and Golden Bell Frogs are seasonally active and prefer permanent water, either ponds or sluggish backwaters of creeks and rivers, particularly where complex vegetation occurs around the edges (Courtice & Grigg 1975). They are diurnal and sunbake while resting on emergent aquatic vegetation. The distribution of the Green and Golden Bell Frog is from Tyaharah Nature Reserve, Byron Bay NSW (Fitzgerald pers. comm.) in the north to Orbost Vic (Barker and Grigg 1977) in the south. The species seems to no longer occur on the ranges of although a population did exist on the southern tablelands (around Canberra, NSW Wildlife Atlas No 2, Osborne 1990; 1992) and northern tablelands (Cogger 1992). Most extant populations occur within several kilometres of the east coast (Daly 1995e). The species' is now considered to be threatened in New South Wales (NSW National Parks and Wildlife Service Schedule 12). The Green and Golden Bell Frog was once common in NSW (Cogger 1960) but has declined in recent years and the cause of this decline is unknown. Predation of tadpoles and eggs by the exotic Mosquito Fish *Gambusia affinis* is regarded as one possible cause (Mahoney 1993). Daly (1995e) found that given an option Green and Golden Bell Frogs will not spawn in ponds that contain mosquito fish in them. In the Illawarra/Shoalhaven region this species is known by one author from six localities. Previously the species had been recorded from Morton National Park (Jenkins 1987). However, the status of all populations warrants monitoring. At present the species occurs in several isolated populations in the greater Sydney and the Illawarra/ Shoalhaven area (R. Goldingay pers. comm.).

Blue Mountains Tree Frog

This large uncommon frog inhabits rocky rivers and streams in tall open forest (Webb 1991) in east Gippsland and southern New South Wales. This species is listed as 'rare and restricted' in Victoria (CNR 1995). Individuals breed in permanent and semi-permanent pools (Cogger 1994). It has been extensively recorded in suitable habitat in the Cann River Valley section of the proposed route.

Large Brown Tree Frog

This large frog inhabits moist areas in tall open forests (Norris *et al.* 1983). It is thought to be locally common where suitable habitat occurs in eastern Victoria and south eastern New South Wales (G. Watson pers. comm.). This species is listed as 'insufficiently known' in Victoria (CNR 1995). Individuals have been recorded in the vicinity of Lind National Park in Victoria.

Great Barred Frog

This frog is listed as 'vulnerable and rare' in New South Wales. The distribution of this species is described by Barker and Grigg (1977) as rainforests in the mountains. Ferrier *et al.* (1993) state that this species is found in rainforest, antarctic beech and wet sclerophyll forest of the coast and highlands. The Great Barred Frog *Mixophyes balbus* occurs along the entire Great Divide from Victoria to the Gibraltar Range and the Clarence River (Ferrier *et al.* 1993). Jenkins (1993) only located the Great Barred Frog in the eastern edge of Morton National Park. Records are scant as this species is cryptic, living among the leaf litter on the rainforest floor. They are mostly detected by the loud calls of the males which are closely associated with heavy summer rain (Daly pers. obs.). Tadpoles recently located in the Bugong area metamorphosed and were identified as Great Barred Frogs (Daly and Murphy 1995). This is significant because this species has not been positively identified on the south coast of NSW for over a decade. They have also been recorded from near the Victorian border in the Jackson's Bog area in New South Wales.

Red Crowned Toadlet

Apart from an outlier population at Point Lookout in northern NSW this species is restricted to an area within about 200 kilometres of Sydney (NPWS Database, AM records). The south eastern record of this species is from Barren Grounds Nature Reserve (Ms K Tumm pers. comm.). The species has a preference for areas which have a substrate of sandstone. The specific micro-habitat of this species is the upper laterals of small creeks that occur on sandstone escarpments in dry sclerophyll forests (Daly pers. obs.). Within Sydney they are often associated with eucalypt forests dominated by the Smooth-barked Apple *Angophora costata* with a xerophytic understorey (Daly pers. obs.).

Growling Grass Frog

The Growling Grass Frog is found in, or close to, water and very wet areas in woodlands, shrublands, bogs and grasslands (Hero *et al.* 1991; Webb 1991) where it preys by day on other frogs. In the study area it has been recorded from just north of the Victorian/NSW border down to the East Gippsland coast (Webb 1994). Several authors report a decline in this species, eg. Tyler 1994 and Sadlier 1994 (in south-eastern Australia) and Osborne 1986 and Osborne 1990 (Canberra region), although Larwill & Kutt (1994) state that the available data does not support this contention. Also, Osborne (pers. comm. cited in Tanton 1994) claims the species is apparently re-establishing itself over its range. Webb (1991) found it to be common in selected habitat in Bondi State Forest as did Norris *et al* (1983) in the Gippsland Lakes region. Previously the species had been recorded from Morton National Park on the western edge of the Budawang Range (Jenkins 1987). This species probably has disappeared from the area.

Giant Burrowing Frog

This is a large burrowing frog which spawns in burrows, dams, ditches and slow-flowing streams (Hero *et al.* 1991). Ahern (1982) listed the Giant Burrowing Frog as 'possibly threatened' within Victoria, and Robertson (1987) determined it to be rare in habitat of limited extent. Gillespie (1990) suggests it may have a wider geographic distribution and be more abundant than present records suggest, although a series of intensive surveys in favourable conditions in East Gippsland failed to detect it. A review of the Victorian records of this species (Gillespie 1990) shows most are from dry sclerophyll forest, with a few localities being in riparian and wet sclerophyll forest, all below 1000m. It was recorded from between Mossiface and Nowa Nowa including in the Colquhuon State Forest in the Gippsland Coastal Forests and from Bondi State Forest (Webb 1991) through East Gippsland and the Eastern Highlands.

Martin's Toadlet

This small burrowing toadlet has been recorded in dry sclerophyll forest and coastal heath and breeding in coastal swamps and wet heaths (Davies and Littlejohn 1986) although it can survive in dams in forests and pasture (Kemp *et al.* 1993). Martin's Toadlet has been recorded from the Stony Creek area in the Colquhuon Forest and from Lake Tyers Park. Fuel reduction burning and other removal of ground litter from the forest floor would potentially isolate populations by hindering movement through the forest (Kemp *et al.* 1993). This species is listed as 'insufficiently known' (CNR 1995).

Tyler's Toadlet

Tyler's Toadlet is a small burrowing amphibian which is found in a range of forested habitats and coastal heath. It breeds in grassy depressions and roadside drains after spring and summer rains (Cogger 1992). This species is listed as 'insufficiently known' in Victoria (CNR 1995). All the records along the proposed pipeline route are from west of Cann River in the Noorinbee site of significance.

Regional Significance

A number of species are regarded as regionally significant. These are listed below with the region and the reason for listing given for each species. In Victoria regions are delineated by local government boundaries. The proposed route crosses three such boundaries. However as only eight km of the route was in the South Gippsland region, it has been amalgamated with the Gippsland Lakes region.

Table 2. Regionally significant fauna species. ✓ = this species is regionally significant. In Victoria, the divisions are based upon LCC land divisions. In NSW the divisions are based upon the three sections described in the Introduction to this report. The Gippsland Lakes includes the LCC area East Gippsland, however only eight kilometres of this area are included.

Species	General Habitat	Gipps. Lakes	East Gipps.	bord-Num.	Num-Hosk.	Hosk-Nerri	Wilton Table-lands	Reason for Significance
Mammals								
Platypus	Flowing Waterbodies			✓				Declining habitat
White-footed Dunnart	Grassland, Heath, Woodland	✓	✓					Sparsely distributed
Southern Brown Bandicoot	Heath, Shrubland, Woodland, Forest	✓						Sparsely distributed
Feathertail Glider	Woodland, Forest	✓		✓			✓	Declining distribution
Eastern Pygmy Possum	Heath, Woodland, Forest						✓	Declining distribution
Koala	Woodland, Forest		✓					Restricted habitat, sparse distribution
Long-nosed Potoroo	Damp Forest, Damp Shrubland, Riparian	✓	✓					Restricted distribution
Little Red Flying Fox	Farmland & Forest		✓					Rare
Eastern False Pipistrelle	Riparian, high rainfall Woodland / Forest	✓	✓					Uncommon, restricted records
Water Rat	Wetland, Riparian	✓	✓					Restricted records

Birds								
Brown Quail	Damp Woodland / Forest	✓	✓			✓		Generally scarce, restricted habitat
Pink-eared Duck	Wetlands			✓				Uncommon towards edge of range
Spotted Harrier	Open country	✓	✓					Generally scarce
Collared Sparrowhawk	Inland Scrub, Temperate Rainforest, Coastal Woodland			✓		✓		Rare
Wedge-tailed Eagle	Woodland / Forest	✓	✓					Declining
Little Eagle	Plains, Foothills, Woodlands, Scrublands			✓				Uncommon
Peregrine Falcon	Woodland / Forest	✓	✓				✓	Rare, in Vic., was declining, now on increase.
Buff-banded Rail	Swamp Meadow, Grassland	✓	✓					Generally scarce
Lewin's Rail	Wetlands						✓	Rare, restricted habitat
Spotless Crake	Permanent Wetlands	✓						?Restricted records
Whiskered Tern	Wetlands, Saltfields, Irrigated Pasture			✓				Rare
Blue-winged Parrot	Open country to Open Forest	✓	✓					Generally scarce, possibly declining
Barking Owl	Woodlands / Forests						✓	Sparsely distributed, restricted habitat
White-throated Night-jar	Dry Forest	✓	✓			✓		Sparsely distributed
Rainbow Bee-eater	Woodland, Forest				✓		✓	Edge of range, seasonal migrant

Brown Treecreeper	Dry Woodland	✓	✓			✓		Edge of range, patchy distribution / Uncommon
Yellow-throated Scrubwren	Rainforest						✓	Edge of range
Large-billed Scrubwren	Damp Forest, Rainforest, Riparian	✓	✓					Edge of range, restricted by habitat, patchy distribution
Pilotbird	Rainforest						✓	Restricted habitat
Rock Warbler	Sandstone escarpment						✓	Restricted habitat
Chestnut-rumped Heathwren	Heath, heathy Woodland	✓	✓			✓	✓	Rare, sparsely distributed, restricted records
Weebill	Forest to Inland Scrub				✓	✓		Possibly declining
White-throated Gerygone	Damp Woodland / Forest	✓	✓			✓		Uncommon, summer migrant
Yellow-tufted Honeyeater	Forest, Woodland, Coastal Scrub & Heath					✓		Uncommon
Scarlet Honeyeater	Rainforest, Riparian	✓	✓				✓	Edge of range
Hooded Robin	Heath, Woodland	✓	✓			✓		Restricted distribution
Logrunner	Rainforest						✓	
Crested Shrike-tit	Forest / Woodland, Riparian					✓	✓	Uncommon
Black-faced Monarch	Damp Forest, Rainforest, Riparian	✓	✓				✓	Edge of range
Rufous Fantail	Rainforest, wet sclerophyll forest						✓	Seasonal migrant
White-bellied Cuckoo-shrike	Dry Woodland	✓	✓			✓		Rare

Cicada-bird	Dry Forest, Damp Forest, Riparian	✓	✓					Edge of range, seasonal migrants
Green Catbird	Rainforest						✓	Restricted habitat
Beautiful Firetail	Riparian, Woodland, Heath	✓	✓				✓	Restricted habitat
Diamond Firetail	Forest, Woodland, Open Mallee, Scrub			✓		✓		Uncommon, patchy distribution
Bassian Thrush	Tall Forest, Rainforest						✓	Uncommon
Reptiles								
Ctenotus uber				✓				Edge of range
Three-toed Skink			✓					Rare and restricted
Gippsland Water Dragon	Streams, Riparian	✓	✓					Restricted habitat
MacCoy's Skink	Rainforest, Wet Forest, Coastal Forest						✓	Uncommon, edge of range
Diamond Python							✓	Declining
Common Death Adder	Forest			✓				Restricted habitat
Highland Copperhead			✓					Regionally rare and restricted (high altitudes only)
Small-eyed Snake					✓			Regionally rare, near extent of range
Amphibians								
Haswells Froglet						✓		Only known record above escarpment

Southern Toadlet			✓					Edge of range
Common Spadefoot Toad				✓				Distribution poorly known
Booroolong Frog	Mountain streams					✓		Uncommon to rare
Leaf Green Tree Frog	Mountain streams	✓	✓					Restricted habitat; edge of range in Gipps. Lakes.
Growling Grass Frog			✓					Restricted range; declined populations and listed as threatened in NSW

APPENDIX 2A

A list of the native and introduced vertebrate fauna recorded from the study area during the present survey and from previous surveys. Codes included are as follows:

Status: N = national, S = state & R = regional significance. Victoria: (ex) = extinct, (e)endangered, (v) vulnerable, (r) rare, (i) insufficiently known, (r/c) restricted colonial breeding or roosting sites, (t) threatened. NSW: (t) threatened, (v) vulnerable & rare.

Data source: O = this survey, A = Australian Museum database, V = Atlas of Victorian Wildlife, N = NSW NPWS database, B = Barrett (1994), D = Daley (1995a,b,c), J = Mr. H. Jones *pers. comm.*, K = Mr I. Kininmonth *pers. comm.*, P = previously recorded by Daley adjacent to route, W = Wollongong City Council (1995).

Guild codes:

Mammals and birds: Ae = Aerial forager, Aq = aquatic, Ar = arboreal mammal, B = bark forager, C = carnivore, F = flying mammal, Fo = foliage forager, Fr = frugivore, G = Ground forager, Gr = granivore, He = herbivore, Ho = hollow dependent, I = insectivore, Lh = large herbivorous mammal, N= nectarivore, O = omnivore, S = shrub forager, P = predator / carrion, W = wetland bird.

Reptiles: 1 = fossorial - species which inhabitat the upper soil and litter layers; 2 = ground foraging insectivores, 3 = ground foraging carnivores, 4 = large omnivores, 5 = arboreal carnivores - carnivorous species which at least partiall inhabit the tree and shrub layer, 6 = aquatic omnivores - omnivorous species which are at least partially aquatic, 7 = arboreal insectivores - insectivorous species which at least partially inhabit the tree and shrub layer.

Amphibians: 1 = wide-ranging terrestial egg-layers, 2 = wide-ranging ephemeral water egg-layers, 3 = wide-ranging permanent water egg-layers, 4 = riparian and riverine species.

		Guild	Status in Vic	Status in NSW	Gipps. Coastal Plains	Gipps. Coastal Forests	Cann River Valley	Monaro Plains	Mtn Valleys	Hoskins-town - Nerriga Hills	Morton Plateau & Slopes	Illawarra Coastal Plain	Wilton Table-lands
MAMMALS													
Platypus	*Ornithorhynchus anatinus*	Aq		R	V	V	V	N	N			B	
Short-beaked Echidna	*Tachyglossus aculeatus*	I			OV	OV	O	N	ON	ON		D	O
Brown Antechinus	*Antechinus stuartii*	I			V	OV	OV			O	O	O	O
Dusky Antechinus	*Antechinus swainsonii*	I				OV	O						O
Spot-tailed Quoll	*Dasyurus maculatus*	C	S(v)	S(v)		V		N			O	D	
Brush-tailed Phascogale	*Phascogale tapoatafa*	ICAr	S(r)		V								
White-footed Dunnart	*Sminthopsis leucopus*	I	R	S(v)	V		V						
Southern Brown Bandicoot	*Isoodon obesulus*	I	R	S(t)		OV							
Long-nosed Bandicoot	*Perameles nasuta*	I			V	OV	V					O	O
Bandicoot	*Bandicoot spp.*	ArHeHo			O	V	O						
Common Brushtail Possum	*Trichosurus vulpecula*	ArHeHo			OV	OV	O	ON	ON	ON		O	
Mountain Brushtail Possum	*Trichosurus caninus*	ArHeHo				V	V					O	
Unknown Brushtail possum	*Trichosurus sp.*	ArHeHo			O	OV	O						
Common Ringtail Possum	*Pseudocheirus peregrinus*	ArHe			OV	OV	O			ON		O	O
Greater Glider	*Petauroides volans*	ArHeHo			V	OV	OV				O		O
Yellow-bellied Glider	*Petaurus australis*	ArHeHo		S(v)	V	OV	OV				O	O	O
Sugar Glider	*Petaurus breviceps*	Ar			O	OV	OV		O	O	O	O	O
Squirrel Glider	*Petaurus norfolcensis*	ArIHe	S(r)	S(v)							N		?
Feathertail Glider	*Acrobates pygmaeus*	ArIHe	R	R	K	V	OV	N				J	O
Eastern Pygmy-possum	*Cercartetus nanus*	ArO		R		OV	OV					J	
Koala	*Phascolarctos cinereus*	ArHe	R	S(v)	V	V		N		N	N		
Common Wombat	*Vombatus ursinus*	Lh			OV	OV	OV	O	O	ON	O	O	O
Long-nosed Potoroo	*Potorous tridactylus*	O	R	S(v)		V							
Long-footed Potoroo	*Potorous longipes*	O	N(e)	N(e)		V							
Black Wallaby	*Wallabia bicolor*	Lh			OV	OV	OV		O	ON	O	O	O
Eastern Grey Kangaroo	*Macropus giganteus*	Lh			OV	OV	OV	O	ON	ON	O	O	
Wallaroo	*Macropus robustus*	Lh	S(r)								O	O	O
Red-necked Wallaby	*Macropus rufogriseus*	Lh				O	OV	O		O	O	D	
Grey-headed Flying Fox	*Pteropus poliocephalus*	FHe	S(r/c)								O	D	
Little Red Flying Fox	*Pteropus scapulatus*	FI	R			V							
Little Northern Mastiff Bat	*Mormopterus sp.*	FI										B	
Eastern Little Mastiff Bat	*Mormopterus norfolkensis*	FI										D?	
White-striped Freetail Bat	*Tadarida australis*	FI				V				O		D	

Appendix 2a: A list of the native and introduced vertebrate fauna recorded from the study area during this and other surveys.

		Guild	Status in Vic	Status in NSW	Gipps. Coastal Plains	Gipps. Coastal Forests	Cann River Valley	Monaro Plains	Mtn Valleys	Hoskins-town - Nerriga Hills	Morton Plateau & Slopes	Illawarra Coastal Plain	Wilton Table-lands
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	FI	S(r/c)			V							
Gould's Long-eared Bat	*Nyctophilus gouldi*	FI				V	V					D	
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	FI				V	V					D	
Common Bent-wing Bat	*Miniopterus schreibersii*	FI	S(r/c)	S(v)		V							
Gould's Wattled Bat	*Chalinolobus gouldii*	FI				V	V					B	
Chocolate Wattled Bat	*Chalinolobus morio*	FI			V	V	V		O			D	
Large-footed Myotis	*Myotis adversus*	FI	S(r)	S(v)		V							
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	FI	R			V	V						
Southern Forest Bat	*Vespadelus regulus*	FI				V	V		O	O		D	
Little Forest Bat	*Vespadelus vulturnus*	FI			V	V	V		O	O		D	
Large Forest Bat	*Vespadelus darlingtoni*	FI				V	V					D	
Eastern Broad-nosed Bat	*Scotorepens orion*	FI	S(i)			V	V						
Bush Rat	*Rattus fuscipes*	O			V	OV	OV				O	O	O
Swamp Rat	*Rattus lutreolus*	He				V	OV						O
Black Rat *	*Rattus rattus*	O			V					O	O		
Water Rat	*Hydromys chrysogaster*	O	R			V						B	
House Mouse *	*Mus musculus*	O	R		V	V	V						O
Smoky Mouse	*Pseudomys fumeus*	He	S(r)			V							
European Rabbit *	*Oryctolagus cuniculus*	He			OV	OV	O	N	ON	ON	O	O	O
Brown Hare *	*Lepus capensis*	He			V			O		ON	O	O	O
Pig (feral) *	*Sus scrofa*	O				O			O	O			
Cattle *	*Bos taurus*	Lh			O	O	O			O			O
Goat *	*Capra hircus*	Lh					O						O
Sheep *	*Ovis aries*	Lh			O	O	O						
Rusa Deer *	*Cervus timorensis*	Lh										O	
Dingo & Dog (feral) *	*Canis familiaris*	C			O	OV	O	N			O	B	O
Red Fox *	*Vulpes vulpes*	C			OV	OV	O	N	O	N	O	O	O
Cat (feral) *	*Felis catus*	C			V	V		N	O	N		J	
BIRDS													
Emu	*Dromaius novaehollandiae*	GGr			OV	OV							
Stubble Quail	*Coturnix pectoralis*	GGr			V	V		N					
Brown Quail	*Coturnix australis*	GGr	R			V				O		W	
Magpie Goose	*Anseranas semipalmata*	W	S(ex)	S(v)	V	V							
Plumed Whistling-Duck	*Dendrocygna eytoni*	W			V								
Blue-billed Duck	*Oxyura australis*	W	S(r)	S(v)	V	V							
Musk Duck	*Biziura lobata*	W			V	V							

Appendix 2a cont.: A list of the native and introduced vertebrate fauna recorded from the study area during this and other surveys.

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Freckled Duck	*Stictonetta naevosa*	W	S(r)	S(v)	V								
Black Swan	*Cygnus atratus*	W			OV	OV		N				W	
Cape Barren Goose	*Cereopsis novaehollandiae*	W	S(r)		V								
Australian Shelduck	*Tadorna tadornoides*	W			OV	OV	O	N					
Maned Duck	*Chenonetta jubata*	W			OV	OV	O	ON	O	ON		O	O
Pacific Black Duck	*Anas superciliosa*	W			OV	OV		ON	O	ON		O	O
Australasian Shoveler	*Anas rhynchotis*	W			V	V		N					
Grey Teal	*Anas gracilis*	W			V	V		N	O			W	
Chestnut Teal	*Anas castanea*	W			V	OV		N			O	OW	
Pink-eared Duck	*Malacorhynchus membranaceus*	W	R					N					
Hardhead	*Aythya australis*	W			V	V		N	O			W	
Australasian Grebe	*Tachybaptus novaehollandiae*	W			V	V		N	O			W	
Hoary-headed Grebe	*Poliocephalus poliocephalus*	W			V	V		N				W	
Great Crested Grebe	*Podiceps cristatus*	W			V	V							
Little Penguin	*Eudyptula minor*	W				V							
Mottled Petrel	*Pterodroma inexpectata*	W				V							
Fairy Prion	*Pachyptila turtur*	W				V							
Short-tailed Shearwater	*Puffinus tenuirostris*	W				V							
Fluttering Shearwater	*Puffinus gavia*	W				V							
Shy Albatross	*Diomedea cauta*	W				V							
Australasian Gannet	*Morus serrator*	W	S(r/c)		V	V							
Darter	*Anhinga melanogaster*	W	S(r/c)			OV						B	
Little Pied Cormorant	*Phalacrocorax melanoleucos*	W			V	OV		N				O	O
Black-faced Cormorant	*Leucocarbo fuscescens*	W	S(r/c)			V							
Pied Cormorant	*Phalacrocorax varius*	W	S(r/c)		V	V						D	
Little Black Cormorant	*Phalacrocorax sulcirostris*	W			V	V				O		D	
Great Cormorant	*Phalacrocorax carbo*	W				V		N				O	
Australian Pelican	*Pelecanus conspicillatus*	W	S(r/c)		OV	OV						O	
White faced Heron	*Egretta novaehollandiae*	W			OV	OV		N	N	ON		O	
Little Egret	*Egretta garzetta*	W	S(r/c)		V	V							
White-necked Heron	*Ardea pacifica*	W			V	V		N		N		W	
Great Egret	*Ardea alba*	W	S(r/c)		OV	OV		N				O	
Cattle Egret	*Ardeola ibis*	W			OV	V							
Rufous Night Heron	*Nycticorax caledonicus*	W			V	V						D	
Australasian Bittern	*Botaurus poiciloptilus*	W	S(i)	S(v)	V	V							
Glossy Ibis	*Plegadis falcinellus*	W	S(r/c)		V	V				N			

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Australian White Ibis	*Threskiornis molucca*	W			OV	OV		N	ON			W	
Straw-necked Ibis	*Threskiornis spinicollis*	W			OV	OV	O	N				W	
Royal Spoonbill	*Platalea regia*	W	S(r/c)		V	V		N				W	
Yellow-billed Spoonbill	*Platalea flavipes*	W			OV	V		N	O			W	
Black-shouldered Kite	*Elanus axillaris*	P			OV	OV		ON	O			O	
Letter-winged Kite	*Elanus scriptus*	P				V							
Square-tailed Kite	*Lophoictinia isura*	P	S(v)	S(v)		V		N				D	
Whistling Kite	*Haliastur sphenurus*	P			V	OV		N				W	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	P	S(r)		V	V						O	O
Spotted Harrier	*Circus assimilis*	P	R		V	V							
Swamp Harrier	*Circus approximans*	P			V	V						W	
Brown Goshawk	*Accipiter fasciatus*	P			V	V	V	N			O	W	O
Grey Goshawk	*Accipiter novaehollandiae*	P	S(r)		V	V						D	
Collared Sparrowhawk	*Accipiter cirrhocephalus*	P		R	OV	V		N		N		W	
Wedge-tailed Eagle	*Aquila audax*	P	R		OV	V	O	ON	ON	ON	O	O	O
Little Eagle	*Hieraaetus morphnoides*	P	R		OV	V		ON					
Brown Falcon	*Falco berigora*	P			OV	V		ON	O			W	
Australian Hobby	*Falco longipennis*	P			V	V		N	O	O		W	
Grey Falcon	*Falco hypoleucos*	P	S(v)	S(v)		V							
Black Falcon	*Falco subniger*	P	S(r)		V	V							
Peregrine Falcon	*Falco peregrinus*	P	R	R	OV	V	O	N				W	
Australian Kestrel	*Falco cenchroides*	P			OV	OV		ON	O	ON		D	
Buff-banded Rail	*Rallus philippensis*	W	R			V	V						
Lewin's Rail	*Rallus pectoralis*	W	S(r)	R		V							
Baillon's Crake	*Porzana pusilla*	W	S(i)		V	V							
Australian Spotted Crake	*Porzana fluminea*	W			V	V							
Spotless Crake	*Porzana tabuensis*	W			V								
Purple Swamphen	*Porphyrio porphyrio*	W			V	OV		N				OW	O
Dusky Moorhen	*Gallinula tenebrosa*	W			V	V						W	
Eurasian Coot	*Fulica atra*	W			V	OV		N	ON			W	
Painted Button-quail	*Turnix varia*	W				V						P	
Latham's Snipe	*Gallinago hardwickii*	W			V	V						W	
Eastern Curlew	*Numenius madagascariensis*	W	S(r)			V							
Common Greenshank	*Tringa nebularia*	W			V								
Red-necked Stint	*Calidris ruficollis*	W			V								
Sharp-tailed Sandpiper	*Calidris acuminata*	W			V								

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Curlew Sandpiper	*Calidris ferruginea*	W			V								
Painted Snipe	*Rostratula benghalensis*	W	R(r/c)	R(r/c)						O			
Pied Oystercatcher	*Haematopus longirostris*	W		S(v)	V	V							
Black-winged Stilt	*Himantopus himantopus*	W			V	V							
Banded Stilt	*Cladorhynchus leucocephalus*	W			V								
Red-necked Avocet	*Recurvirostra novaehollandiae*	W				V							
Red-capped Plover	*Charadrius ruficapillus*	W			OV	V							
Double-banded Plover	*Charadrius bicinctus*	W				V							
Black-fronted Plover	*Elseyornis melanops*	W			OV	V		N	N	O		W	
Hooded Plover	*Charadrius rubricollis*	W	N(v)	N(v)		V							
Red-kneed Dotterel	*Erythogonys cinctus*	W			V	V							
Banded Lapwing	*Vanellus tricolor*	W			V	V		N					
Masked Lapwing	*Vanellus miles*	W			OV	OV	OV	N	ON	O	O	W	
Arctic Jaeger	*Stercorarius parasiticus*	W			V								
Pacific Gull	*Larus pacificus*	W			V	V							
Silver Gull	*Larus novaehollandiae*	W			V	V		N				W	
Caspian Tern	*Hydroprogne caspia*	W	S(r/c)		V	V							
Crested Tern	*Sterna bergii*	W	S(r/c)		V	V							
White-fronted Tern	*Sterna striata*	W			V	V							
Whiskered Tern	*Chlidonias hybridus*	W	S(r/c)	R	V			N					
White-winged Black Tern	*Chlidonias leucopterus*	W			V								
Rock Dove *	*Columba livia*	GGr				OV						W	
White-headed Pigeon	*Columba leucomela*	Fr										W	
Spotted Turtle-Dove *	*Streptopelia chinensis*	Gr			V							O	
Brown Cuckoo-Dove	*Macropygia ambionensis*	GrFr										O	
Emerald Dove	*Chalcophaps indica*	GGr										W	
Common Bronzewing	*Phaps chalcoptera*	GGr			OV	OV	O	N		O	O	O	
Brush Bronzewing	*Phaps elegans*	GGr			V	V		O				O	
Unknown Bronzewing	*Phaps sp.*	GGr								N			
Crested Pigeon	*Ocyphaps lophotes*	GGr								N		O	O
Peaceful Dove	*Geopelia placida*	GGr				V					O	O	
Wonga Pigeon	*Leucosarcia melanoleuca*	GrFr			V	V	O					O	
Topknot Pigeon	*Lophlaimus antarcticus*	Fr										O	
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Gr	S(v)	S(v)		V					N	O	
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	GrI			V	OV	O	ON	O	O		O	O
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Gr			V	OV	O	N	ON	O	O	O	O

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Galah	*Cacatua roseicapilla*	GrFrI			OV	V	O	N	ON	N		O	O
Sulphur-crested Cockatoo	*Cacatua galerita*	O			OV	V		ON	ON	ON	O	O	O
Rainbow Lorikeet	*Trichoglossus haematodus*	NFrI			OV	OV							
Musk Lorikeet	*Glossopsitta concinna*	O			V	V						B	
Little Lorikeet	*Glossopsitta pusilla*	N			V	OV						B	O
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	PoNFr		S(v)	V	V							
Australian King-Parrot	*Alisterus scapularis*	FrGrN			V	OV	O				O	O	
Crimson Rosella	*Platycercus elegans*	GrFr			OV	OV	O	N	O	ON	O	O	O
Eastern Rosella	*Platycercus eximius*	GrFrN			OV	V		ON	O	ON	O	O	O
Swift Parrot	*Lathamus discolor*	NFoFr	N(v)	N(v)	V	V							
Red-rumped Parrot	*Psephotus haematodus*	GGr						N	N			W	
Blue-winged Parrot	*Neophema chrysostoma*	GrFrI	R		V	V							
Turquoise Parrot	*Neophema pulchella*	GGr	S(r)	S(v)		V					N		
Ground Parrot	*Pezoporus wallicus*	GGr	S(r)	S(v)		V					N		
Oriental Cuckoo	*Cuculus saturatus*	I										B	
Pallid Cuckoo	*Cuculus pallidus*	I			V	OV		N	O	O		W	
Brush Cuckoo	*Cuculus variolosus*	FoI			V	V						W	
Fan-tailed Cuckoo	*Cuculus pyrrhophanus*	I			V	V	O		O	O	O	O	
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	I			V	V						W	
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	I			V	V	V					W	
Common Koel	*Eudynamys scolopacea*	Fr										B	
Channel-billed Cuckoo	*Scythrops novaehollandiae*	FrI										D	
Powerful Owl	*Ninox strenua*	P	S(r)	S(v)		V						D	
Barking Owl	*Ninox connivens*	PI	S(r)	R	V								
Southern Boobook	*Ninox novaeseelandiae*	IP			V	OV	OV	N		O		O	O
Sooty Owl	*Tyto tenebricosa*	P	S(r)	S(v)		V		N					
Masked Owl	*Tyto novaehollandiae*	PI	S(r)	S(v)	V	V	O					D	
Barn Owl	*Tyto alba*	P			V	V						D	
Tawny Frogmouth	*Podargus strigoides*	IP			V	V	V			O		D	O
White-throated Nightjar	*Caprimulgus mystacalis*	AeI	R		V	V				O		B	O
Australian Owlet-nightjar	*Aegotheles cristatus*	GI			V	V	V	N		O		O	
White-throated Needletail	*Hirundapus caudacutus*	AeI			V	V		N				D	
Fork-tailed Swift	*Apus pacificus*	AeI			V	V							
Azure Kingfisher	*Ceyx azurea*	P				V					O	D	
Laughing Kookaburra	*Dacelo novaeguineae*	IP			OV	OV	O	N	O	ON	O	O	O
Sacred Kingfisher	*Halcyon sancta*	IP			OV	V			O	O		OW	

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Rainbow Bee-eater	*Merops ornatus*	AeI		R					O			B	
Dollarbird	*Eurystomus orientalis*	AeI			V	V					O	OW	
Superb Lyrebird	*Menura novaehollandiae*	GI			OV	OV	O			O	O	O	O
Brown Treecreeper	*Climacteris picumnus*	GBI	R	R	V	V		N	O	O			
White-throated Treecreeper	*Climacteris leucophaea*	BI			OV	OV	O	O	O	ON	O	O	O
Red-browed Treecreeper	*Climacteris erythrops*	BI				OV	O						
Superb Fairy-wren	*Malurus cyaneus*	SI			OV	OV	O	ON	ON	ON	O	O	O
Variegated Wren	*Malurus lamberti*	SIGr										W	O
Southern Emu-wren	*Stipiturus malachurus*	SI				OV						W	
Spotted Pardalote	*Pardalotus punctatus*	FoI			OV	OV	OV	O	O	ON	O	O	O
Striated Pardalote	*Pardalotus striatus*	FoIN			V	OV		O	O	ON	O	OW	
Eastern Bristlebird	*Dasyornis brachypterus*	GIFr	S(v)	S(v)							ON		
Pilotbird	*Pycnoptilus floccosus*	GI		R		OV	O					O	
Rock Warbler	*Origma solitaria*	GIGr									O	O	O
Yellow-throated Scrubwren	*Sericornis citreogularis*	GIGr		R								O	
White-browed Scrubwren	*Sericornis frontalis*	GSIGr			V	OV	O		N	ON	O	O	O
Large-billed Scrubwren	*Sericornis magnirostris*	SI	R			OV						W	
Chestnut-rumped Heathwren	*Sericornis pyrrhopygius*	GIGr	R	R	V	V				ON		B	
Striated Fieldwren	*Calamanthus fuliginosus*	SIGr		S(v)							O		
Speckled Warbler	*Sericornis sagittatus*	GGrI			V	V							
Weebill	*Smicrornis brevirostris*	FoI		R	V	V	O		O	O	O		
Brown Gerygone	*Gerygone mouki*	FoI			V	OV				N	O	O	O
White-throated Gerygone	*Gerygone olivacea*	FoI	R		V	V				O	O	OW	O
Brown Thornbill	*Acanthiza pusilla*	SI			OV	OV	O	O		ON	O	D	O
Buff-rumped Thornbill	*Acanthiza reguloides*	GSI			V	OV		O	O	ON		W	O
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	GIGr			OV	V		ON	O	ON		W	
Yellow Thornbill	*Acanthiza nana*	FoI			OV	V			O		O	O	O
Striated Thornbill	*Acanthiza lineata*	FoI			OV	OV	O	ON	O	ON		O	O
Red Wattlebird	*Anthochaera carunculata*	NIFr			OV	OV	O	ON	O	ON	O	O	O
Little Wattlebird	*Anthochaera chrysoptera*	NIFr			OV	V						W	O
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	NIFr				V							
Noisy Friarbird	*Philemon corniculatus*	O			V	V			O	ON	O	W	
Little Friarbird	*Philemon citreogularis*	NIFr			V	V							
Regent Honeyeater	*Xanthomyza phrygia*	NI	N(e)	N(e)	V	V				N	N		
Bell Miner	*Manorina melanophrys*	FoI			V	OV	O					O	
Noisy Miner	*Manorina melanocephala*	NIFr			OV	V		ON	O	ON	O	O	O

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Lewin's Honeyeater	*Meliphaga lewinii*	NIFr			V	OV	O				O	O	O
Yellow-faced Honeyeater	*Lichenostomus chrysops*	NI			OV	OV	O	N	O	ON	O	O	O
White-eared Honeyeater	*Lichenostomus leucotis*	FoNI			OV	OV	O	ON	ON	ON	O	B	O
Yellow-tufted Honeyeater	*Lichenostomus melanops*	FoNI		R	V	OV	OV		O	N	O	O	
Fuscous Honeyeater	*Lichenostomus fuscus*	NI							O			B	
White-plumed Honeyeater	*Lichenostomus penicillatus*	NI			V	V			O				
Brown-headed Honeyeater	*Melithreptus brevirostris*	FoNI			V	OV	O	N	O	N		B	
White-naped Honeyeater	*Melithreptus lunatus*	FoNI			V	OV	O	N		ON	O	W	O
Crescent Honeyeater	*Phylidonyris pyrrhoptera*	NI			V	OV	O			O	O		O
New Holland Honeyeater	*Phylidonyris novaehollandiae*	NI			OV	OV	O			ON	O	W	O
Tawny-crowned Honeyeater	*Phylidonyris melanops*	N			V	V					O		
Eastern Spinebill	*Acanthorhynchus tenuirostris*	NI			OV	OV	O	O	O	ON	O	O	O
Scarlet Honeyeater	*Myzomela sanguinolenta*	NI	R	R	V	V						W	
White-fronted Chat	*Ephthianura albifrons*	GI			OV	V		N		O			
Jacky Winter	*Microeca leucophaea*	GAeI			OV	OV	O			ON	O	W	
Scarlet Robin	*Petroica multicolor*	I			OV	OV	O	ON	O	ON	O	W	
Red-capped Robin	*Petroica goodenovii*	I				V							
Flame Robin	*Petroica phoenicea*	I			V	V	O	ON	ON	ON	O	W	
Rose Robin	*Petroica rosea*	I			V	V					O	O	
Pink Robin	*Petroica rodinogaster*	I		S(v)	V	OV	OV	N		N	N		
Hooded Robin	*Melanodryas cucullata*	GI	R		V	V				ON			
Eastern Yellow Robin	*Eopsaltria australis*	GI			OV	OV	O			O	O	O	O
Logrunner	*Orthonyx temminckii*	GI		R								O	
Eastern Whipbird	*Psophodes olivaceus*	GI			OV	OV	O			ON	O	O	
Spotted Quail-thrush	*Cinclosoma punctatum*	GIGr			V	OV	O			N	O		O
Varied Sittella	*Daphoenositta chrysoptera*	BI			OV	OV		N		ON	O	O	O
Crested Shrike-tit	*Falcunculus frontatus*	BI		R	V	OV	OV			ON		W	O
Olive Whistler	*Pachycephala olivacea*	GI		S(v)	OV	OV	O	N			O	O	O
Golden Whistler	*Pachycephala pectoralis*	I			OV	OV	O	O	O	O	O	O	O
Rufous Whistler	*Pachycephala rufiventris*	I			V	OV		N	O	ON	O	W	
Grey Shrike-thrush	*Colluricincla harmonica*	IP			OV	OV	O	ON	O	ON	O	O	O
Black-faced Monarch	*Monarcha melanopsis*	I	R	R		V						W	
Leaden Flycatcher	*Myiagra rubecula*	AeI			V	V				O		W	
Satin Flycatcher	*Myiagra cyanoleuca*	I			V	V		O		O		W	
Restless Flycatcher	*Myiagra inquieta*	I			V	V		ON	N			W	
Australian Magpie Lark	*Grallina cyanoleuca*	GI			OV	OV	O	N	ON	ON	O	O	O

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Rufous Fantail	*Rhipidura rufifrons*	FoI		R	V	OV		N				W	
Grey Fantail	*Rhipidura fuliginosa*	AeI			OV	OV	O	N	O	ON	O	O	O
Willie Wagtail	*Rhipidura leucophrys*	AeI			OV	OB	O	N	ON	ON	O	W	O
Spangled Drongo	*Dicrurus bracteatus*	I										W	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	IGr			V			N	O	ON	O	OW	O
White-bellied Cuckoo-shrike	*Coracina papuensis*	IFr	R	R	V	V				N		B	
Cicadabird	*Coracina tenuirostris*	FoBI				V	V						
White-winged Triller	*Lalage sueurii*	GAeI			V	V				N		W	
Olive-backed Oriole	*Oriolus sagittatus*	IFr			V	V				O	O	O	
Masked Woodswallow	*Artamus personatus*	IN			V	V							
White-browed Woodswallow	*Artamus superciliosus*	IN			V	V							
Dusky Woodswallow	*Artamus cyanopterus*	IN			OV	OV	O	N		ON		W	
Pied Currawong	*Strepera graculina*	FrI			OV	OV	O	N	ON	ON	O	O	O
Grey Currawong	*Strepera versicolor*	IFr			V	V		N		O	O	O	O
Grey Butcherbird	*Cracticus torquatus*	IPGr			OV	OV			O	ON	O	O	O
Australian Magpie	*Gymnorhina tibicen*	GIGr			OV	OV	O	ON	ON	ON	O	O	O
Unknown Corvid	*Corvus sp.*	O			V		O						
Australian Raven	*Corvus coronoides*	O			V	OV	O	ON	ON	ON	O	O	O
Little Raven	*Corvus mellori*	O			OV	OV	O	ON	O	O		O	O
White-winged Chough	*Corcorax melanorhamphos*	GI			OV	OV	O	N		ON			
Green Catbird	*Ailuroedus crassirostris*	O		R								O	
Satin Bowerbird	*Ptilonorhynchus violaceus*	FrI			OV	OV				N		O	O
Common Skylark *	*Alauda arvensis*	GIGr			V			ON	O				
Richard's Pipit	*Anthus novaeseelandiae*	GIGr			OV	V		ON	O	O		OW	
Brown Songlark	*Cinclorhamphus cruralis*	GIGr			V	V						W	
Rufous Songlark	*Cinclorhamphus mathewsi*	GGrI			V	V				N		W	
Eurasian Tree Sparrow *	*Passer montanus*	GrFrI			V								
House Sparrow *	*Passer domesticus*	O			OV	V		N				O	O
Double-barred Finch	*Taeniopygia bichenovii*	GGr									O	W	
Red-browed Finch	*Neochimia temporalis*	GrFrI			OV	OV	O	ON	O	ON			
Diamond Firetail	*Stagonopleura guttata*	GGrI		R	V	V		O		ON			
Beautiful Firetail	*Stagonopleura bella*	GSGr	R		V	V					O		O
Red-eared Firetail	*Stagonopleura oculata*	SGrI									O	O	O
European Goldfinch *	*Carduelis carduelis*	GrI			OV	OV		ON	O			OW	
European Greenfinch *	*Carduelis chloris*	Gr			V	OV							
Mistletoebird	*Dicaeum hirundinaceum*	FrI			OV	OV	O			O	O	O	O

Appendix 2a cont.: A list of the native and introduced vertebrate fauna recorded from the study area during this and other surveys.

		Guild	Status in Vic	Status in NSW	Gipps. Coastal Plains	Gipps. Coastal Forests	Cann River Valley	Monaro Plains	Mtn Valleys	Hoskins-town - Nerriga Hills	Morton Plateau & Slopes	Illawarra Coastal Plain	Wilton Table-lands
Welcome Swallow	*Hirundo neoxena*	AeI			OV	OV	OV	ON	ON	ON		O	O
Tree Martin	*Cecropis nigricans*	AeI			V	V				ON	O	W	O
Fairy Martin	*Cecropis ariel*	AeI			V	V						W	
Red-whiskered Bulbul *	*Pycnotonus jocosus*	AeIFr										O	
Clamorous Reed Warbler	*Acrocephalus stentoreus*	I			V	V						W	
Little Grassbird	*Megalurus gramineus*	I			V	V						W	
Golden-headed Cisticola	*Cisticola exilis*	GI			V	V			O	O		W	
Silvereye	*Zosterops lateralis*	NIFr			V	OV	O	N	N	ON	O	O	O
Bassian Thrush	*Zoothera lunulata*	GI			V	OV					O	O	
Common Blackbird *	*Turdus merula*	GIFr		R	V	OV	O		O			W	
Common Myna *	*Acridotheres tristis*	GO			OV						O	O	O
Common Starling *	*Sturnus vulgaris*	O			OV	OV	V	N	O	ON		OW	O
REPTILES													
Common Long-necked Tortoise	*Chelodina longicollis*	1			V	V			O	ON		W	O
Wood Gecko	*Diplodactylus vittatus*	2							O				
Striped Legless Lizard	*Delma impar*	1,2	N	N				O					
Tree Dragon	*Amphibolurus muricatus*	7			V	V	OV		O	O	O	P	O
Gippsland Water Dragon	*Physignathus lesueurii howittii*	6			V	V	V		O	O	P	D	O
Bearded Dragon	*Pogona barbata*	7								O			
Southern Lined Earless Dragon	*Tympanocryptis lineata pinguicolla*	2						O					
Scaly Foot	*Pygopus lepidopodus*	2										D	
Wall Skink	*Cryptoblepharus virgatus*	7									O	P	
Striped Skink	*Ctenotus robustus*	2										O	O
Coppertailed Skink	*Ctenotus taeniolatus*	2							O	O	O	D	O
	Ctenotus uber	2						ON	O				
Swamp Skink	*Egernia coventryi*	4	S(v)			V							
Cunningham's Skink	*Egernia cunninghami*	2						ON	O	O		P	O
White's Skink	*Egernia whitii*	4				V	V	ON			O		O
Black Rock Skink	*Egernia saxatilis*	7				V	OV						O
Southern Water Skink WTF	*Eulamprus heatwolei*	4				V	OV		O	O			
Eastern Water-skink	*Eulamprus quoyii*	2	S(i)									D	O
Southern Water Skink GROUP	*Eulamprus tympanum*	4	S(i)			OV	OV	ON					
Barred-sided Skink	*Eulamprus tenuis*	2										D	

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Three-toed Skink	*Hemiergis decresiensis*	2				V		ON	O	ON			
McCoy's Skink	*Nannoscincus maccoyi*	2		R		V		N				O	
Delicate Skink	*Lampropholis delicata*	2			OV	OV	OV	ON	O	ON	O	O	O
Garden Skink	*Lampropholis guichenoti*	2			OV	V	OV	ON	O	ON	O	O	O
Boulenger's Skink	*Morethia boulengeri*	2							O				
Weasel Skink	*Saproscincus mustelina*	2			V	V	OV	N				O	
Coventry's Skink	*Niveoscincus coventryi*	2				V		N					
Spencer's Skink	*Pseudemoia spenceri*	7				V	V	N					
Tussock Skink	*Pseudemoia pagenstecheri*	2						ON					
Red-throated Skink	*Pseudemoia platynota*	2						N	O	O		P	O
	Saiphos equalis	1										O	
	Bassiana duperryi	2						O					
Blotched Blue-tongued Lizard	*Tiliqua nigrolutea*	4						ON	O	O			
Common Blue-tongued Lizard	*Tiliqua scincoides*	4			V	V	V	ON	O		O	O	
Heath Monitor	*Varanus rosenbergi*	3	S(r)	S(v)							OA		
Tree Goanna	*Varanus varius*	5	S(i)		V	V	V				O	D	O
Diamond Python	*Morelia spilota*	5		R								D	
Death Adder	*Acanthophis antarcticus*	3	S(ex)					N					
Highland Copperhead	*Austrelaps ramsayi*	3				V	V	O				P	
Lowland Copperhead	*Austrelaps superbus*	3			V			N					
Golden Crowned Snake	*Cacophis squamulosus*	3										D	
Yellow-faced Whip Snake	*Demansia psammophis*	3	S(r)									D	O
White-lipped Snake	*Drysdalia coronoides*	3				V	OV						
Master's Snake	*Drysdalia rhodogaster*	3									D	O	
Swamp Snake	*Hemiaspis signata*	3										OW	
Broad-headed Snake	*Hoplocephalus bungeroides*	3	N(e)	N(e)							N		
Tiger Snake	*Notechis scutatus*	3				V	O	O	ON	N	O	W	
Red-bellied Black Snake	*Pseudechis porphyriacus*	3			V	OV	OV		O	O	O	D	
Eastern Brown Snake	*Pseudonaja textilis*	3						O	O	O			
Eastern Small-eyed Snake	*Rhinoplocephalis nigrescens*	3			V	V			O		O	O	O
Blind Snake	*Ramphotyphlops nigrescens*	1										D	O
Little Whip Snake	*Suta flagellum*	3		S(v)						O			
AMPHIBIANS													
Green and Golden Bell Frog	*Litoria aurea*	3		S(t)		OV							
Booroolong Frog	*Litoria booroolongensis*	4								N			

Appendix 2a cont.: A list of the native and introduced vertebrate fauna recorded from the study area during this and other surveys.

		Guild	Status in Vic	Status in NSW	Gipps. Coastal Plains	Gipps. Coastal Forests	Cann River Valley	Monaro Plains	Mtn Valleys	Hoskins-town - Nerriga Hills	Morton Plateau & Slopes	Illawarra Coastal Plain	Wilton Table-lands
Green Tree Frog	*Litoria caerulea*	3										P	
Blue Mountains Tree Frog	*Litoria citropa*	3	S(r)				V				P		O
Bleating Tree Frog	*Litoria dentata*	3									O	O	O
Southern Brown Tree Frog	*Litoria ewingii*	3			V	OV		N			O		
Eastern Dwarf Tree Frog	*Litoria fallax*	3										OW	P
Large Brown Tree Frog	*Litoria jervisiensis*	4	S(i)			V							
Lesueur's Frog	*Litoria lesueuri*	4			V	OV		ON	O	ON		O	O
Heath Tree Frog	*Litoria littlejohni*	2									P		
Peron's Tree Frog	*Litoria peronii*	3			V	V				ON	O	P	O
Leaf Green Tree Frog	*Litoria phyllochroa*	4				V		N		N	O	O	
Growling Grass Frog	*Litoria raniformis*	3		S(t)		V		N					
Tyler's Tree Frog	*Litoria tyleri*	2										P	
Verreaux's Tree Frog	*Litoria verreauxii*	3				V	V	ON	O	ON		O	
Plains Froglet	*Crinia parinsignifera*	2							O	O			
Common Froglet	*Crinia signifera*	2			OV	OV	OV	ON	O	ON	O	O	O
Victorian Smooth Froglet	*Geocrinia victoriana*	1				V	V	N					
Giant Burrowing Frog	*Heleioporus australiacus*	1	S(r)	S(v)	V	V	V					P	O
Southern Bullfrog	*Limnodynastes dumerilii*	3			V	OV	V	ON	O	ON	O		
Striped Marsh Frog	*Limnodynastes peronii*	3				V	V	N			P	O	
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	3			OV	V		ON	O	O	O		
	Limnodynastes terraereginae	4								N			
Great Barred Frog	*Mixophyes balbus*	2		S(v)									
Common Spadefoot Frog	*Neobatrachus sudelli*	2						ON					
Haswell's Froglet	*Paracrinia haswelli*	3			V	V	V			O	O		
Red-crowned Toadlet	*Pseudophryne australis*	2		S(v)							O	P	
Bibron's Toadlet	*Pseudophryne bibronii*	2						N	O	O	O	P	
Dendy's Toadlet	*Pseudophryne dendyi*	1				V							
Southern Toadlet	*Pseudophryne semimarmorata*	1			V	V							
Gray's Toadlet	*Uperoleia laevigata*	2							O	O		P	
	Uperoleia marmorata	2						N					
Martin's Toadlet	*Uperoleia martini*	u	S(i)			V							
Tyler's Toadlet	*Uperoleia tyleri*	u	S(i)			V					O	B	

Appendix 2a cont.: A list of the native and introduced vertebrate fauna recorded from the study area during this and other surveys.

APPENDIX 3

STREAM ECOLOGY

DETAILED METHODS

Identifying streams to be affected

All streams, marked on 1:25,000 topographic and supplied GIS maps, which intersect the pipeline were identified as streams to be potentially affected by pipeline construction activities. Each stream crossing point was given an identifying number and its location was defined by two methods:

1. Survey reference points (SRP): This method was primarily used for accurately defining the location of crossing points. Outward distances (i.e. in the direction from Longford to Wilton) from the SRPs to the crossing points were measured on 1:25,000 maps to the nearest 10m. In situations where the SRP was off the route, outward distances were measured from the intersection point of a line perpendicular to the route which runs through the SRP.

2. Outward distance: This method was primarily used for developing co-ordinates necessary in later figure production. Distances were determined to the nearest 100 m in relation to kilometre points (KP) marked on supplied Revision 5.1 1:25,000 GIS maps. These maps were however not available when map work was being undertaken earlier in the study in the 'Spread III' section. Revision 4.0 maps were used in this section, and as these did not have KP points marked, cumulative distances from Wilton were determined. These distances were later converted to standard KP distances once equivalent KP distances were available from next Spread (II) in Revision 5.1.

It is recognised that not all the streams will contain functioning ecosystems, however, even the smallest feeder stream can act as a conduit for sediments which may affect intrinsically valuable streams downstream, a feature frequently overlooked by catchment managers. Clinnick (1984) described small feeder streams as the 'capillaries' of the stream system, draining the body of the catchment.

Determining the conservation value of each stream

Index derivation

Information was gathered with the aim of developing an index which would collectively reflect the occurrence of the following features:

1) recognised valuable areas in which diminished integrity of stream ecosystems would diminish intrinsic values
2) the naturalness of fish communities
3) high conservation-value fish species
4) high recreational-value fish species
5) high conservation-value freshwater crayfish species, and 6) valuable areas for scientific research.

Emphasis was placed on fish and crayfish as i) these are the taxa for which information on conservation status is adequate, and ii) the general public are familiar with them.

The six components above formed the basis of the derived index. The method by which scores were attributed to each component is given below:

1) Recognised valuable areas. The occurrence of these areas was determined by reference to: Australian Heritage Commission listed areas shown on GIS maps provided by BHPP; LCC (1990a)-nominated wilderness blocks; LCC (1990b)-nominated Victorian heritage rivers; DWR (1987)-proposed NSW wild and scenic rivers; SPCC (1980)-protected, controlled and specially protected NSW waters; information supplied by NSW National Parks and Wildlife Service-declared and identified NSW wilderness areas. The scores were attributed as follows;

- area 0 to 1 km downstream (by stream) of crossing point : 2
- area 1 to 50km downstream of crossing point : 1
- area >50km downstream or no area : 0

The scores were summed if more than one area was present downstream.

2) Naturalness of fish communities. Fish communities with few introduced species are becoming increasingly rare in south-eastern Australia. Accordingly, such communities should be recognised to have a higher conservation status than those dominated by introduced taxa. Information on the known occurrence of introduced fish taxa was derived from: 1) a report by T. Raadik using the Victorian Fish Database (Freshwater Ecology Section, Vic Dept. of Conservation and Natural Resources): 2) data supplied by NSW Fisheries (Fisheries Research Institute, Cronulla); 3) data supplied by the Fish Department of the Australian Museum, Sydney; 4) personal communications with L. Smith (consultant), J. Harris (NSW Fisheries), B. Faragher (NSW Fisheries); 5) Tunbridge et al. (1991), 6) Llewellyn (1983), 7) Weatherley and Lake (1967); 8) Bishop (1979); 9) Bishop and Bell (1978); 10) Bishop and Tilzey (1978); 11) Weatherley et al. (1980).

The report by T. Raadik provided a summary of data from a wide range of sources, including: DWRV (1989): Raadik (1992a,b,c), Raadik (1995), and Tunbridge and Glenane (1984). Possible occurrences arose from my conservative assumptions regarding the likelihood of taxa being found more widely than limiting sampling indicated. The scores were attributed as follows:

0-1 km downstream of crossing point:

- no introduced species (IS) : 6
- one IS : 4
- two to four IS : 2
- greater than four IS : 0

1-50 km downstream of crossing point:

- no IS : 3
- one IS : 2
- two to four IS : 1
- greater than four IS : 0

The scores were halved for situations where large impoundments were between the crossing point and the downstream stream section (the impoundments would buffer any impacts in these sections). Scores were summed across areas.

3) High conservation-value fish taxa. High conservation-value fish taxa were identified as:

Nationally: those with status 'Indeterminate' or greater as listed by Jackson (1994)

Victoria: those with status 'rare' or greater as listed by DCNR (1993) NSW: no clear guidelines exist, but Jackson (1994) and Wagner and Jackson (1993) note bans and proposed bans on capture exist for a number of species

Information on known occurrences was variously derived from sources listed in '2)' above with the following additional references: McDowall (1976), Wagner and Jackson (1993), Jackson (1994), Merrick and Rimmer (1984), Starling (1991) and J. Mathews pers. comm. (NSW Fisheries). Possible occurrences arose from my conservative assumptions as described above. The scores were attributed as follows:

0-1 km downstream of crossing point:

- number of such species present x 2

1-50 km downstream of crossing point:

- number of such species present x 1

The scores were halved for situations where large impoundments were between the crossing point and the downstream stream section. Scores were summed across areas.

4) High recreational-value fish taxa. These are taken to be large-bodied species (weight >0.5 kg) which can readily be taken by angling. Information on known occurrences, assumptions concerning possible occurrences, and the scoring system is listed as for '3)' above. Estuarine areas not included.

5) High conservation-value freshwater crayfish. Information on occurrences was derived from a report prepared by Dr. P. Horwitz (Edith Cowan University, WA); 'Freshwater crayfish (Decapoda: Family Parastacidae) along the preferred BHP gas pipeline corridor in south-eastern Australia-a preliminary appraisal'. This report provided a summary of distributional data within Horwitz (1990a,b), Horwitz (1995, in press), Horwitz and Knott (1995, in press), Morgan (1983) and Morgan (1986). Possible occurrences within various stream types arose from my conservative assumptions directed by preliminary habitat notes provided in Horwitz's report. All crayfish species were taken to have a high conservation status. Very high conservation status was attributed to Euastacus diversus which is protected under the Victoria FFG Act (DCNR 1993). Dr. Horwitz indicated that Euastacus sp. 8 should also have elevated status given its apparently very restricted distribution in NSW. Scores were attributed as follows:

0-1 km downstream of crossing point:

- number of high conservation value species x 2, plus
- number of very high conservation value species x 4

1-50 km downstream of crossing point:

number of high conservation value species x 1, plus number of very high conservation value species x 2

The scores were halved for situations where large impoundments were between the crossing point and the downstream stream section. Scores were summed across areas.

6) Valuable areas for scientific research. These areas were identified by the occurrence of reference sites currently being used for the longterm monitoring of freshwater fauna. Such monitoring is extremely valuable as it directly provides a measure of ecosystem integrity and it produces information crucial to stream managers. Because of the longterm nature of the monitoring, large investments have so far been made in obtaining the data. A range of research organisations were approached, particularly those involved in the Commonwealth Government's 'Monitoring River Health Initiative', and three were found to have sites downstream of pipeline stream crossings (Victorian EPA, CRC for Freshwater Ecology (Canberra University) and Sydney Water), which could be potentially affected by construction activities.

Scores were attributed as follows:

0-0.1 km downstream of crossing point:

- number of sites x 4

0.1-1 km downstream of crossing point:

- number of sites x 2

1-50 km downstream of crossing point:

- number of sites x 1

The scores were halved for situations where large impoundments were between the crossing point and the downstream stream section. Scores were summed across areas.

Calculation of index

To give equal weighting to the six components (variables) defined above, scores for each component variable were standardised so that their mean value was 1.0. These standardised scores were then summed across the six components. The resultant variable was then standardised so that its mean value was 1.0 (i.e. the resultant scores were divided by 6).

Determining the potential hazard exposure of each stream

Index derivation: approach hazards (Mechanisms B & C):

A range of features of the route of the pipeline approaching stream crossings will determine the magnitude of any resultant impact:

1) steep bank slope (Mechanism B),
2) damage to riparian vegetation which leads to bank destabilisation (Mechanism B), 3) catchment in pristine state (thus it is not usually exposed to disturbances (Mechanisms B & C),
3) high rainfall intensity (Mechanism B primarily),
4) high soil erodibility (Mechanism B), and
5) dominance of acidic soils, which if disturbed could allow acidic waters and any associated dissolved metallic constituents to enter streams (Mechanism C).

The method by which scores were attributed to each component is given below:

1) Bank slope. Contouring on 1:25,000 topographic and supplied GIS maps was used to estimate slopes and slope lengths on both sides of stream crossings. As bank-slopes are generally steeper closer to streams, slopes along the pipe route were calculated across two intervals from the stream: 0-100 m from the stream, and 0-100 m to the closest crest point of the pipe route, or a point of major slope reduction

Slopes were determined by calculating differences between spot heights in the stream, at the 100 m point, and at the crest, and then dividing the differences by the length of the respective horizontal intervals. These heights were determined through linear interpolation between contours. Where contour data were inadequate, conservative estimates of heights were made by examining the general form of the land surface in the area.

Only slope in the 0-100 m interval was recorded as the horizontal interval length, and hence the slope length was always the same. This slope is hereafter referred to as the 'gradient within 100 m'. For the interval from 100 m to the crest, the slope length was calculated (horizontal interval length and height were known) and then multiplied by the determined slope to give a combined indication of slope and slope length. This product is hereafter referred to as the 'gradient x slope length > 100 m'. Accordingly, four slope variables, which are taken to be indices of slope conditions about stream crossing, were available:

- left bank gradient within 100 m
- right bank gradient within 100 m
- left bank gradient x slope length > 100 m
- right bank gradient x slope length > 100 m.

It is recognised that these variables have the weakness that slope features of the immediate stream bank can be overlooked because of lack of detail on the examined map.

2) Riparian vegetation. The extent of the existing riparian vegetation zone is taken to give an indication of the level of hazard the stream is exposed to if the zone is ruptured by pipeline construction activities. The extent of the zone was determined by the examination of 1:25,000 aerial photographs (NSW: 1990-1992, Victoria: 1986-1991). Tree/shrub canopy cover was taken to be indicative of the zone extent, although it is recognised that conditions beneath the canopy may be variable due to factors such as differences in stock access. A two kilometre length of the stream, one kilometre upstream and downstream of

the crossing point, was examined. These distances were of course less if the stream being examined had lesser dimensions.

Scores were attributed in the following manner:

- zone to be ruptured, zone > 50 m wide, 95-100% intact: 5
- zone to be ruptured, zone > 50 m wide, 50-95% intact: 4
- zone to be ruptured, zone > 50 m wide, 5-50% intact: 3
- zone to be ruptured, zone 5-50 m wide, 50-95% intact: 2
- zone to be ruptured, zone 5-50 m wide, 5-50% intact: 1
- no identified zone at the crossing point: 0.5.

The last category was given a score of 0.5, instead of 0.0, as this serves to indicate that a stream bank may have some degree of stability even though it is not covered by trees and shrubs. The extent of the riparian zone on both banks was scored, and accordingly, two riparian variables were available:

- left bank riparian vegetation
- right bank riparian vegetation.

3) Catchment condition. The extent of the catchment in near pristine condition was estimated by examining 1:25,000 aerial photographs, 1:25,000 topographic maps and 1:100,000 topographic maps for evidence of disturbance (forestry activities, roading, fencing, etc.). A homogeneous forest canopy was taken to be the best indication of near pristine conditions, although it is recognised that disturbance could be present under the canopy. Scores were attributed in the following manner:

95-100% near pristine : 3
50-95% near pristine : 2
5-50% near pristine : 1
0-5% near pristine : 0.

Catchments upstream and downstream of the crossing points were examined and scored separately. (The examination of the downstream extent of the catchments was limited if smaller streams met rivers or large impoundments. In these cases the downstream limit was either the confluence point or the head of the impoundment). Accordingly two catchment condition variables were available:

- upstream catchment condition
- downstream catchment condition.

4) Rainfall intensity. Information on rainfall intensity (mm/h) was derived from contouring on maps (IAE [1992]; maps 1.7 & 1.8) showing design rainfall isopleths, 1 hour duration / 2 year average recurrence interval. Stream crossings within a particular contour interval (5mm/h spacing) were all given the same median rainfall intensity value. Accordingly, one rainfall intensity variable was available:

- rainfall intensity

5) Soil erodibility. Information on soil erodibility was derived from the following sources:

NSW-Wollongong/Port Hacking soil landscape sheet (SLS) by Hazelton and Tille (1990),

NSW-Kiama SLS by Hazelton (1992),
NSW-survey of erosion within the Shoalhaven Valley by Higginson (1970)
NSW-Michelago SLS by Jenkins (1992)
NSW-Cooma SLS by Tulau (1994)
VIC-East Gippsland forest management land systems sheet by CNR (1993)
VIC-Land systems of the Gippsland Lakes catchments by Aldrick et al.(1988).

There were major gaps in the coverage of information (e.g. lower Shoalhaven, Lake George area to the Michelago SLS, Cooma SLS to the NSW border), and information in the Victorian sources was only marginally useful because soil erodibility was not specifically addressed. For example, information in CNR (1993) was primarily based on landform and lithology. Scores were attributed in relation to descriptions of soil erodibility about stream crossings:

extreme = 3
high to very high = 2
erodible = 1
no mention = 0.

In the case of CNR (1993), information was extracted only for granitic lithology (given score '2') as it is commonly understood that associated soils can be quite erodible. It is recognised, however, that there can be considerable variation in the erodibility of granitic soils.

One soil erodibility variable was available:

- soil erodibility.

6) Acidic soils. Information on soil acidity was derived from the sources listed for '5)' above. There were major gaps in the coverage of information as only the NSW SLSs addressed soil acidity. Scores were attributed in relation to descriptions of soil acidity about stream crossings as follows:

- 'acid-sulphate soil', 'highly acid', 'strongly acid': 1
- no mention : 0.

One soil acidity variable was available:

- soil acidity

Calculation of indices

To give initial equal weighting to the eleven approach-hazard components (variables) defined above, scores for each component variable were standardised so that their mean value was 1.0. The standardised scores of the soil erodibility variable was then doubled to give it higher weight which reflects its major importance as an approach-hazard component.

Three approach hazard variables were calculated so to avoid major loss of information caused by gaps in the data on soil erodibility and soil acidity:

1. approach hazard without soil factors - standardised scores summed across 4 slope variables, 2 riparian vegetation variables, 2 catchment condition variables, 1 rainfall intensity variable.

2. approach hazard with soil erosion factor only - standardised scores summed across the variables above, plus the soil erodibility variable which had its weight doubled.

3. approach hazard with both soil factors included - standardised scores summed across the variables above, plus soil acidity.

Each of the above variables were standardised so that their mean values were 1.0, thus creating indices used later in the report.

Index derivation: within-stream hazards (Mechanism A):

As discussed in Section 1, site-by-site assessments of within-stream hazards are not possible at this stage, However, for situations where stream sediments will be disturbed in pool habitats, information can be obtained now which indicates that the sediments may contain toxic materials (biocides, metals, etc.) arising from upstream land use or natural sources. Land uses which could result in the accumulation of toxic materials in stream sediments are agriculture, industry and urban development. Natural sources of toxic materials could include areas of mineralisation or certain soil types which contain, for example, elevated levels of aluminium or iron. The occurrence of the above natural sources can in some situations be indicated by areas with marked soil acidity.

Since information on upstream land uses can be obtained for the whole route, and information on soil acidity has major gaps, two within-stream hazard indices were developed:

1) Within-stream hazard-land use factors only. Information on upstream land uses was derived by examining 1:25,000 aerial photographs, 1:25,000 topographic maps and 1:100,000 topographic maps. Scores were attributed in the following manner in relation to three component variables: i) agriculture (including pastoral activities, ii) industry (including mining operations) and urban developments:

- extensive : 3
- moderate : 2
- trace : 1
- none : 0.

Each of the three component variables was standardised so that their mean value was 1.0. The scores across the three were then summed. The index was formed by standardising (mean = 1.0) the resultant summed variable.

2) Within-stream hazard-land use + soil acidity. This index was the standardised sum (mean = 1.0) of the above index ('1)') plus the soil acidity component variable defined in Section 2.3.1.

Identify problematic areas

Problematic areas were identified by combining (summing) the conservation value index (CV) with the three approach hazard (AH) indices. It was not considered worthwhile to undertake this procedure with the within-stream hazard indices at this stage. Three identifiers of problematic areas were thus available:

CV + AH with soil factors

CV + AH with soil erosion factor only (data set limited)
CV + AH with both soil factors (data set very limited).

Descriptive variables

Remaining land use variables

Information was recorded on two other upstream land uses, roading and logging, but these data were not used in the calculation of any indices. The scoring system of these variables was the same as for the three used above in the calculation of the within-stream hazard indices.

Stream type variables

Following a cursory examination of 1:25,000 and 1:100,000 topographic maps, stream types were assigned to each stream to be crossed as follows:

1. small tributary streams (1st to ~3rd order streams with catchments < ~2 km2)
2. minor trunk streams (~3rd to ~4th order streams with catchments > ~2 km2, but < ~5 km2)
3. major trunk streams (~4th to ~5th order streams with catchments > ~5 km2)
4. minor rivers (~5th order streams or greater, stream width < ~10 m)
5. major rivers (~5th order streams or greater, stream width > ~10 m).

It is assumed that perennial flows, or at least permanent waters, are most likely in stream types 3, 4 and 5. Additional waterbodies assigned identification codes were:

6. minor estuary (channel width < ~100m.).
7. major estuary (channel width > ~100m.).
8. agricultural drains (identified by straight alignment of channel and angular direction changes).

The location of wetlands and areas subject to inundation were also noted.

TURBIDITY OF STREAM WATER

To determine the ecological significance of possible changes in suspended solids concentrations, it was recognised that it was necessary to obtain indicative water quality data for as many streams as possible along the proposed pipe route. The NSW Department of Water Resources (DWR), Water Ecoscience Pty. Ltd. (Victoria) and the ACT Department of Electricity and Water were contacted, and only the former two had extensive sets of data on an indicative variable, turbidity. Substantial sets of turbidity data were available for 29 sites, most of which were located on streams which intersected the pipe route (the others drained catchments near the pipe route and thus provide an indication of stream conditions in areas near the route). Details of the sites and sampling periods are given in Table 5.

It was considered fundamentally important that the turbidity data be examined in conjunction with available flow data, as stream flows can have a profound effect on stream turbidity. To obtain an indication of the duration which stream biota are typically exposed to high turbidity levels along the pipe route, the turbidity data was examined at specific points on yearly flow duration curves (flow duration data supplied by the DWR in NSW, and the Rural Water Corporation in Victoria), the 50 and 10 percentile flow exceedence levels. Relationships between flow and turbidity were developed (either through regression analysis or by drawing the line of best fit on turbidity vs flow plots), and from these turbidity levels at the above two flow levels were estimated. In situations where no relationship was apparent between turbidity and stream flow, the indicative turbidity value was the median of the available data in the following flow percentile ranges:

50 percentile: 55 to 45 percentiles
10 percentile: 15 to 5 percentiles.

It is recognised that any developed relationship between turbidity and stream flow will sometimes contain high levels of variability due to differences in turbidity during the rising and falling stage of a flow events (an hysteresis effect-exhaustion of the sediment supply in the present case). It was not within the capacity of this study to examine the turbidity data for each of these stages.

Appendix 3

Stream Ecology

Conservation Value, Approach Hazard and Within Stream Indices for stream crossings along proposed pipeline route 5.1.

Appendix 3a: Listing of the Conservation Value Index for each of the pipeline route stream crossings used in the calculation of the hazard indices.

Appendix 3b: Listings of hazard indices for each of the pipeline route stream crossings

Appendix 3c: Listings of combined conservation value and approach hazard indices for each pipeline route stream crossing.

Appendix 3a: Listing of the Conservation Value Index for each of the pipeline route stream crossings used in the calculation of the hazard indices.

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
1	721.7	1.0718
2	720.5	1.0718
3	720.2	1.0718
4	719.6	1.0718
5	719.4	1.0718
6	717.3	0.9286
7	716.8	0.9286
8	710.3	1.0718
9	709.6	1.0718
10	709.1	1.0718
11	709	1.0718
12	708.7	1.0718
13	708.6	1.0718
14	708.5	1.0718
15	708.4	1.0718
16	705.8	1.0718
17	705.2	1.0718
18	701.3	0.5493
19	701.1	0.5493
20	700.8	0.5493
21	699.7	0.5493
22	697.5	0.5493
23	697.1	0.5493
24	696.6	0.5493
25	696.4	0.5493
26	696.3	0.5493
27	696.2	0.5493
28	696.1	0.5493
29	695.8	0.5493
30	695.7	0.5493
31	695.5	0.5493
32	695.4	0.5493
33	695.2	0.5493
34	695.1	0.5493
35	694.3	0.5493
36	693	0.7084
37	692.7	0.7084
38	692.2	0.7084
39	691.9	0.7084
40	691.2	0.7084
41	690.9	0.7084
42	690.4	0.7084
43	690	0.7084
44	689.1	0.7084
45	687.7	0.7084
46	686.7	0.7084
46.1	686.4	0.7084
47	686.2	0.7084
48	685.4	0.7084
49	684.8	0.7815
50	684.6	0.7815
51	684	0.7815
52	683.6	0.8547
53	683.1	0.7815
54	682.5	0.8516
55	682.3	0.8516
56	681.8	0.9948
57	681.5	0.8516
58	680.9	0.8516
59	680.7	0.8516
60	680.2	0.9948
61	679.6	0.9948
62	678.7	0.8516

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
63	677.7	0.8516
64	676.7	0.8516
65	676.6	0.8516
66	676.4	0.8516
67	676.2	0.8516
68	675.9	0.6925
69	675.7	0.6925
70	675	0.6925
71	674.8	0.6925
72	674.7	0.6925
73	674.4	0.6925
74	674.3	0.6925
75	673.8	0.6925
76	673.6	0.6925
77	673.5	0.6925
78	673.4	0.6925
79	673.2	0.6925
80	673	0.6925
81	672.7	0.6925
82	672	0.6925
83	671.1	0.6925
84	670.9	0.8357
85	670.5	0.6925
86	670.2	0.8357
87	669.6	0.6925
88	669	0.6925
89	668.3	0.8357
90	668.2	0.8357
91	667.9	0.6925
92	667.2	0.6925
93	666.4	0.6925
94	666.2	0.6925
95	665.7	0.6925
96	665.6	0.6925
97	664.6	0.6925
98	664.1	0.6925
99	663.7	0.6925
100	663.4	0.6925
101	663.1	0.6925
102	662.9	0.6925
103	662.8	0.6925
104	662.4	0.6925
105	662.2	0.6925
106	661.9	0.6925
107	661.6	0.6925
108	661.2	0.6925
109	660.9	0.8357
110	660.8	0.6925
111	660.4	0.8357
112	659.9	0.6925
113	659.7	0.6925
114	659.4	0.8357
115	658.7	0.6925
116	658.4	0.6925
117	658	0.6925
118	655.5	0.6925
119	655.3	0.8357
120	655	0.6925
121	654.8	0.6925
122	654.6	0.6925
123	654.3	0.6925
124	654	0.6925
125	653.3	0.6925
126	653	0.6925
127	652.9	0.6925
128	652.5	0.6925
129	652.4	0.8357

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
129.1	651.8	0.6925
130	651.3	0.6925
131	650.8	0.6925
132	650.3	0.6925
133	650.1	0.6925
134	649.8	0.6925
135	649.3	0.6925
136	648.8	0.6925
137	648.1	0.6925
138	647.9	0.6925
139	647.7	0.6925
140	647.2	0.6925
141	646.9	0.6925
142	646.8	0.6925
143	646.4	0.6925
144	645.9	0.6925
145	645.8	0.6925
146	645.3	0.6925
147	645	0.6925
148	644.5	0.6925
149	644.4	0.6925
150	644.3	0.6925
151	643.7	0.6925
152	642.8	0.6925
153	642.3	0.6925
154	641.7	0.6925
155	641.3	0.6925
156	641.1	0.6925
157	639.9	0.8357
158	639.6	0.6925
159	638.8	0.6925
160	637.2	0.8357
161	636.5	0.6925
162	636	0.5395
163	635.4	0.6925
164	634.2	0.8357
165	633.3	0.6925
166	631.8	0.6925
167	631.2	0.6925
168	629.3	0.6925
169	628.2	0.6925
170	622.1	0.6925
171	622	0.7689
172	606.4	0.7689
173	603.6	1.6698
174	601.6	1.6698
175	601.3	1.6698
176	598.6	1.6698
177	597.4	1.6698
178	597.1	1.6698
179	596.8	0.7866
180	596.2	0.7866
181	595.9	0.7866
182	592.7	0.7866
183	592.4	0.7866
184	588.4	0.7866
185	587.9	0.7866
186	587.5	0.7866
187	581.5	0.7866
188	578.9	1.0157
189	578.4	0.7866
190	578.1	0.6275
191	577.7	0.6275
192	577.3	0.6275
193	577.1	0.6275
194	575.7	0.6275
195	575.3	0.6275

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
196	575	0.6275
197	574.5	0.6275
198	573.7	0.6275
199	573.5	0.6275
200	572.6	0.6275
201	572.1	0.4684
202	569.4	0.4684
203	568.9	0.4684
204	568.8	0.4684
205	568.5	0.4684
206	567.7	0.4684
207	567.5	0.4684
208	567	0.4684
209	566.7	0.4684
210	566.2	0.4684
211	566	0.4684
212	565.8	0.7838
213	565.4	0.4684
214	565.2	0.4684
215	564.9	0.4684
216	564.4	0.3952
217	564.2	0.3952
218	564.1	0.3952
219	564	0.3952
220	563.7	0.3952
221	563.6	0.3952
222	563.4	0.3952
223	562.7	0.3952
224	562.3	0.3952
225	562.2	0.3952
226	562.1	0.3952
227	561.8	0.3952
228	561.7	0.3952
229	561.4	0.3952
230	560.7	0.3952
231	560.5	0.3952
232	560.4	0.3952
233	559.8	0.3952
234	559.4	0.3952
235	559.3	0.3952
236	558.7	0.3952
237	558.5	0.3952
238	558.1	0.3952
239	557.8	0.6375
240	556.9	0.3952
241	556.2	0.3952
242	555.9	0.3952
243	555.5	0.3952
244	554.6	0.3952
245	554.5	0.3952
246	554.2	0.3952
247	553.8	0.3952
248	553.5	0.3952
249	553.2	0.3952
250	553.1	0.3952
251	552.7	0.3952
252	552.3	0.3952
253	552.1	0.3952
254	551.1	0.3952
255	551	0.3952
256	550.8	0.3952
257	550.6	0.3952
258	550.2	0.3952
259	550.1	0.3952
260	549.9	0.3952
261	549.7	0.3952
262	548.2	0.3952

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
263	547.7	0.3952
264	547.4	0.3952
265	547.3	0.3952
266	547.2	0.3952
267	546.7	0.4943
268	546	0.3952
269	546	0.3952
270	545.2	0.3952
271	545.2	0.3952
272	544.6	0.3952
273	543.8	0.3952
274	543.4	0.3952
275	543.3	0.3952
276	542.5	0.3952
277	542.1	0.3952
278	541.9	0.3952
279	541.4	0.3952
280	541.3	0.3952
281	540.2	0.3952
282	540.1	0.3952
283	539.7	0.3952
284	539.3	0.3952
285	539	0.3952
286	538.5	0.3952
287	538.1	0.3952
288	537.7	0.3952
289	537.4	0.3952
290	536.8	0.3952
291	536.7	0.3952
292	536.2	0.3952
293	535.8	0.3952
294	535.5	0.3952
295	535.1	0.3952
296	535	0.3952
297	532.3	0.9009
298	532	0.8018
299	530.5	0.8018
300	530.3	0.8018
301	529.9	0.8018
302	529.8	0.8018
303	529.6	0.8018
304	529.1	0.8018
305	528.2	0.8018
306	528.1	0.8018
307	528	0.8018
308	527.4	0.8018
309	527.2	0.8018
310	527	0.8018
311	526.7	0.8018
312	526.5	0.8018
313	525.6	0.8018
314	525.5	0.8018
315	525.4	0.8018
316	524.5	0.8018
317	524.1	0.8018
318	523.1	0.8018
319	522.8	0.8018
320	522.3	0.8018
321	522	0.8018
322	521.5	0.8018
323	521.2	0.8018
324	520.8	0.8018
325	520.7	0.8018
326	520.4	0.8018
327	520.1	0.8018
328	520.1	0.8018
329	520	0.8018

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
330	519.8	0.8018
331	519.6	0.8018
332	519.3	0.8018
333	519	0.8018
334	518.5	0.252
335	517.8	0.252
336	517.7	0.252
337	517.6	0.252
338	516.9	0.252
339	516.7	0.252
340	516.1	0.252
341	516	0.252
342	514.8	0.252
343	514.8	0.252
344	514.7	0.252
345	514.6	0.252
346	514.2	0.252
347	513.5	0.252
348	513.2	0.252
349	513.1	0.252
350	512.4	0.252
351	512.1	0.252
352	511.9	0.252
353	511.6	0.252
354	511.4	0.252
355	511.1	0.252
356	511	0.252
357	510.9	0.252
358	510.8	0.252
359	510.8	0.252
360	510.7	0.252
361	509.5	0.252
361.1	509.4	0.252
362	509.2	0.252
363	508.7	0.252
364	508.2	0.252
365	507.9	0.252
366	507.5	0.252
367	507.1	0.252
368	506.9	0.252
369	506	0.252
370	504.6	0.252
371	503.1	0.252
372	503	0.252
373	501	0.252
374	500.4	0.252
375	500.1	0.252
376	500	0.252
377	499.3	0.252
378	498.7	0.252
379	497.5	0.252
380	496.9	0.3511
381	495.1	0.252
382	493.1	0.252
383	492.5	0.252
383.1	492.3	0.252
384	491.1	0.252
385	490.7	0.252
386	490.6	0.252
387	490.3	0.252
388	490.2	0.252
389	488.8	0.252
390	488.6	0.252
391	488.2	0.252
392	487.9	0.252
393	487.7	0.252
394	487.4	0.252

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
395	487	0.252
396	486.9	0.252
397	486.6	0.252
398	486.4	0.252
399	485.9	0.252
400	483.9	0.7007
401	483.3	0.7007
402	482.9	0.7007
403	482.8	0.7007
404	482.3	0.7007
405	482.1	0.7007
406	481.9	0.7007
407	481.6	1.2484
408	481.2	0.7007
409	480.7	0.7007
410	479.7	0.7007
411	479.4	0.7007
412	478.9	0.7007
413	478.7	0.7007
414	478.6	0.7007
415	477.1	0.7007
416	476.1	1.5139
417	475.9	1.5139
418	475.5	1.5139
419	474.1	1.5139
420	471.8	1.5139
421	471.7	1.5139
422	470.6	1.5139
423	470.3	1.5139
424	470.1	1.5139
425	469.4	1.5139
426	469.2	0.7007
427	468.6	0.7007
428	468.1	0.7007
429	467.9	0.7007
430	467.2	0.7007
431	466.2	1.6406
432	465.6	1.6406
433	465.3	1.6406
434	464.8	1.6406
435	464.6	1.6406
436	464.5	1.6406
437	463.9	1.6406
438	463.6	1.6406
439	463.3	1.6406
440	463.2	1.6406
441	462.7	1.6406
442	462.3	1.6406
443	462.1	1.6406
444	461.1	1.6406
445	461	1.6406
446	460.4	1.6406
447	459.7	1.6406
448	459.1	1.6406
449	458.9	1.6406
450	458.3	1.6406
451	458.1	1.6406
452	457.8	0.8274
453	457.6	0.8274
454	457.2	0.8274
455	456.9	0.8274
456	455.3	0.9737
457	454.3	1.1328
458	452.8	0.9737
459	451.3	0.8274
460	450.3	0.8274
461	447.7	0.8274

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
462	447.2	0.8274
463	446.6	0.8274
464	446.1	0.8274
465	445.9	0.8274
466	444.7	0.8274
467	444.4	0.8274
468	443.7	0.8274
469	443.4	0.8274
470	443	0.8274
471	442.2	0.8274
472	441.2	0.8274
473	440.9	0.8274
474	439.5	0.8274
475	439.3	0.8274
476	439	0.8274
477	438.7	0.8274
478	438.5	0.8274
479	438.3	0.8274
480	438.2	0.8274
481	438	0.8274
482	437.2	0.8274
483	435.8	0.8274
484	435.1	0.8274
485	435	0.8274
486	434.9	0.8274
487	434.3	0.8274
488	434.1	0.8274
489	433.9	0.8274
490	433.8	0.8274
491	433.1	0.8274
492	432	0.8274
493	431.9	0.8274
494	431.7	0.8274
495	431.2	0.8274
496	431.1	0.8274
497	430.4	0.8274
498	429.9	0.8274
499	429	0.8274
500	428.5	0.8274
501	428.1	0.8274
502	427.4	0.8274
503	426.7	0.8274
504	425.9	1.381
505	424	0.8274
506	423.3	0.8274
507	423.1	0.8274
508	422.6	0.8274
509	421.9	0.8274
510	421.2	1.234
511	420.9	1.234
512	420.6	1.234
513	420.1	1.234
514	420	1.234
515	419.4	1.234
516	419.3	1.234
517	418.8	1.234
518	418.2	1.234
519	416.2	2.0472
520	414.7	2.0472
521	414.5	2.0472
522	414.2	2.0472
523	413.8	2.0472
524	413.5	2.0472
525	413.4	2.0472
526	413.2	2.0472
527	410.5	2.6008
528	409.2	2.0472

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
529	408.7	2.0472
530	408	1.6406
531	407.1	1.6406
532	406	1.6406
533	403.2	1.6406
534	402.5	2.7592
535	399.4	2.0472
536	399.4	2.0472
537	397.2	2.0472
538	396.7	2.0472
539	394.1	2.0472
540	393.8	2.0472
541	393.5	2.0472
542	393.1	2.0472
543	393	2.0472
544	392.7	2.0472
545	392.4	2.0472
546	391.5	2.0472
547	387.8	2.0472
548	386.1	2.0472
549	381.9	2.0472
550	380.5	2.0472
551	380.3	2.0472
552	379.3	2.0472
553	378.1	2.0472
554	377.8	2.0472
555	376.9	2.0472
556	376.3	2.0472
557	375.7	2.0472
558	374.9	2.0472
559	374.5	2.0472
560	372.2	2.8604
561	371.3	2.2121
562	370.7	2.2121
563	369.8	2.2121
564	369.7	2.2121
565	369.2	2.2121
566	369	2.2121
567	367.9	2.2121
568	367.6	2.2121
569	366.6	2.2121
570	365.1	0.5284
571	365	0.5284
572	364.8	0.5284
573	364.3	0.5284
574	362.7	0.5284
575	361.9	0.5284
576	361	0.5284
577	360.8	0.5284
578	359.9	0.5284
579	357.5	0.5284
580	357.4	0.5284
581	356.6	0.5284
582	355	0.5284
583	354.2	0.5284
584	353.7	0.6683
585	353.2	0.5284
586	352.8	0.5284
587	352.3	0.5284
588	351.7	0.5284
589	351.6	0.5284
590	350.7	0.5284
591	349.9	0.5284
592	347.7	0.5284
593	347.1	0.5284
594	346.7	0.5284
595	346.2	0.6747

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
596	345.4	0.5284
597	345	0.5284
598	344.2	0.5284
599	343.7	0.5284
600	343.6	0.5284
601	341.5	0.5284
602	341.2	0.5284
603	340.9	0.6747
604	340.8	0.5284
605	340.4	0.5284
606	340	0.5284
607	339.4	0.5284
608	339.3	0.5284
609	338.9	0.5284
610	338.4	0.5284
611	338.3	0.5284
612	337.8	0.5284
613	336.7	0.5284
614	336.2	0.5284
615	335.4	0.5284
616	335.2	0.5284
617	334	0.5284
618	333	0.5284
619	332.3	0.5284
620	332.1	0.5284
621	331.9	0.5284
622	331	0.5284
623	330.9	0.5284
624	330.3	0.5284
625	329.9	0.5284
626	329.5	0.5284
627	328.5	0.5284
628	328.3	0.5284
629	327.8	0.5284
630	327.5	0.5284
631	326.8	0.5284
632	325.8	0.5284
633	325.7	0.5284
634	325	0.5284
635	324.9	0.5284
636	323.6	0.5284
637	323.1	0.6683
638	322.7	0.5284
639	322.2	0.5284
640	322	0.5284
641	321.3	0.5284
642	321.1	0.5284
643	320.7	0.5284
644	320.6	0.5284
645	320	0.5284
646	319.8	0.5284
647	319.6	0.5284
648	319.5	0.5284
649	319.4	0.5284
650	319	0.5284
651	318.1	0.5284
652	317.6	0.5284
653	317.1	0.5284
654	316.9	0.5284
655	316.5	0.5284
656	316.4	0.6875
657	316.1	0.6875
658	315	0.6875
659	314.4	0.6875
660	313.9	0.8274
661	313.2	0.6875
662	312.9	0.6875

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
663	312.7	0.6875
664	312.2	0.6875
665	311.2	0.6875
666	311.2	0.6875
667	311.1	0.6875
668	310.9	0.6875
669	310.5	0.6875
670	310.3	0.8274
671	309.3	0.6875
672	308.9	0.6875
673	308.7	0.6875
674	308.3	0.6875
675	308.3	0.6875
676	308.2	0.6875
677	307.9	0.6875
678	307.5	0.6875
679	307.1	0.6875
680	306.7	0.6875
681	306.4	0.6875
682	306.3	0.6875
683	305.1	0.6875
684	304.6	0.6875
685	304.5	0.6875
686	304.5	0.8339
687	304.1	0.6875
688	303.6	0.6875
689	302.8	0.6875
690	302.5	0.6875
691	302	0.6875
692	301.7	0.6875
693	301.3	0.6875
694	300.7	0.6875
695	300.3	0.6875
696	300	0.6875
697	299.4	0.6875
698	298.8	0.6875
699	298.3	0.6875
700	297.7	0.6875
701	297	0.6875
702	296.4	0.6875
703	296.1	0.6875
704	295.7	0.6875
705	295.4	0.8339
706	294.9	0.6875
707	294.3	0.8339
708	293.7	0.6875
709	293.1	0.6875
710	292.4	0.6875
711	292.1	0.6875
712	291.6	0.6875
713	291.3	0.6875
714	291.2	0.8339
715	291.1	0.6875
716	290.7	0.6875
717	290.5	0.6875
718	290.3	0.6875
719	289.6	0.6875
720	289.3	0.6875
721	289.2	0.6875
722	289.1	0.6875
723	288.4	0.6875
724	288.4	0.6875
725	287.8	0.6875
726	287.6	0.6875
727	287.3	0.6875
728	286.7	0.6875
729	286.3	0.6875

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
730	286.1	0.6875
731	286	0.6875
732	285.6	0.6875
733	285.5	0.6875
734	285.4	0.6875
735	285.3	0.6875
736	285	0.6875
737	284.6	0.6875
738	284.1	0.6875
739	283.9	0.6875
740	283.6	0.6875
741	283	0.6875
742	282.7	0.6875
743	282.5	0.6875
744	281.3	0.6875
745	281	0.6875
746	280.6	0.6875
747	280.3	0.6875
748	279.8	0.6875
749	279.7	0.6875
750	278.1	0.6875
751	277.8	0.6875
752	275.4	1.7728
753	273.2	1.7728
754	272.9	1.7728
755	272.5	1.7728
756	272	1.7728
757	271.6	1.7728
758	271.3	1.7728
759	271.1	1.7728
760	268.8	2.4269
761	256.6	1.7728
762	256.3	2.4269
763	256	2.4269
764	255.7	2.4269
765	255.5	2.4269
766	255.1	2.4269
767	255	2.4269
768	254.5	2.4269
769	254.3	2.4269
770	252	2.4269
771	251.9	2.707
772	251.5	2.4269
773	251.1	2.5975
774	250.9	2.5975
775	250.6	2.5975
776	250.4	2.5975
777	250.3	2.5975
778	250.2	2.5975
779	249.5	2.5975
780	249	2.5975
781	248.7	2.5975
782	248.6	2.5975
783	247.8	2.3681
784	247.5	2.5975
785	247	2.5975
786	246.5	2.5975
787	246.2	2.5975
788	246.1	2.5975
789	245.2	2.5975
790	244.1	2.5975
791	244	2.5975
792	243.6	2.5975
793	243	2.5975
794	242.8	2.5975
795	242.5	2.5975
796	242.1	2.2793

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
797	241.9	2.2793
798	241.5	2.2793
799	240.7	2.2793
800	240.5	2.2793
801	239.5	2.2793
802	239.3	2.2793
803	238.6	2.0499
804	237.9	2.2793
805	237.7	2.0499
806	237.5	2.2793
807	237.2	2.2793
808	237.1	2.2793
809	237	2.2793
810	236.5	2.2793
811	235.9	2.2793
812	235.9	2.2793
813	235.2	2.2793
814	234.4	2.4384
815	234.2	2.4384
816	234.1	2.4384
817	233.4	2.4384
818	232.7	2.4384
819	232.4	2.4384
820	231.6	2.4384
821	231.5	2.4384
822	230.9	2.4384
823	230.9	2.4384
824	229	2.053
825	228.7	2.3581
826	228.6	2.3581
827	222.3	2.3581
828	221.9	2.2316
829	221.4	2.2316
830	221.3	1.9515
831	221.1	1.9515
832	221	1.9515
833	220.7	1.9515
834	219.2	1.9515
835	214.4	2.0318
836	213.7	1.3662
837	204.8	1.6463
838	204.2	2.8703
839	202.3	2.8703
840	202	2.8703
841	201.7	2.8703
842	201.3	2.8703
843	200.3	2.8703
844	200	2.8703
845	199.7	2.8703
846	199.5	2.6409
847	198.9	2.4117
848	198.2	2.4117
849	107.8	2.4117
850	194.9	2.4117
851	194.7	1.5985
852	193.7	1.5985
853	192.4	1.5985
854	191.7	1.5794
855	188.6	1.6686
856	187	1.4394
857	186.6	1.4394
858	184.9	1.4394
859	183.9	1.898
860	182.1	1.4394
861	180.2	1.4394
862	180	1.5239
863	179.6	1.5239

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
864	179.2	1.5239
865	179	1.5239
866	177.7	1.5239
867	177.3	1.5239
868	174.6	0.983
869	174	0.983
870	173.4	0.983
871	171.9	0.983
872	171.4	0.983
873	170.8	0.983
874	170.7	0.983
875	169.2	0.983
876	169.1	0.983
877	168.7	0.983
878	167.5	0.983
879	166	0.983
880	165.6	0.983
881	165.2	0.983
882	165.1	0.983
883	164.9	0.983
884	164.2	0.983
885	162.7	1.6716
886	162.6	1.6716
887	161.3	1.5187
888	160.1	2.0505
889	159.4	2.0505
890	158.6	1.7384
891	157.8	1.4587
892	156.5	1.4587
893	156.4	1.4587
894	155.9	1.4587
895	154.5	1.5256
896	152.5	1.8913
897	150.7	1.6847
898	150.4	1.4265
899	148.9	1.4265
900	148.6	1.4265
901	148.5	1.4265
902	148.1	1.4265
903	147.5	0.9065
904	147.1	0.9065
905	146.9	0.9065
906	143.1	0.9065
907	141.6	0.9065
908	138.7	0.9065
909	137.4	0.9065
910	136.1	0.9065
911	135.5	0.9065
912	135.4	0.9065
913	134.8	0.9065
914	132.6	0.83
915	132.4	0.9065
916	132	0.9065
917	131.9	0.9065
918	129.6	0.9065
919	128	0.9065
920	126.3	0.9065
921	125.7	0.9065
922	125.3	0.9065
923	124.8	0.9065
924	124.2	0.9065
925	124	0.9065
926	123.8	0.9065
927	123.6	0.9065
928	123.2	0.9065
929	119.6	1.1229
930	119.6	1.1229

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
931	119.1	1.1229
932	117.9	1.282
933	117.2	1.282
934	117.1	1.4983
935	117	1.282
936	116.6	1.3392
937	115.5	0.9699
938	115	1.1229
939	113	0.9638
940	112.2	0.9638
941	111.2	0.982
942	110.2	0.982
943	109.3	0.9638
944	108.4	0.9638
945	107.1	0.9638
946	105.8	0.9638
947	104.3	0.9638
948	104.2	0.9638
949	102.4	0.9638
950	100.7	0.7474
951	98.4	1.2621
952	98.1	1.2621
953	97.7	1.2621
954	97.5	1.2621
955	97.2	1.2621
956	96.8	1.2621
957	96.6	1.2621
958	95.8	1.2621
959	95.3	1.2621
960	95	1.2621
961	92.8	1.4202
962	91.7	1.2621
963	91.1	1.4202
964	90.1	1.2621
965	89.8	1.2621
966	89.7	1.2621
967	88.7	1.2621
968	88.6	1.2621
969	87.5	0.7776
970	86.9	0.7776
971	86.3	0.7776
972	85.3	0.8388
973	84.6	0.8388
974	83	0.9301
975	81.1	0.8537
976	80.6	0.9301
977	79.9	0.8388
978	78.1	0.8388
979	78	0.8388
980	77.6	0.8388
981	76.6	1.7204
982	74.8	1.7204
983	74.6	1.7204
984	72.9	1.7204
985	71.9	1.955
986	71	1.7204
987	70.2	1.7204
988	69.7	1.7204
989	69.3	1.7204
990	67.4	1.8795
991	67	1.8795
992	66.1	2.0376
993	65.5	1.8795
994	65.4	1.8795
995	64	1.7204
996	63.1	1.7204
997	61.2	1.7204

Stream Crossing Number	Outward distance from Longford	Conservation Value Index
998	59.4	1.7204
999	51.4	1.0458
1000	49.4	1.0458
1001	44.9	1.0458
1002	44	1.0458
1003	43.9	1.0458
1004	43.7	1.064
1005	37.9	0.9239
1006	35.7	0.9239
1007	33.2	1.082
1008	32.7	1.1584
1009	25.6	1.1689
1010	25.3	1.5285
1011	25	1.1689
1012	24.7	0.8507
1013	23.4	0.9356
1014	23	0.8507
1015	22.4	0.8507
1016	20.3	0.7257
1017	19.9	0.7257
1018	19.3	0.7075
1019	17.2	0.7257
1020	16.7	0.7075
1021	16.6	0.7075
1022	16.1	0.7257
1023	9.1	1.4002
1024	7.7	1.184
1025	6.1	1.0249
1026	5.4	1.0067
1027	5	1.0249
1028	3.1	1.0249

Appendix 3b: Listings of hazard indices for each pipeline route stream crossing

See text for details of indices. * = no data available

Stream Crossing Number	Distance from Longford	Approach Hazard Indices: Without soil factors	Approach Hazard Indices: With soil erosion factor only	Approach Hazard Indices: Both soil factors only	Within Stream Indices: Landuse factors only	Within Stream Indices: Landuse and low soil pH & metals factor
1	721.7	1.781	1.457	1.335	0.47	0.117
2	720.5	1.756	1.436	1.317	0	0
3	720.2	1.816	1.486	1.362	0	0
4	719.6	1.07	0.876	0.803	0	0
5	719.4	1.197	0.98	0.898	0	0
6	717.3	0.786	1.08	0.99	0	0
7	716.8	1.061	1.305	1.196	0	0
8	710.3	1.769	1.884	1.727	0	0
9	709.6	1.695	1.824	1.672	0	0
10	709.1	1.31	1.509	1.383	0	0
11	709	1.217	1.433	1.314	0	0
12	708.7	1.495	1.66	1.522	0	0
13	708.6	1.314	1.512	1.386	0	0
14	708.5	0.988	1.246	1.142	0	0
15	708.4	1.669	1.803	1.653	0	0
16	705.8	1.12	1.353	1.241	41.288	10.322
17	705.2	1.189	0.973	0.892	0	0
18	701.3	3.056	2.5	2.292	0	0
19	701.1	1.066	1.309	1.2	0	0
20	700.8	1.101	1.338	1.226	0	0
21	699.7	2.145	2.192	2.01	0	0
22	697.5	1.818	1.925	1.764	47.619	11.905
23	697.1	1.566	1.718	1.575	0.94	0.235
24	696.6	0.98	1.239	1.136	0.94	0.235
25	696.4	1.009	1.262	1.157	0.94	0.235
26	696.3	0.924	1.193	1.094	0.94	0.235
27	696.2	1.185	1.406	1.289	0.94	0.235
28	696.1	1.026	1.277	1.17	0.94	0.235
29	695.8	1.056	1.301	1.193	32.686	8.172
30	695.7	1.085	1.325	1.214	32.686	8.172
31	695.5	0.872	1.15	1.054	32.216	8.054
32	695.4	1.668	1.802	1.652	0.47	0.117
33	695.2	1.151	1.379	1.264	0.94	0.235
34	695.1	2.543	2.518	2.308	0.94	0.235
35	694.3	0.962	1.224	1.122	0.94	0.235
36	693	1.638	1.777	1.629	0.94	0.235
37	692.7	0.373	0.742	0.681	1.41	0.352
38	692.2	0.346	0.72	0.66	1.41	0.352
39	691.9	0.611	0.5	0.458	0.94	0.235
40	691.2	0.543	0.444	0.407	0.94	0.235
41	690.9	0.514	0.42	0.385	1.41	0.352
42	690.4	0.71	0.581	0.533	1.41	0.352
43	690	0.572	0.468	0.429	1.41	0.352
44	689.1	1.179	0.965	0.884	1.41	0.352
45	687.7	1.479	1.21	1.109	1.41	0.352
46	686.7	0.812	0.664	0.609	1.41	0.352
46.1	686.4	0.396	0.324	0.297	1.41	0.352
47	686.2	0.532	0.436	0.399	1.41	0.352
48	685.4	0.472	0.386	0.354	1.41	0.352
49	684.8	0.582	0.476	0.437	1.41	0.352
50	684.6	0.699	0.572	0.524	1.41	0.352
51	684	1.123	0.919	0.842	1.41	0.352
52	683.6	1.27	1.039	0.952	1.41	0.352
53	683.1	0.45	0.368	0.337	1.41	0.352
54	682.5	0.903	0.739	0.677	1.41	0.352
55	682.3	0.463	0.379	0.347	1.41	0.352
56	681.8	1.024	0.838	0.768	1.41	0.352

57	681.5	0.37	0.303	0.277	1.41	0.352
58	680.9	0.352	0.288	0.264	1.41	0.352
59	680.7	0.351	0.287	0.263	1.41	0.352
60	680.2	1.049	0.859	0.787	1.41	0.352
61	679.6	0.685	0.56	0.514	1.41	0.352
62	678.7	0.898	0.735	0.674	1.41	0.352
63	677.7	1.918	1.569	1.438	1.41	0.352
64	676.7	1.275	1.481	1.357	0.94	0.235
65	676.6	1.121	1.354	1.241	0.47	0.117
66	676.4	2.529	2.506	2.297	0.47	0.117
67	676.2	2.411	2.41	2.209	0.47	0.117
68	675.9	1.497	1.662	1.524	0.47	0.117
69	675.7	1.653	1.789	1.64	0.47	0.117
70	675	1.812	1.482	1.359	0.94	0.235
71	674.8	0.529	0.432	0.396	1.41	0.352
72	674.7	0.889	0.727	0.667	1.41	0.352
73	674.4	0.683	0.559	0.512	1.41	0.352
74	674.3	0.658	0.538	0.493	1.41	0.352
75	673.8	0.742	0.607	0.557	1.41	0.352
76	673.6	0.658	0.539	0.494	1.41	0.352
77	673.5	0.929	0.76	0.697	1.41	0.352
78	673.4	0.63	0.515	0.472	1.41	0.352
79	673.2	0.736	0.602	0.552	1.41	0.352
80	673	1.093	0.894	0.82	1.41	0.352
81	672.7	0.63	0.516	0.473	1.41	0.352
82	672	0.974	0.797	0.731	1.41	0.352
83	671.1	1.456	1.337	1.225	1.41	0.352
84	670.9	1.023	0.837	1.032	33.156	9.083
85	670.5	0.428	0.35	0.586	33.156	9.083
86	670.2	1.246	1.019	1.199	33.156	9.083
87	669.6	1.689	1.382	1.266	1.41	0.352
88	669	0.594	0.486	0.446	1.41	0.352
89	668.3	1.823	1.492	1.367	1.41	0.352
90	668.2	1.021	0.835	0.766	1.41	0.352
91	667.9	2.168	1.774	1.626	1.41	0.352
92	667.2	2.457	2.01	1.843	1.41	0.352
93	666.4	0.588	0.481	0.441	1.41	0.352
94	666.2	1.529	1.251	1.146	1.41	0.352
95	665.7	1.667	1.801	1.651	0.94	0.235
96	665.6	2.384	2.388	2.189	0.94	0.235
97	664.6	3.017	2.905	2.663	0	0
98	664.1	2.883	2.505	2.296	0.47	0.117
99	663.7	2.843	2.326	2.397	0.94	1.029
100	663.4	1.801	1.474	1.616	0.94	1.029
101	663.1	0.809	0.662	0.871	1.41	1.147
102	662.9	0.741	0.607	0.821	1.41	1.147
103	662.8	1.084	0.887	1.078	1.41	1.147
104	662.4	1.015	0.976	0.895	1.41	0.352
105	662.2	0.673	0.696	0.638	1.41	0.352
106	661.9	0.656	0.537	0.757	1.41	1.147
107	661.6	0.796	0.651	0.862	1.41	1.147
108	661.2	0.521	0.426	0.655	1.41	1.147
109	660.9	1.111	0.909	1.098	1.41	1.147
110	660.8	0.381	0.311	0.286	1.41	0.352
111	660.4	1.324	1.084	0.993	1.41	0.352
112	659.9	1.463	1.197	1.097	0.94	0.235
113	659.7	0.535	0.438	0.401	0.94	0.235
114	659.4	1.676	1.371	1.257	1.41	0.352
115	658.7	0.746	0.611	0.824	0.47	0.912
116	658.4	2.015	1.649	1.776	0.47	0.912
117	658	2.147	1.757	1.875	0.47	0.912
118	655.5	0.823	0.965	0.884	1.41	0.352
119	655.3	0.915	1.04	0.954	1.41	0.352
120	655	0.438	0.359	0.593	1.41	1.147
121	654.8	0.547	0.447	0.675	1.41	1.147
122	654.6	0.515	0.421	0.651	0.47	0.912
123	654.3	1.07	1.166	1.069	0.47	0.117

124	654	0.593	0.776	0.712	1.41	0.352
125	653.3	0.972	0.795	0.993	1.41	1.147
126	653	0.659	0.83	0.761	1.41	0.352
127	652.9	0.783	0.932	0.854	1.41	0.352
128	652.5	0.323	0.264	0.242	33.156	8.289
129	652.4	0.65	0.532	0.488	33.156	8.289
129.1	651.8	0.577	0.472	0.433	33.156	8.289
130	651.3	0.726	0.594	0.545	1.41	0.352
131	650.8	0.972	1.087	0.996	1.41	0.352
132	650.3	1.443	1.472	1.35	1.41	0.352
133	650.1	1.147	1.23	1.127	1.41	0.352
134	649.8	0.931	1.053	0.965	1.41	0.352
135	649.3	1.527	1.541	1.412	1.41	0.352
136	648.8	1.341	1.389	1.273	1.41	0.352
137	648.1	1.265	1.327	1.216	1.41	0.352
138	647.9	0.338	0.567	0.52	1.41	0.352
139	647.7	0.868	1.001	0.918	1.41	0.352
140	647.2	0.617	0.505	0.463	1.41	0.352
141	646.9	0.866	0.709	0.65	1.41	0.352
142	646.8	1.013	0.829	0.76	1.41	0.352
143	646.4	1.033	1.136	1.042	1.41	0.352
144	645.9	0.856	0.992	0.909	1.41	0.352
145	645.8	0.724	0.883	0.81	1.41	0.352
146	645.3	0.49	0.692	0.634	1.41	0.352
147	645	0.781	0.639	0.585	1.41	0.352
148	644.5	0.773	0.632	0.579	1.41	0.352
149	644.4	0.615	0.503	0.726	1.41	1.147
150	644.3	0.883	0.722	0.927	1.41	1.147
151	643.7	1.183	0.968	1.152	1.41	1.147
152	642.8	0.483	0.395	0.627	1.41	1.147
153	642.3	0.479	0.392	0.624	1.41	1.147
154	641.7	0.664	0.543	0.763	1.41	1.147
155	641.3	0.364	0.298	0.537	1.41	1.147
156	641.1	0.762	0.623	0.836	1.41	1.147
157	639.9	0.487	0.398	0.63	1.41	1.147
158	639.6	0.344	0.281	0.522	1.41	1.147
159	638.8	1.182	0.967	1.151	1.41	1.147
160	637.2	2.193	1.794	1.909	32.216	8.848
161	636.5	1.914	1.566	1.7	15.873	4.762
162	636	1.87	1.53	1.668	0	0.794
163	635.4	2.435	2.138	2.224	74.444	19.405
164	634.2	*	*	*	58.101	15.319
165	633.3	1.463	1.197	1.362	41.288	11.116
166	631.8	1.083	0.886	1.077	1.41	1.147
167	631.2	1.444	1.181	1.347	1.41	1.147
168	629.3	0.8	0.8	0.998	0.94	1.029
169	628.2	2.625	2.147	2.233	73.974	19.288
170	622.1	1.947	1.593	1.725	0	0.794
171	622	1.034	0.846	1.04	0	0.794
172	606.4	1.645	*	*	0	*
173	603.6	1.369	*	*	0	*
174	601.6	2.116	*	*	0	*
175	601.3	2.595	*	*	0	*
176	598.6	2.221	*	*	0	*
177	597.4	1.27	*	*	0	*
178	597.1	1.078	*	*	0	*
179	596.8	*	*	*	0	*
180	596.2	1.229	*	*	0	*
181	595.9	2.21	*	*	0	*
182	592.7	1.021	*	*	0	*
183	592.4	2.002	*	*	0	*
184	588.4	0.599	*	*	1.41	*
185	587.9	0.79	*	*	1.41	*
186	587.5	0.807	*	*	1.41	*
187	581.5	1.41	1.154	*	0	*
188	578.9	1.563	1.279	*	0	*
189	578.4	2.274	1.861	*	0	*

190	578.1	2.313	1.893	*	0	*
191	577.7	*	*	*	0	*
192	577.3	2.675	2.188	*	42.228	*
193	577.1	1.734	1.419	*	1.41	*
194	575.7	0.769	0.775	*	1.41	*
195	575.3	0.845	0.837	*	1.41	*
196	575	0.883	0.868	*	1.41	*
197	574.5	1.793	1.613	*	1.41	*
198	573.7	0.694	0.714	*	17.283	*
199	573.5	1.807	1.624	*	17.283	*
200	572.6	0.541	0.588	*	17.283	*
201	572.1	1.222	1.146	*	74.444	*
202	569.4	1.938	1.732	*	42.698	*
203	568.9	0.784	0.933	*	1.41	*
204	568.8	0.694	0.86	*	1.41	*
205	568.5	0.786	0.935	*	0.94	*
206	567.7	1.696	1.679	*	0.47	*
207	567.5	1.315	1.367	*	0.94	*
208	567	2.12	2.026	*	83.516	*
209	566.7	1.572	1.577	*	0.47	*
210	566.2	1.024	1.129	*	0.47	*
211	566	0.811	0.955	*	1.41	*
212	565.8	2.047	1.966	*	42.698	*
213	565.4	0.825	0.821	*	1.41	*
214	565.2	*	*	*	1.41	*
215	564.9	1.016	0.977	*	1.41	*
216	564.4	0.667	0.692	*	1.41	*
217	564.2	0.709	0.726	*	1.41	*
218	564.1	0.545	0.591	*	1.41	*
219	564	0.455	0.518	*	1.41	*
220	563.7	0.84	0.833	*	1.41	*
221	563.6	0.691	0.711	*	1.41	*
222	563.4	1.197	1.125	*	1.41	*
223	562.7	1.854	1.662	*	1.41	*
224	562.3	1.5	1.519	*	83.986	*
225	562.2	0.596	0.779	*	1.41	*
226	562.1	0.621	0.799	*	0.94	*
227	561.8	1.449	1.477	*	0.47	*
228	561.7	0.687	0.853	*	0.94	*
229	561.4	0.647	0.82	*	1.41	*
230	560.7	1.012	0.974	*	1.41	*
231	560.5	0.518	0.57	*	1.41	*
232	560.4	0.974	0.942	*	1.41	*
233	559.8	0.461	0.523	*	1.41	*
234	559.4	0.607	0.933	*	0.94	*
235	559.3	1.273	1.479	*	0.47	*
236	558.7	1.127	1.359	*	1.41	*
237	558.5	1.257	1.465	*	1.41	*
238	558.1	1.356	1.546	*	0.94	*
239	557.8	2.934	2.838	*	58.571	*
240	556.9	0.867	1.146	*	1.41	*
241	556.2	1.074	1.316	*	0.47	*
242	555.9	0.769	1.066	*	0.47	*
243	555.5	0.974	1.234	*	0.94	*
244	554.6	0.814	1.103	*	0.94	*
245	554.5	0.894	1.169	*	0.94	*
246	554.2	1.117	1.351	*	0.47	*
247	553.8	1.154	1.381	*	0.47	*
248	553.5	0.895	1.169	*	0.47	*
249	553.2	0.648	0.967	*	0.94	*
250	553.1	0.706	1.015	*	0.94	*
251	552.7	0.594	0.923	*	0.94	*
252	552.3	0.662	0.979	*	0.94	*
253	552.1	1.078	1.319	*	0.94	*
254	551.1	1.775	1.889	*	0	*
255	551	0.99	1.247	*	0	*
256	550.8	0.996	1.252	*	0	*

257	550.6	1.08	1.32	*	0.94	*
258	550.2	1.111	1.346	*	0.47	*
259	550.1	1.285	1.489	*	0	*
260	549.9	1.574	1.725	*	0	*
261	549.7	1.546	1.41	*	0	*
262	548.2	1.224	1.147	*	0.94	*
263	547.7	*	*	*	1.41	*
264	547.4	0.378	0.455	*	1.41	*
265	547.3	0.335	0.42	*	1.41	*
266	547.2	*	*	*	1.41	*
267	546.7	0.704	0.721	*	1.41	*
268	546	0.58	0.62	*	0.94	*
269	546	0.489	0.546	*	1.41	*
270	545.2	0.765	0.771	*	0.94	*
271	545.2	1.292	1.203	*	0.94	*
272	544.6	2.921	2.535	*	0.94	*
273	543.8	2.169	1.921	*	0	*
274	543.4	1.621	1.472	*	0.94	*
275	543.3	1.071	1.022	*	1.41	*
276	542.5	0.637	0.667	*	1.41	*
277	542.1	0.556	0.601	*	1.41	*
278	541.9	0.615	0.649	*	1.41	*
279	541.4	1.339	1.241	*	1.41	*
280	541.3	0.448	0.512	*	0.94	*
281	540.2	*	*	*	1.41	*
282	540.1	0.42	0.344	*	1.41	*
283	539.7	0.395	0.323	*	1.41	*
284	539.3	0.534	0.437	*	1.41	*
285	539	0.96	0.785	*	1.41	*
286	538.5	0.445	0.364	*	1.41	*
287	538.1	0.547	0.594	*	1.41	*
288	537.7	0.429	0.496	*	1.41	*
289	537.4	0.509	0.562	*	1.41	*
290	536.8	0.34	0.424	*	1.41	*
291	536.7	0.269	0.366	*	1.41	*
292	536.2	0.409	0.48	*	1.41	*
293	535.8	0.704	0.722	*	1.41	*
294	535.5	0.453	0.516	*	1.41	*
295	535.1	0.259	0.357	*	1.41	*
296	535	1.01	0.827	*	1.41	*
297	532.3	2.455	2.008	*	1.41	*
298	532	0.693	0.567	*	0.94	*
299	530.5	0.473	0.387	*	1.41	*
300	530.3	0.701	0.573	*	0.94	*
301	529.9	0.394	0.468	*	1.41	*
302	529.8	0.49	0.547	*	1.41	*
303	529.6	0.969	0.939	*	1.41	*
304	529.1	1.451	1.333	*	1.41	*
305	528.2	0.75	0.759	*	1.41	*
306	528.1	0.591	0.629	*	1.41	*
307	528	0.768	0.774	*	1.41	*
308	527.4	1.431	1.316	*	1.41	*
309	527.2	0.755	0.763	*	1.41	*
310	527	0.529	0.578	*	1.41	*
311	526.7	0.615	0.504	*	1.41	*
312	526.5	0.659	0.539	*	1.41	*
313	525.6	1.301	1.064	*	0.94	*
314	525.5	0.618	0.505	*	0.94	*
315	525.4	1.041	0.852	*	0.94	*
316	524.5	1.489	1.219	*	0.47	*
317	524.1	2.011	1.646	*	0	*
318	523.1	1.572	1.286	*	0	*
319	522.8	1.551	1.269	*	0	*
320	522.3	1.08	0.884	*	0.94	*
321	522	0.655	0.536	*	0.94	*
322	521.5	0.768	0.628	*	1.41	*
323	521.2	0.672	0.55	*	1.41	*

324	520.8	0.583	0.477	•	1.41	•
325	520.7	1.181	0.966	•	0.94	•
326	520.4	0.508	0.416	•	1.41	•
327	520.1	0.627	0.513	•	1.41	•
328	520.1	0.518	0.424	•	1.41	•
329	520	0.617	0.505	•	1.41	•
330	519.8	0.809	0.662	•	1.41	•
331	519.6	0.693	0.567	•	1.41	•
332	519.3	1.017	0.832	•	1.41	•
333	519	0.823	0.673	•	1.41	•
334	518.5	0.533	•	•	1.41	•
335	517.8	0.658	•	•	1.41	•
336	517.7	0.447	•	•	1.41	•
337	517.6	0.636	•	•	1.41	•
338	516.9	0.933	•	•	1.41	•
339	516.7	•	•	•	1.41	•
340	516.1	0.495	•	•	0.94	•
341	516	0.92	•	•	0.94	•
342	514.8	1.615	•	•	0.47	•
343	514.8	1.339	•	•	0.47	•
344	514.7	1.506	•	•	0.47	•
345	514.6	1.386	•	•	0.47	•
346	514.2	•	•	•	0.47	•
347	513.5	0.985	•	•	0.47	•
348	513.2	1.042	•	•	0.94	•
349	513.1	•	•	•	0.94	•
350	512.4	1.444	•	•	0.47	•
351	512.1	1.415	•	•	0.94	•
352	511.9	1.385	•	•	0.47	•
353	511.6	0.811	•	•	0.94	•
354	511.4	1.366	•	•	0.47	•
355	511.1	1.492	•	•	0.47	•
356	511	1.257	•	•	0.94	•
357	510.9	0.791	•	•	0.94	•
358	510.8	0.738	•	•	0.94	•
359	510.8	0.72	•	•	0.94	•
360	510.7	2.789	•	•	0.47	•
361	509.5	1.898	•	•	0.94	•
361.1	509.4	1.357	•	•	0	•
362	509.2	0.861	•	•	0.94	•
363	508.7	1.419	•	•	1.41	•
364	508.2	0.801	•	•	1.41	•
365	507.9	1.044	•	•	1.41	•
366	507.5	1.454	•	•	0.47	•
367	507.1	1.134	•	•	0.94	•
368	506.9	1.671	•	•	0.94	•
369	506	1.717	•	•	0.47	•
370	504.6	1.341	•	•	1.41	•
371	503.1	0.637	•	•	33.156	•
372	503	0.848	•	•	33.156	•
373	501	0.927	•	•	1.41	•
374	500.4	0.562	•	•	1.41	•
375	500.1	0.453	•	•	1.41	•
376	500	0.98	•	•	1.41	•
377	499.3	1.24	•	•	1.41	•
378	498.7	1.012	•	•	1.41	•
379	497.5	0.822	•	•	1.41	•
380	496.9	0.795	•	•	83.986	•
381	495.1	0.993	•	•	1.41	•
382	493.1	0.826	•	•	1.41	•
383	492.5	0.522	•	•	1.41	•
383.1	492.3	0.86	•	•	1.41	•
384	491.1	0.683	•	•	0.94	•
385	490.7	0.622	•	•	0.94	•
386	490.6	0.505	•	•	1.41	•
387	490.3	0.625	•	•	0.94	•
388	490.2	0.615	•	•	0.94	•

389	488.8	0.515	0.422	0.651	1.41	1.147
390	488.6	0.519	0.425	0.654	1.41	1.147
391	488.2	0.38	0.311	0.549	1.41	1.147
392	487.9	0.381	0.312	0.551	1.41	1.147
393	487.7	0.61	0.499	0.722	1.41	1.147
394	487.4	0.549	0.449	0.676	1.41	1.147
395	487	0.653	0.534	0.754	1.41	1.147
396	486.9	0.686	0.561	0.779	1.41	1.147
397	486.6	0.556	0.455	0.682	0.94	1.029
398	486.4	0.638	0.522	0.743	0.94	1.029
399	485.9	1.084	0.887	1.078	0.94	1.029
400	483.9	0.93	0.761	0.962	0.47	0.912
401	483.3	0.884	0.723	0.928	0.47	0.912
402	482.9	0.918	0.751	0.953	0.47	0.912
403	482.8	0.72	0.589	0.805	0.47	0.912
404	482.3	1.507	1.524	1.662	0.47	0.912
405	482.1	0.802	0.947	1.133	0.47	0.912
406	481.9	0.869	1.003	1.184	0.47	0.912
407	481.6	1.034	1.138	1.308	1.41	1.147
408	481.2	3.661	3.286	3.277	0.94	1.029
409	480.7	1.749	1.431	1.312	0.94	0.235
410	479.7	1.663	1.506	1.645	0.94	1.029
411	479.4	1.328	1.232	1.394	1.41	1.147
412	478.9	0.767	0.628	0.576	1.41	0.352
413	478.7	0.61	0.499	0.458	1.41	0.352
414	478.6	0.952	0.779	0.714	1.41	0.352
415	477.1	0.617	0.505	0.463	1.41	0.352
416	476.1	1.443	1.472	1.614	0	0.794
417	475.9	1.063	1.161	1.329	0	0.794
418	475.5	2.349	2.214	2.294	0	0.794
419	474.1	1.002	0.965	1.149	0.94	1.029
420	471.8	0.508	0.561	0.515	1.41	0.352
421	471.7	•	•	•	1.41	0.352
422	470.6	0.663	0.688	0.896	1.41	1.147
423	470.3	0.377	0.454	0.681	0.94	1.029
424	470.1	0.687	0.708	0.649	0.94	0.235
425	469.4	0.708	0.725	0.664	0.47	0.117
426	469.2	0.923	0.901	0.826	1.41	0.352
427	468.6	0.583	0.623	0.571	0.94	0.235
428	468.1	0.552	0.598	0.548	0.94	0.235
429	467.9	0.858	0.848	0.777	1.41	0.352
430	467.2	1.014	0.975	0.894	1.41	0.352
431	466.2	0.713	0.729	0.933	1.41	1.147
432	465.6	0.672	0.695	0.902	0.94	1.029
433	465.3	0.549	0.595	0.81	0.94	1.029
434	464.8	0.495	0.55	0.769	0.94	1.029
435	464.6	0.515	0.567	0.785	0.94	1.029
436	464.5	0.618	0.651	0.862	0.94	1.029
437	463.9	1.086	1.034	1.212	1.41	1.147
438	463.6	0.702	0.72	0.925	1.41	1.147
439	463.3	0.656	0.682	0.625	1.41	0.352
440	463.2	0.515	0.567	0.52	1.41	0.352
441	462.7	0.601	0.637	0.584	1.41	0.352
442	462.3	0.659	0.685	0.628	1.41	0.352
443	462.1	0.702	0.72	0.66	0.94	0.235
444	461.1	0.995	0.814	0.746	0.47	0.117
445	461	0.693	0.567	0.52	0.94	0.235
446	460.4	1.014	0.975	0.894	0.94	0.235
447	459.7	0.978	0.946	0.867	0.94	0.235
448	459.1	0.555	0.6	0.55	1.41	0.352
449	458.9	0.625	0.657	0.602	0.94	0.235
450	458.3	0.693	0.713	0.653	0.94	0.235
451	458.1	0.625	0.657	0.603	0.94	0.235
452	457.8	0.739	0.751	0.688	1.41	0.352
453	457.6	0.749	0.904	1.094	0.94	1.029
454	457.2	0.941	1.061	1.237	1.41	1.147
455	456.9	0.707	0.579	0.531	0.94	0.235

456	455.3	0.819	0.67	0.614	1.41	0.352
457	454.3	0.831	0.68	0.623	1.41	0.352
458	452.8	0.804	0.658	0.603	1.41	0.352
459	451.3	0.795	0.651	0.596	1.41	0.352
460	450.3	0.364	0.443	0.407	1.41	0.352
461	447.7	0.967	0.791	0.725	1.41	0.352
462	447.2	1.095	0.896	0.821	1.41	0.352
463	446.6	0.903	0.739	0.677	1.41	0.352
464	446.1	0.667	0.545	0.5	1.41	0.352
465	445.9	0.827	0.677	0.62	1.41	0.352
466	444.7	0.815	0.812	1.009	1.41	1.147
467	444.4	0.752	0.761	0.963	0.94	1.029
468	443.7	0.666	0.691	0.898	1.41	1.147
469	443.4	0.479	0.538	0.758	1.41	1.147
470	443	1.244	1.018	0.933	1.41	0.352
471	442.2	1.032	0.99	1.172	1.41	1.147
472	441.2	1.123	1.065	1.241	1.41	1.147
473	440.9	1.092	1.039	1.217	1.41	1.147
474	439.5	0.672	0.55	0.504	1.41	0.352
475	439.3	0.459	0.376	0.345	1.41	0.352
476	439	0.549	0.741	0.679	1.41	0.352
477	438.7	0.577	0.763	0.7	1.41	0.352
478	438.5	0.364	0.589	0.54	1.41	0.352
479	438.3	0.652	0.825	0.756	1.41	0.352
480	438.2	0.384	0.606	0.555	1.41	0.352
481	438	0.57	0.758	0.695	1.41	0.352
482	437.2	0.77	0.776	0.711	1.41	0.352
483	435.8	0.509	0.416	0.381	0.94	0.235
484	435.1	0.384	0.606	0.555	0.94	0.235
485	435	0.61	0.79	0.725	0.94	0.235
486	434.9	0.856	0.992	0.909	0.94	0.235
487	434.3	0.556	0.746	0.684	0.94	0.235
488	434.1	0.495	0.696	0.638	0.94	0.235
489	433.9	0.651	0.824	0.755	0.94	0.235
490	433.8	0.816	0.959	0.879	0.94	0.235
491	433.1	1.172	1.25	1.146	0.94	0.235
492	432	1.316	1.368	1.254	1.41	0.352
493	431.9	0.407	0.625	0.573	1.41	0.352
494	431.7	0.465	0.672	0.616	1.41	0.352
495	431.2	0.263	0.506	0.464	1.41	0.352
496	431.1	0.412	0.628	0.576	1.41	0.352
497	430.4	0.262	0.506	0.464	1.41	0.352
498	429.9	0.517	0.715	0.655	1.41	0.352
499	429	0.551	0.742	0.68	0.94	0.235
500	428.5	0.55	0.742	0.68	0.94	0.235
501	428.1	0.421	0.635	0.582	0.94	0.235
502	427.4	0.358	0.439	0.402	1.41	0.352
503	426.7	0.496	0.697	0.639	0.94	0.235
504	425.9	1.815	1.631	1.76	1.41	1.147
505	424	0.497	0.698	0.64	1.41	0.352
506	423.3	0.495	0.696	0.638	1.41	0.352
507	423.1	0.317	0.551	0.505	1.41	0.352
508	422.6	0.65	0.824	0.755	1.41	0.352
509	421.9	0.403	0.621	0.569	1.41	0.352
510	421.2	0.928	1.196	1.361	1.41	1.147
511	420.9	0.31	0.691	0.898	1.41	1.147
512	420.6	0.31	0.691	0.898	1.41	1.147
513	420.1	0.304	0.686	0.893	1.41	1.147
514	420	0.238	0.632	0.844	1.41	1.147
515	419.4	0.242	0.635	0.847	1.41	1.147
516	419.3	0.538	0.877	1.069	1.41	1.147
517	418.8	0.671	0.986	1.169	1.41	1.147
518	418.2	0.728	1.033	1.211	1.41	1.147
519	416.2	0.438	0.795	0.994	1.41	1.147
520	414.7	0.714	1.021	1.201	1.41	1.147
521	414.5	0.447	0.803	1	1.41	1.147
522	414.2	0.447	0.803	1.001	1.41	1.147

523	413.8	0.461	0.814	1.011	1.41	1.147
524	413.5	0.462	0.815	1.012	1.41	1.147
525	413.4	0.47	0.821	1.018	1.41	1.147
526	413.2	0.407	0.77	0.971	0	0.794
527	410.5	1.066	1.164	1.067	17.283	4.321
528	409.2	0.447	0.803	1.001	1.41	1.147
529	408.7	1.482	1.649	1.777	1.41	1.147
530	408	0.5	0.846	1.04	1.41	1.147
531	407.1	0.508	0.853	1.047	1.41	1.147
532	406	0.482	0.832	1.027	1.41	1.147
533	403.2	0.871	1.149	1.318	49.029	13.051
534	402.5	1.389	1.428	1.309	1.41	0.352
535	399.4	0.83	1.116	1.288	1.41	1.147
536	399.4	0.576	0.908	1.097	1.41	1.147
537	397.2	0.672	0.841	0.771	1.41	0.352
538	396.7	0.336	0.566	0.519	1.41	0.352
539	394.1	0.259	0.503	0.461	1.41	0.352
540	393.8	0.31	0.545	0.5	1.41	0.352
541	393.5	0.252	0.497	0.456	1.41	0.352
542	393.1	0.318	0.551	0.505	1.41	0.352
543	393	0.296	0.534	0.489	1.41	0.352
544	392.7	0.35	0.578	0.529	1.41	0.352
545	392.4	0.79	0.938	0.859	1.41	0.352
546	391.5	0.44	0.652	0.597	1.41	0.352
547	387.8	0.514	0.712	0.653	1.41	0.352
548	386.1	0.59	0.774	0.71	1.41	0.352
549	381.9	0.806	0.951	0.871	1.41	0.352
550	380.5	0.909	1.035	0.949	17.283	4.321
551	380.3	0.679	0.847	0.777	1.41	0.352
552	379.3	0.788	0.936	0.858	1.41	0.352
553	378.1	0.606	0.787	0.721	1.41	0.352
554	377.8	0.255	0.5	0.459	1.41	0.352
555	376.9	0.732	0.891	0.816	1.41	0.352
556	376.3	0.417	0.632	0.58	1.41	0.352
557	375.7	0.444	0.655	0.6	1.41	0.352
558	374.9	0.425	0.639	0.586	42.698	10.675
559	374.5	1.358	1.402	1.286	1.41	0.352
560	372.2	0.602	0.784	0.719	1.41	0.352
561	371.3	0.385	0.606	0.556	1.41	0.352
562	370.7	0.259	0.503	0.461	1.41	0.352
563	369.8	0.283	0.523	0.48	1.41	0.352
564	369.7	•	•	•	1.41	0.352
565	369.2	0.242	0.489	0.449	1.41	0.352
566	369	•	•	•	1.41	0.352
567	367.9	0.495	0.696	0.638	1.41	0.352
568	367.6	0.587	0.771	0.707	1.41	0.352
569	366.6	1.914	1.857	1.702	1.41	0.352
570	365.1	0.301	0.537	0.492	1.41	0.352
571	365	0.502	0.702	0.644	1.41	0.352
572	364.8	0.668	0.838	0.768	1.41	0.352
573	364.3	0.547	0.739	0.677	1.41	0.352
574	362.7	0.953	1.071	0.982	1.41	0.352
575	361.9	0.813	•	•	1.41	•
576	361	0.943	•	•	1.41	•
577	360.8	0.626	•	•	1.41	•
578	359.9	0.538	•	•	33.156	•
579	357.5	•	•	•	1.41	•
580	357.4	0.379	•	•	1.41	•
581	356.6	0.553	•	•	1.41	•
582	355	1.5	•	•	1.41	•
583	354.2	0.939	•	•	1.41	•
584	353.7	1.9	•	•	0.94	•
585	353.2	0.758	•	•	0.94	•
586	352.8	0.774	•	•	1.41	•
587	352.3	0.58	•	•	1.41	•
588	351.7	0.586	•	•	1.41	•
589	351.6	0.754	•	•	1.41	•

590	350.7	0.297	*	*	1.41		*
591	349.9	1.576	*	*	1.41		*
592	347.7	*	*	*	1.41		*
593	347.1	0.816	*	*	1.41		*
594	346.7	0.556	*	*	1.41		*
595	346.2	0.88	*	*	1.41		*
596	345.4	0.624	*	*	1.41		*
597	345	0.583	*	*	1.41		*
598	344.2	0.578	*	*	1.41		*
599	343.7	0.426	*	*	1.41		*
600	343.6	0.419	*	*	1.41		*
601	341.5	0.974	*	*	1.41		*
602	341.2	0.561	*	*	1.41		*
603	340.9	0.956	*	*	1.41		*
604	340.8	0.452	*	*	1.41		*
605	340.4	0.582	*	*	1.41		*
606	340	0.734	*	*	1.41		*
607	339.4	0.528	*	*	1.41		*
608	339.3	0.664	*	*	1.41		*
609	338.9	0.905	*	*	1.41		*
610	338.4	0.467	*	*	1.41		*
611	338.3	0.606	*	*	1.41		*
612	337.8	0.601	*	*	1.41		*
613	336.7	1.181	*	*	1.41		*
614	336.2	0.402	*	*	1.41		*
615	335.4	0.644	*	*	1.41		*
616	335.2	0.707	*	*	1.41		*
617	334	0.457	*	*	1.41		*
618	333	0.738	*	*	1.41		*
619	332.3	0.341	*	*	1.41		*
620	332.1	0.345	*	*	1.41		*
621	331.9	0.653	*	*	1.41		*
622	331	0.849	*	*	1.41		*
623	330.9	0.399	*	*	1.41		*
624	330.3	1.294	*	*	1.41		*
625	329.9	1.222	*	*	1.41		*
626	329.5	0.44	*	*	1.41		*
627	328.5	1.396	*	*	1.41		*
628	328.3	0.406	*	*	1.41		*
629	327.8	0.578	*	*	1.41		*
630	327.5	0.488	*	*	1.41		*
631	326.8	0.754	*	*	1.41		*
632	325.8	0.547	*	*	1.41		*
633	325.7	0.314	*	*	1.41		*
634	325	0.409	*	*	1.41		*
635	324.9	0.595	*	*	1.41		*
636	323.6	0.57	*	*	1.41		*
637	323.1	1.944	*	*	1.41		*
638	322.7	0.919	*	*	1.41		*
639	322.2	0.459	*	*	1.41		*
640	322	0.542	*	*	1.41		*
641	321.3	0.507	*	*	1.41		*
642	321.1	0.949	*	*	1.41		*
643	320.7	0.508	*	*	1.41		*
644	320.6	0.843	*	*	1.41		*
645	320	0.576	*	*	1.41		*
646	319.8	0.377	*	*	1.41		*
647	319.6	0.623	*	*	1.41		*
648	319.5	0.468	*	*	1.41		*
649	319.4	0.343	*	*	1.41		*
650	319	0.538	*	*	1.41		*
651	318.1	1.856	*	*	1.41		*
652	317.6	0.7	*	*	1.41		*
653	317.1	0.419	*	*	1.41		*
654	316.9	0.364	*	*	1.41		*
655	316.5	0.685	*	*	1.41		*
656	316.4	0.607	*	*	1.41		*

657	316.1	0.842	*	*		1.41	*
658	315	0.482	*	*		1.41	*
659	314.4	0.711	*	*		1.41	*
660	313.9	1.994	*	*		0.94	*
661	313.2	0.468	*	*		1.41	*
662	312.9	0.815	*	*		1.41	*
663	312.7	0.872	*	*		1.41	*
664	312.2	0.29	*	*		1.41	*
665	311.2	0.853	*	*		1.41	*
666	311.2	0.273	*	*		1.41	*
667	311.1	0.356	*	*		1.41	*
668	310.9	0.469	*	*		1.41	*
669	310.5	0.918	*	*		1.41	*
670	310.3	2.009	*	*		43.559	*
671	309.3	0.748	*	*		1.41	*
672	308.9	0.996	*	*		1.41	*
673	308.7	0.367	*	*		1.41	*
674	308.3	0.351	*	*		1.41	*
675	308.3	0.407	*	*		1.41	*
676	308.2	0.454	*	*		1.41	*
677	307.9	0.367	*	*		1.41	*
678	307.5	0.435	*	*		1.41	*
679	307.1	0.394	*	*		1.41	*
680	306.7	0.29	*	*		1.41	*
681	306.4	0.307	*	*		1.41	*
682	306.3	0.694	*	*		1.41	*
683	305.1	0.79	*	*		1.41	*
684	304.6	0.523	*	*		1.41	*
685	304.5	0.324	*	*		1.41	*
686	304.5	1.013	*	*		0.94	*
687	304.1	1.066	*	*		1.41	*
688	303.6	0.41	*	*		1.41	*
689	302.8	0.355	*	*		1.41	*
690	302.5	0.392	*	*		1.41	*
691	302	0.542	*	*		1.41	*
692	301.7	0.399	*	*		1.41	*
693	301.3	0.327	*	*		1.41	*
694	300.7	0.867	*	*		1.41	*
695	300.3	0.457	*	*		1.41	*
696	300	0.583	*	*		1.41	*
697	299.4	0.81	*	*		0.94	*
698	298.8	0.382	*	*		1.41	*
699	298.3	0.64	*	*		1.41	*
700	297.7	0.62	*	*		1.41	*
701	297	1.228	*	*		1.41	*
702	296.4	*	*	*		1.41	*
703	296.1	0.89	*	*		1.41	*
704	295.7	0.76	*	*		1.41	*
705	295.4	0.999	*	*		1.41	*
706	294.9	0.451	*	*		1.41	*
707	294.3	0.96	*	*		1.41	*
708	293.7	*	*	*		1.41	*
709	293.1	0.426	*	*		1.41	*
710	292.4	0.494	*	*		1.41	*
711	292.1	0.548	*	*		1.41	*
712	291.6	0.535	*	*		1.41	*
713	291.3	0.408	*	*		1.41	*
714	291.2	0.588	*	*		0.94	*
715	291.1	0.735	*	*		1.41	*
716	290.7	0.384	*	*		1.41	*
717	290.5	0.61	*	*		1.41	*
718	290.3	0.741	*	*		1.41	*
719	289.6	1.004	*	*		1.41	*
720	289.3	0.82	*	*		1.41	*
721	289.2	0.447	*	*		1.41	*
722	289.1	0.583	*	*		0.94	*
723	288.4	0.853	*	*		0.94	*

724	288.4	0.658	*	*	0.94	*
725	287.8	0.446	*	*	0	*
726	287.6	0.631	*	*	0	*
727	287.3	0.385	*	*	0	*
728	286.7	0.6	*	*	0	*
729	286.3	0.462	*	*	0	*
730	286.1	0.401	*	*	0	*
731	286	0.658	*	*	0	*
732	285.6	0.714	*	*	0	*
733	285.5	0.843	*	*	0	*
734	285.4	0.592	*	*	0	*
735	285.3	0.405	*	*	0	*
736	285	0.73	*	*	0	*
737	284.6	0.775	*	*	0	*
738	284.1	0.364	*	*	0	*
739	283.9	0.521	*	*	0	*
740	283.6	0.865	*	*	0	*
741	283	0.775	*	*	0	*
742	282.7	0.514	*	*	0	*
743	282.5	0.384	*	*	0	*
744	281.3	0.6	*	*	0	*
745	281	0.552	*	*	0	*
746	280.6	0.535	*	*	0	*
747	280.3	0.48	*	*	0	*
748	279.8	0.581	*	*	0	*
749	279.7	0.529	*	*	0	*
750	278.1	0.493	*	*	0	*
751	277.8	0.712	*	*	0	*
752	275.4	0.486	*	*	0	*
753	273.2	1.131	1.217	*	0	*
754	272.9	0.482	0.686	*	0	*
755	272.5	0.567	0.755	*	0	*
756	272	0.775	0.926	*	0	*
757	271.6	0.68	0.848	*	0	*
758	271.3	0.711	0.873	*	0	*
759	271.1	3.299	2.99	*	0	*
760	268.8	1.642	1.635	*	0	*
761	256.6	2.143	*	*	0	*
762	256.3	2.655	2.464	*	0	*
763	256	1.107	1.197	*	0	*
764	255.7	0.959	1.076	*	0	*
765	255.5	1.044	1.146	*	0	*
766	255.1	1.223	1.292	*	0	*
767	255	1.002	1.112	*	0	*
768	254.5	1.298	1.353	*	0	*
769	254.3	1.15	1.233	*	0	*
770	252	*	*	*	0	*
771	251.9	2.746	2.538	*	0	*
772	251.5	1.161	1.241	*	0	*
773	251.1	2.157	2.056	*	0	*
774	250.9	2.134	2.037	*	0	*
775	250.6	2.139	2.042	*	0	*
776	250.4	1.874	1.825	*	0	*
777	250.3	1.791	1.757	*	0	*
778	250.2	2.208	2.098	*	0	*
779	249.5	3.097	2.825	*	0	*
780	249	2.223	2.11	*	0	*
781	248.7	2.348	2.213	*	0	*
782	248.6	1.668	1.656	*	0	*
783	247.8	1.804	1.767	*	0.47	*
784	247.6	2.454	2.299	*	0	*
785	247	1.858	1.811	*	0	*
786	246.5	1.986	1.916	*	0	*
787	246.2	1.011	1.119	*	0	*
788	246.1	1.429	1.46	*	0	*
789	245.2	3.251	2.951	*	0	*
790	244.1	1.779	1.747	*	0	*

Appendix 3b

791	244	2.031	1.953	*	0	*
792	243.6	1.549	1.558	*	0	*
793	243	1.169	1.248	*	0	*
794	242.8	1.598	1.599	*	0	*
795	242.5	1.949	1.886	*	0	*
796	242.1	1.451	1.478	*	0.94	*
797	241.9	1.188	1.263	*	0.94	*
798	241.5	1.744	1.719	*	0	*
799	240.7	0.617	*	*	1.41	*
800	240.5	0.843	*	*	0.94	*
801	239.5	0.768	*	*	0.94	*
802	239.3	0.899	*	*	0.94	*
803	238.6	1.07	*	*	0.94	*
804	237.9	0.486	*	*	1.41	*
805	237.7	1.393	*	*	0.94	*
806	237.5	0.472	*	*	1.41	*
807	237.2	0.568	*	*	0.94	*
808	237.1	0.83	*	*	0.94	*
809	237	0.973	*	*	0.94	*
810	236.5	0.784	*	*	0.94	*
811	235.9	0.496	*	*	1.41	*
812	235.9	1.021	*	*	0.94	*
813	235.2	1.987	*	*	0.47	*
814	234.4	1.027	*	*	0.94	*
815	234.2	1.044	*	*	0.94	*
816	234.1	1.679	*	*	0.94	*
817	233.4	1.603	*	*	1.41	*
818	232.7	2.29	*	*	0.47	*
819	232.4	1.343	*	*	1.41	*
820	231.6	2.227	2.114	*	0.94	*
821	231.5	1.901	1.847	*	0	*
822	230.9	1.952	1.889	*	0.47	*
823	230.9	1.822	1.782	*	0.94	*
824	229	1.798	1.762	*	0	*
825	228.7	1.833	1.791	*	0	*
826	228.6	2.544	2.373	*	0	*
827	222.3	2.243	2.127	*	0	*
828	221.9	1.981	1.912	*	0	*
829	221.4	1.838	1.795	*	0	*
830	221.3	1.838	1.795	*	0	*
831	221.1	1.968	1.902	*	0	*
832	221	*	*	*	0	*
833	220.7	2.967	2.719	*	0	*
834	219.2	4.171	3.704	*	1.41	*
835	214.4	3.042	*	*	0	*
836	213.7	3.588	*	*	0	*
837	204.8	2.346	*	*	41.288	*
838	204.2	1.362	*	*	0	*
839	202.3	1.807	*	*	0	*
840	202	1.474	*	*	0	*
841	201.7	1.698	*	*	0.47	*
842	201.3	2.004	*	*	0	*
843	200.3	1.23	*	*	0	*
844	200	1.927	*	*	0	*
845	199.7	2.505	*	*	0.47	*
846	199.5	0.76	*	*	1.41	*
847	198.9	1.486	*	*	0.94	*
848	198.2	1.094	*	*	0	*
849	107.8	1.97	*	*	0	*
850	194.9	2.026	*	*	0	*
851	194.7	1.163	*	*	0	*
852	193.7	0.862	*	*	0	*
853	192.4	1.391	*	*	0	*
854	191.7	1.946	*	*	0	*
855	188.6	0.829	*	*	0.94	*
856	187	1.377	*	*	0	*
857	186.6	1.594	*	*	0	*

858	184.9	2.789	*	*	0.47	*
859	183.9	1.573	*	*	0	*
860	182.1	2.173	*	*	0	*
861	180.2	1.101	*	*	0	*
862	180	1.138	*	*	0	*
863	179.6	0.56	*	*	0	*
864	179.2	0.985	*	*	0	*
865	179	1.138	*	*	0	*
866	177.7	1.007	*	*	0	*
867	177.3	1.081	*	*	0	*
868	174.6	2.27	*	*	1.41	*
869	174	1.087	*	*	1.41	*
870	173.4	2.074	*	*	0.47	*
871	171.9	0.625	*	*	0	*
872	171.4	2.005	*	*	0	*
873	170.8	1.188	*	*	0	*
874	170.7	1.576	*	*	0	*
875	169.2	2.723	*	*	0	*
876	169.1	2.064	*	*	0	*
877	168.7	3.091	*	*	0	*
878	167.5	2.328	*	*	0	*
879	166	2.198	*	*	0	*
880	165.6	1.993	*	*	0	*
881	165.2	2.835	*	*	0	*
882	165.1	1.508	*	*	0	*
883	164.9	1.203	*	*	0	*
884	164.2	3.07	*	*	0	*
885	162.7	2.469	*	*	0	*
886	162.6	0.701	*	*	0	*
887	161.3	1.484	*	*	0	*
888	160.1	0.824	*	*	0.94	*
889	159.4	0.495	*	*	0.94	*
890	158.6	0.667	*	*	0.47	*
891	157.8	0.364	*	*	1.41	*
892	156.5	0.35	*	*	1.41	*
893	156.4	0.35	*	*	1.41	*
894	155.9	0.35	*	*	1.41	*
895	154.5	0.35	*	*	1.41	*
896	152.5	0.804	*	*	49.029	*
897	150.7	0.35	*	*	1.41	*
898	150.4	0.35	*	*	1.41	*
899	148.9	0.716	*	*	1.41	*
900	148.6	0.484	*	*	1.41	*
901	148.5	0.477	*	*	1.41	*
902	148.1	0.618	*	*	1.41	*
903	147.5	0.516	*	*	1.41	*
904	147.1	0.472	*	*	1.41	*
905	146.9	*	*	*	1.41	*
906	143.1	0.608	*	*	0	*
907	141.6	0.808	*	*	1.41	*
908	138.7	2.47	*	*	1.41	*
909	137.4	0.587	*	*	1.41	*
910	136.1	0.735	*	*	1.41	*
911	135.5	0.515	*	*	1.41	*
912	135.4	0.626	*	*	1.41	*
913	134.8	0.98	*	*	1.41	*
914	132.6	1.146	*	*	0.47	*
915	132.4	0.897	*	*	0.94	*
916	132	0.828	*	*	1.41	*
917	131.9	1.583	*	*	0	*
918	129.6	1.67	*	*	0	*
919	128	2.15	*	*	0	*
920	126.3	2.205	*	*	0	*
921	125.7	1.178	*	*	0.94	*
922	125.3	1.321	*	*	1.41	*
923	124.8	0.946	*	*	0.94	*
924	124.2	0.697	*	*	1.41	*

925	124	0.685	*	*	1.41	*
926	123.8	0.684	*	*	1.41	*
927	123.6	0.706	*	*	1.41	*
928	123.2	1.025	*	*	1.41	*
929	119.6	1.501	*	*	0.94	*
930	119.6	1.349	*	*	0.94	*
931	119.1	0.94	*	*	1.41	*
932	117.9	1.172	*	*	1.41	*
933	117.2	2.032	*	*	0.47	*
934	117.1	2.405	*	*	0.94	*
935	117	1.775	*	*	0	*
936	116.6	0.909	*	*	1.41	*
937	115.5	2.079	*	*	32.686	*
938	115	1.366	*	*	1.41	*
939	113	2.152	*	*	0	*
940	112.2	2.03	*	*	0	*
941	111.2	2.685	*	*	0	*
942	110.2	2.861	*	*	0	*
943	109.3	2.474	*	*	0	*
944	108.4	2.194	*	*	0	*
945	107.1	0.746	*	*	0	*
946	105.8	1.762	*	*	0	*
947	104.3	1.838	*	*	0	*
948	104.2	2.244	*	*	0	*
949	102.4	1.857	*	*	0	*
950	100.7	1.929	1.724	*	0	*
951	98.4	2.304	2.031	*	0	*
952	98.1	1.73	1.561	*	0	*
953	97.7	1.814	1.63	*	0	*
954	97.5	0.82	0.817	*	0.94	*
955	97.2	1.276	1.19	*	1.41	*
956	96.8	1.091	1.038	*	1.41	*
957	96.6	1.688	1.527	*	1.41	*
958	95.8	2.453	2.152	*	0.94	*
959	95.3	0.952	0.924	*	0.94	*
960	95	1.068	1.02	*	0	*
961	92.8	1.384	1.278	*	115.732	*
962	91.7	0.35	0.432	*	1.41	*
963	91.1	0.694	0.713	*	115.732	*
964	90.1	0.549	0.595	*	1.41	*
965	89.8	0.493	0.549	*	1.41	*
966	89.7	0.596	0.633	*	1.41	*
967	88.7	0.619	0.652	*	1.41	*
968	88.6	0.66	0.686	*	1.41	*
969	87.5	1.31	1.218	*	1.41	*
970	86.9	1.173	1.105	*	1.41	*
971	86.3	0.942	0.917	*	1.41	*
972	85.3	0.745	0.755	*	1.41	*
973	84.6	0.597	0.634	*	1.41	*
974	83	0.946	0.774	*	1.41	*
975	81.1	0.531	0.58	*	1.41	*
976	80.6	0.563	0.607	*	1.41	*
977	79.9	0.877	0.863	*	1.41	*
978	78.1	0.488	0.545	*	1.41	*
979	78	0.433	0.5	*	1.41	*
980	77.6	0.866	0.854	*	1.41	*
981	76.6	0.399	0.472	*	1.41	*
982	74.8	0.638	0.668	*	0.94	*
983	74.6	0.482	0.54	*	0.94	*
984	72.9	0.973	0.942	*	1.41	*
985	71.9	1.359	1.258	*	1.41	*
986	71	1.526	1.394	*	1.41	*
987	70.2	1.258	1.175	*	1.41	*
988	69.7	1.003	0.966	*	1.41	*
989	69.3	0.564	0.607	*	1.41	*
990	67.4	0.952	0.925	*	1.41	*
991	67	0.736	0.748	*	0.94	*

992	66.1	0.974	0.797	*	1.41	*
993	65.5	0.476	0.389	*	1.41	*
994	65.4	0.528	0.578	*	1.41	*
995	64	0.365	0.444	*	1.41	*
996	63.1	0.275	0.371	*	1.41	*
997	61.2	0.207	0.315	*	1.41	*
998	59.4	0.338	0.422	*	0.94	*
999	51.4	0.657	0.683	*	1.41	*
1000	49.4	0.336	0.421	*	1.41	*
1001	44.9	0.282	0.377	*	1.41	*
1002	44	0.44	0.505	*	1.41	*
1003	43.9	0.311	0.4	*	1.41	*
1004	43.7	1.311	1.218	*	1.41	*
1005	37.9	0.272	0.368	*	1.41	*
1006	35.7	0.343	0.426	*	1.41	*
1007	33.2	0.632	0.663	*	1.41	*
1008	32.7	0.79	0.792	*	1.41	*
1009	25.6	0.921	0.899	*	1.41	*
1010	25.3	0.801	0.801	*	1.41	*
1011	25	0.371	0.449	*	1.41	*
1012	24.7	0.541	0.588	*	1.41	*
1013	23.4	0.481	0.393	*	58.571	*
1014	23	0.207	0.17	*	1.41	*
1015	22.4	0.207	0.17	*	1.41	*
1016	20.3	0.207	0.315	*	1.41	*
1017	19.9	0.207	0.17	*	1.41	*
1018	19.3	0.207	0.17	*	1.41	*
1019	17.2	0.329	0.269	*	1.41	*
1020	16.7	0.329	0.269	*	1.41	*
1021	16.6	0.329	0.269	*	1.41	*
1022	16.1	0.329	0.269	*	1.41	*
1023	9.1	0.645	0.674	*	131.605	*
1024	7.7	0.35	0.286	*	1.41	*
1025	6.1	0.673	0.551	*	49.029	*
1026	5.4	0.634	0.665	*	0.94	*
1027	5	0.667	0.692	*	1.41	*
1028	3.1	1.352	1.252	*	1.41	*

Appendix 3c: Listings of combined conservation value and approach hazard indices for each pipeline route stream crossing.				
* = no data available CV = Conservation value AH = Approach Hazard See text for details of indices.				
Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
1	721.7	2.852	2.529	2.407
2	720.5	2.827	2.508	2.388
3	720.2	2.888	2.558	2.434
4	719.6	2.142	1.948	1.875
5	719.4	2.269	2.051	1.97
6	717.3	1.715	2.009	1.919
7	716.8	1.989	2.233	2.125
8	710.3	2.841	2.956	2.799
9	709.6	2.766	2.895	2.743
10	709.1	2.382	2.581	2.455
11	709	2.289	2.505	2.385
12	708.7	2.567	2.732	2.594
13	708.6	2.386	2.584	2.458
14	708.5	2.06	2.317	2.214
15	708.4	2.741	2.875	2.724
16	705.8	2.192	2.425	2.312
17	705.2	2.261	2.044	1.963
18	701.3	3.605	3.049	2.841
19	701.1	1.615	1.858	1.749
20	700.8	1.65	1.887	1.775
21	699.7	2.695	2.742	2.559
22	697.5	2.368	2.474	2.314
23	697.1	2.115	2.268	2.124
24	696.6	1.529	1.788	1.685
25	696.4	1.558	1.812	1.706
26	696.3	1.474	1.743	1.643
27	696.2	1.734	1.956	1.839
28	696.1	1.576	1.826	1.72
29	695.8	1.605	1.85	1.742
30	695.7	1.634	1.874	1.764
31	695.5	1.421	1.7	1.604
32	695.4	2.217	2.351	2.201
33	695.2	1.7	1.928	1.813
34	695.1	3.092	3.067	2.857
35	694.3	1.512	1.774	1.672
36	693	2.347	2.486	2.338
37	692.7	1.082	1.451	1.389
38	692.2	1.054	1.428	1.368
39	691.9	1.32	1.209	1.167
40	691.2	1.252	1.153	1.116
41	690.9	1.222	1.129	1.094
42	690.4	1.419	1.29	1.241
43	690	1.281	1.177	1.138
44	689.1	1.888	1.673	1.593
45	687.7	2.187	1.918	1.818
46	686.7	1.521	1.373	1.317
46.1	686.4	1.105	1.033	1.006
47	686.2	1.241	1.144	1.108
48	685.4	1.18	1.094	1.062
49	684.8	1.364	1.258	1.218
50	684.6	1.48	1.353	1.305
51	684	1.904	1.7	1.624
52	683.6	2.124	1.894	1.807
53	683.1	1.231	1.149	1.119
54	682.5	1.754	1.59	1.529
55	682.3	1.314	1.23	1.199
56	681.8	2.019	1.833	1.763
57	681.5	1.222	1.154	1.129
58	680.9	1.203	1.139	1.115

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
59	680.7	1.203	1.139	1.115
60	680.2	2.044	1.853	1.782
61	679.6	1.68	1.555	1.508
62	678.7	1.75	1.586	1.525
63	677.7	2.769	2.421	2.29
64	676.7	2.127	2.332	2.209
65	676.6	1.972	2.205	2.093
66	676.4	3.38	3.357	3.149
67	676.2	3.262	3.261	3.06
68	675.9	2.19	2.355	2.216
69	675.7	2.346	2.482	2.333
70	675	2.504	2.175	2.051
71	674.8	1.221	1.125	1.089
72	674.7	1.581	1.42	1.359
73	674.4	1.375	1.251	1.205
74	674.3	1.35	1.231	1.186
75	673.8	1.435	1.3	1.249
76	673.6	1.351	1.231	1.186
77	673.5	1.622	1.453	1.389
78	673.4	1.322	1.208	1.165
79	673.2	1.428	1.295	1.244
80	673	1.785	1.587	1.512
81	672.7	1.323	1.208	1.165
82	672	1.667	1.489	1.423
83	671.1	2.148	2.029	1.918
84	670.9	1.859	1.673	1.868
85	670.5	1.12	1.043	1.278
86	670.2	2.081	1.855	2.035
87	669.6	2.381	2.074	1.959
88	669	1.287	1.179	1.138
89	668.3	2.659	2.327	2.203
90	668.2	1.857	1.671	1.602
91	667.9	2.861	2.466	2.319
92	667.2	3.149	2.703	2.535
93	666.4	1.28	1.174	1.133
94	666.2	2.221	1.943	1.839
95	665.7	2.359	2.493	2.343
96	665.6	3.077	3.08	2.881
97	664.6	3.71	3.598	3.356
98	664.1	3.576	3.197	2.988
99	663.7	3.535	3.018	3.089
100	663.4	2.494	2.166	2.308
101	663.1	1.501	1.354	1.564
102	662.9	1.434	1.299	1.513
103	662.8	1.776	1.579	1.77
104	662.4	1.708	1.669	1.588
105	662.2	1.365	1.389	1.331
106	661.9	1.349	1.229	1.449
107	661.6	1.488	1.344	1.554
108	661.2	1.213	1.118	1.348
109	660.9	1.947	1.745	1.934
110	660.8	1.073	1.004	0.978
111	660.4	2.16	1.919	1.829
112	659.9	2.155	1.889	1.79
113	659.7	1.228	1.13	1.094
114	659.4	2.512	2.207	2.093
115	658.7	1.439	1.303	1.517
116	658.4	2.707	2.341	2.468
117	658	2.84	2.449	2.568
118	655.5	1.516	1.657	1.577
119	655.3	1.751	1.876	1.789
120	655	1.131	1.051	1.286
121	654.8	1.239	1.14	1.367
122	654.6	1.207	1.114	1.343
123	654.3	1.762	1.859	1.762

Appendix 3c

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
124	654	1.285	1.469	1.404
125	653.3	1.664	1.487	1.686
126	653	1.351	1.523	1.454
127	652.9	1.476	1.625	1.547
128	652.5	1.015	0.956	0.934
129	652.4	1.486	1.368	1.323
129.1	651.8	1.27	1.165	1.125
130	651.3	1.419	1.287	1.237
131	650.8	1.665	1.779	1.689
132	650.3	2.136	2.165	2.042
133	650.1	1.84	1.922	1.82
134	649.8	1.623	1.745	1.658
135	649.3	2.22	2.233	2.105
136	648.8	2.034	2.081	1.966
137	648.1	1.958	2.019	1.909
138	647.9	1.03	1.26	1.213
139	647.7	1.56	1.694	1.61
140	647.2	1.309	1.197	1.155
141	646.9	1.559	1.401	1.342
142	646.8	1.705	1.521	1.452
143	646.4	1.725	1.829	1.734
144	645.9	1.549	1.684	1.602
145	645.8	1.416	1.576	1.502
146	645.3	1.182	1.385	1.327
147	645	1.473	1.331	1.278
148	644.5	1.465	1.325	1.272
149	644.4	1.307	1.195	1.418
150	644.3	1.575	1.415	1.619
151	643.7	1.875	1.66	1.844
152	642.8	1.175	1.088	1.319
153	642.3	1.171	1.084	1.316
154	641.7	1.357	1.236	1.455
155	641.3	1.056	0.99	1.23
156	641.1	1.597	1.459	1.672
157	639.9	1.179	1.091	1.322
158	639.6	1.036	0.974	1.215
159	638.8	2.017	1.803	1.987
160	637.2	2.885	2.486	2.602
161	636.5	2.453	2.105	2.239
162	636	2.563	2.223	2.36
163	635.4	3.271	2.974	3.06
164	634.2	*	*	*
165	633.3	2.156	1.89	2.055
166	631.8	1.775	1.578	1.769
167	631.2	2.136	1.874	2.04
168	629.3	1.492	1.493	1.691
169	628.2	3.317	2.84	2.926
170	622.1	2.716	2.362	2.494
171	622	1.803	1.615	1.809
172	606.4	3.315	*	*
173	603.6	3.039	*	*
174	601.6	3.786	*	*
175	601.3	4.265	*	*
176	598.6	3.891	*	*
177	597.4	2.94	*	*
178	597.1	1.865	*	*
179	596.8	*	*	*
180	596.2	2.016	*	*
181	595.9	2.997	*	*
182	592.7	1.807	*	*
183	592.4	2.789	*	*
184	588.4	1.385	*	*
185	587.9	1.577	*	*
186	587.5	1.594	*	*
187	581.5	2.426	2.17	*

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
188	578.9	2.35	2.065	*
189	578.4	2.902	2.488	*
190	578.1	2.941	2.52	*
191	577.7	*	*	*
192	577.3	3.302	2.816	*
193	577.1	2.361	2.046	*
194	575.7	1.396	1.402	*
195	575.3	1.472	1.465	*
196	575	1.511	1.496	*
197	574.5	2.42	2.24	*
198	573.7	1.322	1.341	*
199	573.5	2.434	2.252	*
200	572.6	1.168	1.216	*
201	572.1	1.691	1.614	*
202	569.4	2.407	2.2	*
203	568.9	1.252	1.401	*
204	568.8	1.163	1.328	*
205	568.5	1.255	1.403	*
206	567.7	2.165	2.148	*
207	567.5	1.784	1.836	*
208	567	2.588	2.494	*
209	566.7	2.04	2.046	*
210	566.2	1.493	1.598	*
211	566	1.28	1.424	*
212	565.8	2.831	2.75	*
213	565.4	1.293	1.289	*
214	565.2	*	*	*
215	564.9	1.484	1.445	*
216	564.4	1.063	1.087	*
217	564.2	1.105	1.121	*
218	564.1	0.94	0.987	*
219	564	0.851	0.913	*
220	563.7	1.235	1.228	*
221	563.6	1.086	1.106	*
222	563.4	1.592	1.52	*
223	562.7	2.249	2.057	*
224	562.3	1.895	1.914	*
225	562.2	0.991	1.174	*
226	562.1	1.016	1.195	*
227	561.8	1.844	1.872	*
228	561.7	1.082	1.249	*
229	561.4	1.042	1.216	*
230	560.7	1.407	1.369	*
231	560.5	0.913	0.965	*
232	560.4	1.369	1.338	*
233	559.8	0.856	0.918	*
234	559.4	1.002	1.329	*
235	559.3	1.669	1.874	*
236	558.7	1.522	1.754	*
237	558.5	1.652	1.861	*
238	558.1	1.751	1.941	*
239	557.8	3.572	3.475	*
240	556.9	1.262	1.541	*
241	556.2	1.469	1.711	*
242	555.9	1.164	1.461	*
243	555.5	1.37	1.63	*
244	554.6	1.209	1.498	*
245	554.5	1.289	1.564	*
246	554.2	1.512	1.746	*
247	553.8	1.549	1.776	*
248	553.5	1.29	1.564	*
249	553.2	1.043	1.362	*
250	553.1	1.101	1.41	*
251	552.7	0.989	1.318	*
252	552.3	1.057	1.374	*

Appendix 3c

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
253	552.1	1.473	1.714	*
254	551.1	2.17	2.284	*
255	551	1.385	1.642	*
256	550.8	1.392	1.648	*
257	550.6	1.475	1.716	*
258	550.2	1.507	1.742	*
259	550.1	1.681	1.884	*
260	549.9	1.969	2.12	*
261	549.7	1.941	1.805	*
262	548.2	1.62	1.543	*
263	547.7	*	*	*
264	547.4	0.773	0.85	*
265	547.3	0.73	0.815	*
266	547.2	*	*	*
267	546.7	1.198	1.216	*
268	546	0.975	1.015	*
269	546	0.885	0.941	*
270	545.2	1.16	1.167	*
271	545.2	1.687	1.598	*
272	544.6	3.316	2.93	*
273	543.8	2.565	2.316	*
274	543.4	2.017	1.867	*
275	543.3	1.467	1.417	*
276	542.5	1.032	1.062	*
277	542.1	0.951	0.996	*
278	541.9	1.01	1.044	*
279	541.4	1.734	1.636	*
280	541.3	0.843	0.907	*
281	540.2	*	*	*
282	540.1	0.816	0.739	*
283	539.7	0.79	0.718	*
284	539.3	0.929	0.832	*
285	539	1.355	1.181	*
286	538.5	0.84	0.759	*
287	538.1	0.943	0.989	*
288	537.7	0.824	0.891	*
289	537.4	0.904	0.957	*
290	536.8	0.736	0.819	*
291	536.7	0.664	0.761	*
292	536.2	0.804	0.875	*
293	535.8	1.099	1.117	*
294	535.5	0.848	0.911	*
295	535.1	0.654	0.752	*
296	535	1.406	1.222	*
297	532.3	3.356	2.909	*
298	532	1.495	1.369	*
299	530.5	1.275	1.189	*
300	530.3	1.502	1.375	*
301	529.9	1.196	1.27	*
302	529.8	1.292	1.349	*
303	529.6	1.771	1.74	*
304	529.1	2.253	2.135	*
305	528.2	1.552	1.561	*
306	528.1	1.393	1.431	*
307	528	1.57	1.576	*
308	527.4	2.232	2.118	*
309	527.2	1.557	1.565	*
310	527	1.331	1.38	*
311	526.7	1.417	1.305	*
312	526.5	1.46	1.341	*
313	525.6	2.102	1.866	*
314	525.5	1.419	1.307	*
315	525.4	1.843	1.654	*
316	524.5	2.291	2.02	*
317	524.1	2.813	2.447	*

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
318	523.1	2.373	2.088	*
319	522.8	2.353	2.071	*
320	522.3	1.882	1.686	*
321	522	1.457	1.338	*
322	521.5	1.57	1.43	*
323	521.2	1.474	1.352	*
324	520.8	1.385	1.279	*
325	520.7	1.983	1.768	*
326	520.4	1.31	1.218	*
327	520.1	1.429	1.315	*
328	520.1	1.32	1.226	*
329	520	1.419	1.307	*
330	519.8	1.611	1.464	*
331	519.6	1.495	1.369	*
332	519.3	1.818	1.633	*
333	519	1.624	1.475	*
334	518.5	0.785	*	*
335	517.8	0.91	*	*
336	517.7	0.699	*	*
337	517.6	0.888	*	*
338	516.9	1.185	*	*
339	516.7	*	*	*
340	516.1	0.747	*	*
341	516	1.172	*	*
342	514.8	1.867	*	*
343	514.8	1.591	*	*
344	514.7	1.758	*	*
345	514.6	1.638	*	*
346	514.2	*	*	*
347	513.5	1.237	*	*
348	513.2	1.294	*	*
349	513.1	*	*	*
350	512.4	1.696	*	*
351	512.1	1.667	*	*
352	511.9	1.637	*	*
353	511.6	1.063	*	*
354	511.4	1.618	*	*
355	511.1	1.744	*	*
356	511	1.509	*	*
357	510.9	1.043	*	*
358	510.8	0.99	*	*
359	510.8	0.972	*	*
360	510.7	3.041	*	*
361	509.5	2.15	*	*
361.1	509.4	1.609	*	*
362	509.2	1.113	*	*
363	508.7	1.671	*	*
364	508.2	1.053	*	*
365	507.9	1.296	*	*
366	507.5	1.706	*	*
367	507.1	1.386	*	*
368	506.9	1.923	*	*
369	506	1.969	*	*
370	504.6	1.593	*	*
371	503.1	0.889	*	*
372	503	1.1	*	*
373	501	1.179	*	*
374	500.4	0.814	*	*
375	500.1	0.705	*	*
376	500	1.232	*	*
377	499.3	1.492	*	*
378	498.7	1.264	*	*
379	497.5	1.074	*	*
380	496.9	1.146	*	*
381	495.1	1.245	*	*

Appendix 3c

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
382	493.1	1.078	*	*
383	492.5	0.774	*	*
383.1	492.3	1.112	*	*
384	491.1	0.935	*	*
385	490.7	0.874	*	*
386	490.6	0.757	*	*
387	490.3	0.877	*	*
388	490.2	0.867	*	*
389	488.8	0.767	0.674	0.903
390	488.6	0.771	0.677	0.906
391	488.2	0.632	0.563	0.801
392	487.9	0.633	0.564	0.803
393	487.7	0.862	0.751	0.974
394	487.4	0.801	0.701	0.928
395	487	0.905	0.786	1.006
396	486.9	0.938	0.813	1.031
397	486.6	0.808	0.707	0.934
398	486.4	0.89	0.774	0.995
399	485.9	1.336	1.139	1.33
400	483.9	1.63	1.461	1.663
401	483.3	1.584	1.424	1.628
402	482.9	1.618	1.451	1.654
403	482.8	1.421	1.29	1.505
404	482.3	2.208	2.225	2.363
405	482.1	1.502	1.648	1.834
406	481.9	1.57	1.703	1.885
407	481.6	2.283	2.386	2.556
408	481.2	4.361	3.987	3.978
409	480.7	2.45	2.132	2.013
410	479.7	2.363	2.207	2.346
411	479.4	2.028	1.933	2.095
412	478.9	1.468	1.329	1.276
413	478.7	1.311	1.2	1.158
414	478.6	1.652	1.479	1.414
415	477.1	1.317	1.205	1.163
416	476.1	2.956	2.986	3.128
417	475.9	2.577	2.675	2.843
418	475.5	3.863	3.727	3.808
419	474.1	2.516	2.479	2.663
420	471.8	2.022	2.075	2.028
421	471.7	*	*	*
422	470.6	2.177	2.202	2.409
423	470.3	1.891	1.968	2.195
424	470.1	2.201	2.222	2.163
425	469.4	2.222	2.239	2.178
426	469.2	1.624	1.601	1.526
427	468.6	1.284	1.323	1.272
428	468.1	1.253	1.298	1.249
429	467.9	1.559	1.549	1.478
430	467.2	1.715	1.676	1.595
431	466.2	2.354	2.37	2.574
432	465.6	2.313	2.336	2.543
433	465.3	2.189	2.235	2.45
434	464.8	2.135	2.191	2.41
435	464.6	2.156	2.208	2.425
436	464.5	2.258	2.292	2.502
437	463.9	2.726	2.675	2.853
438	463.6	2.342	2.361	2.565
439	463.3	2.296	2.323	2.266
440	463.2	2.156	2.208	2.161
441	462.7	2.242	2.278	2.225
442	462.3	2.299	2.325	2.268
443	462.1	2.342	2.361	2.301
444	461.1	2.636	2.455	2.387
445	461	2.334	2.208	2.161

Appendix 3c

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
446	460.4	2.655	2.616	2.535
447	459.7	2.619	2.587	2.508
448	459.1	2.196	2.241	2.191
449	458.9	2.265	2.298	2.243
450	458.3	2.333	2.353	2.294
451	458.1	2.266	2.298	2.243
452	457.8	1.567	1.578	1.515
453	457.6	1.576	1.732	1.921
454	457.2	1.768	1.888	2.065
455	456.9	1.535	1.406	1.358
456	455.3	1.793	1.644	1.588
457	454.3	1.963	1.812	1.756
458	452.8	1.778	1.632	1.577
459	451.3	1.623	1.478	1.424
460	450.3	1.191	1.271	1.234
461	447.7	1.794	1.619	1.553
462	447.2	1.922	1.723	1.648
463	446.6	1.731	1.566	1.505
464	446.1	1.494	1.373	1.327
465	445.9	1.654	1.504	1.448
466	444.7	1.642	1.64	1.837
467	444.4	1.58	1.589	1.79
468	443.7	1.494	1.518	1.725
469	443.4	1.307	1.365	1.585
470	443	2.072	1.846	1.761
471	442.2	1.859	1.817	1.999
472	441.2	1.95	1.892	2.068
473	440.9	1.919	1.866	2.045
474	439.5	1.5	1.378	1.332
475	439.3	1.287	1.203	1.172
476	439	1.377	1.568	1.506
477	438.7	1.404	1.591	1.527
478	438.5	1.191	1.417	1.367
479	438.3	1.48	1.653	1.584
480	438.2	1.212	1.433	1.383
481	438	1.397	1.585	1.522
482	437.2	1.597	1.603	1.538
483	435.8	1.336	1.243	1.209
484	435.1	1.212	1.433	1.383
485	435	1.437	1.618	1.552
486	434.9	1.684	1.819	1.737
487	434.3	1.384	1.574	1.512
488	434.1	1.322	1.524	1.466
489	433.9	1.478	1.651	1.582
490	433.8	1.644	1.787	1.707
491	433.1	1.999	2.077	1.973
492	432	2.143	2.195	2.081
493	431.9	1.235	1.452	1.4
494	431.7	1.292	1.499	1.443
495	431.2	1.09	1.334	1.292
496	431.1	1.239	1.456	1.403
497	430.4	1.09	1.334	1.291
498	429.9	1.345	1.542	1.482
499	429	1.378	1.569	1.507
500	428.5	1.378	1.569	1.507
501	428.1	1.248	1.463	1.41
502	427.4	1.185	1.266	1.229
503	426.7	1.323	1.524	1.466
504	425.9	3.196	3.012	3.141
505	424	1.325	1.526	1.468
506	423.3	1.322	1.524	1.466
507	423.1	1.145	1.378	1.333
508	422.6	1.478	1.651	1.582
509	421.9	1.23	1.448	1.397
510	421.2	2.162	2.43	2.595

Appendix 3c

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
511	420.9	1.544	1.925	2.132
512	420.6	1.544	1.925	2.132
513	420.1	1.538	1.92	2.127
514	420	1.472	1.866	2.078
515	419.4	1.476	1.869	2.081
516	419.3	1.772	2.111	2.303
517	418.8	1.905	2.22	2.403
518	418.2	1.962	2.267	2.445
519	416.2	2.485	2.842	3.041
520	414.7	2.761	3.069	3.248
521	414.5	2.494	2.85	3.048
522	414.2	2.494	2.85	3.048
523	413.8	2.509	2.862	3.059
524	413.5	2.509	2.862	3.059
525	413.4	2.517	2.869	3.065
526	413.2	2.455	2.818	3.018
527	410.5	3.667	3.764	3.667
528	409.2	2.494	2.85	3.048
529	408.7	3.529	3.697	3.824
530	408	2.141	2.487	2.681
531	407.1	2.149	2.494	2.687
532	406	2.123	2.472	2.668
533	403.2	2.511	2.79	2.959
534	402.5	4.148	4.187	4.068
535	399.4	2.877	3.163	3.335
536	399.4	2.623	2.956	3.145
537	397.2	2.719	2.888	2.818
538	396.7	2.383	2.613	2.566
539	394.1	2.306	2.551	2.509
540	393.8	2.358	2.592	2.547
541	393.5	2.299	2.545	2.503
542	393.1	2.365	2.599	2.553
543	393	2.344	2.581	2.537
544	392.7	2.397	2.625	2.577
545	392.4	2.837	2.985	2.907
546	391.5	2.487	2.699	2.644
547	387.8	2.561	2.759	2.7
548	386.1	2.637	2.821	2.757
549	381.9	2.853	2.998	2.919
550	380.5	2.956	3.082	2.996
551	380.3	2.727	2.894	2.824
552	379.3	2.836	2.984	2.906
553	378.1	2.653	2.834	2.768
554	377.8	2.302	2.547	2.506
555	376.9	2.78	2.938	2.864
556	376.3	2.464	2.68	2.627
557	375.7	2.492	2.702	2.648
558	374.9	2.472	2.686	2.633
559	374.5	3.405	3.45	3.333
560	372.2	3.462	3.644	3.579
561	371.3	2.597	2.818	2.768
562	370.7	2.471	2.715	2.673
563	369.8	2.496	2.735	2.692
564	369.7	*	*	*
565	369.2	2.454	2.701	2.661
566	369	*	*	*
567	367.9	2.707	2.908	2.85
568	367.6	2.799	2.983	2.919
569	366.6	4.126	4.069	3.914
570	365.1	0.829	1.066	1.021
571	365	1.03	1.23	1.172
572	364.8	1.196	1.366	1.296
573	364.3	1.075	1.267	1.205
574	362.7	1.482	1.6	1.51
575	361.9	1.342	*	*

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
576	361	1.472	*	*
577	360.8	1.155	*	*
578	359.9	1.067	*	*
579	357.5	*	*	*
580	357.4	0.907	*	*
581	356.6	1.081	*	*
582	355	2.029	*	*
583	354.2	1.467	*	*
584	353.7	2.569	*	*
585	353.2	1.286	*	*
586	352.8	1.303	*	*
587	352.3	1.109	*	*
588	351.7	1.114	*	*
589	351.6	1.283	*	*
590	350.7	0.825	*	*
591	349.9	2.104	*	*
592	347.7	*	*	*
593	347.1	1.344	*	*
594	346.7	1.084	*	*
595	346.2	1.555	*	*
596	345.4	1.152	*	*
597	345	1.111	*	*
598	344.2	1.107	*	*
599	343.7	0.954	*	*
600	343.6	0.947	*	*
601	341.5	1.503	*	*
602	341.2	1.089	*	*
603	340.9	1.631	*	*
604	340.8	0.981	*	*
605	340.4	1.11	*	*
606	340	1.263	*	*
607	339.4	1.057	*	*
608	339.3	1.192	*	*
609	338.9	1.434	*	*
610	338.4	0.995	*	*
611	338.3	1.134	*	*
612	337.8	1.13	*	*
613	336.7	1.71	*	*
614	336.2	0.93	*	*
615	335.4	1.173	*	*
616	335.2	1.235	*	*
617	334	0.985	*	*
618	333	1.267	*	*
619	332.3	0.869	*	*
620	332.1	0.873	*	*
621	331.9	1.181	*	*
622	331	1.377	*	*
623	330.9	0.928	*	*
624	330.3	1.822	*	*
625	329.9	1.75	*	*
626	329.5	0.968	*	*
627	328.5	1.924	*	*
628	328.3	0.935	*	*
629	327.8	1.107	*	*
630	327.5	1.016	*	*
631	326.8	1.282	*	*
632	325.8	1.076	*	*
633	325.7	0.843	*	*
634	325	0.937	*	*
635	324.9	1.123	*	*
636	323.6	1.098	*	*
637	323.1	2.613	*	*
638	322.7	1.447	*	*
639	322.2	0.988	*	*
640	322	1.07	*	*

Appendix 3c

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
641	321.3	1.036	*	*
642	321.1	1.478	*	*
643	320.7	1.036	*	*
644	320.6	1.371	*	*
645	320	1.104	*	*
646	319.8	0.906	*	*
647	319.6	1.151	*	*
648	319.5	0.996	*	*
649	319.4	0.872	*	*
650	319	1.067	*	*
651	318.1	2.385	*	*
652	317.6	1.228	*	*
653	317.1	0.947	*	*
654	316.9	0.892	*	*
655	316.5	1.213	*	*
656	316.4	1.295	*	*
657	316.1	1.529	*	*
658	315	1.169	*	*
659	314.4	1.398	*	*
660	313.9	2.821	*	*
661	313.2	1.156	*	*
662	312.9	1.502	*	*
663	312.7	1.56	*	*
664	312.2	0.977	*	*
665	311.2	1.54	*	*
666	311.2	0.961	*	*
667	311.1	1.043	*	*
668	310.9	1.157	*	*
669	310.5	1.606	*	*
670	310.3	2.837	*	*
671	309.3	1.435	*	*
672	308.9	1.684	*	*
673	308.7	1.055	*	*
674	308.3	1.039	*	*
675	308.3	1.094	*	*
676	308.2	1.142	*	*
677	307.9	1.054	*	*
678	307.5	1.123	*	*
679	307.1	1.081	*	*
680	306.7	0.977	*	*
681	306.4	0.995	*	*
682	306.3	1.381	*	*
683	305.1	1.477	*	*
684	304.6	1.21	*	*
685	304.5	1.012	*	*
686	304.5	1.847	*	*
687	304.1	1.754	*	*
688	303.6	1.098	*	*
689	302.8	1.042	*	*
690	302.5	1.08	*	*
691	302	1.229	*	*
692	301.7	1.086	*	*
693	301.3	1.015	*	*
694	300.7	1.554	*	*
695	300.3	1.145	*	*
696	300	1.27	*	*
697	299.4	1.498	*	*
698	298.8	1.07	*	*
699	298.3	1.328	*	*
700	297.7	1.307	*	*
701	297	1.916	*	*
702	296.4	*	*	*
703	296.1	1.578	*	*
704	295.7	1.448	*	*
705	295.4	1.833	*	*

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
706	294.9	1.139	*	*
707	294.3	1.794	*	*
708	293.7	*	*	*
709	293.1	1.113	*	*
710	292.4	1.181	*	*
711	292.1	1.236	*	*
712	291.6	1.222	*	*
713	291.3	1.096	*	*
714	291.2	1.422	*	*
715	291.1	1.422	*	*
716	290.7	1.072	*	*
717	290.5	1.297	*	*
718	290.3	1.428	*	*
719	289.6	1.691	*	*
720	289.3	1.507	*	*
721	289.2	1.134	*	*
722	289.1	1.27	*	*
723	288.4	1.541	*	*
724	288.4	1.345	*	*
725	287.8	1.133	*	*
726	287.6	1.319	*	*
727	287.3	1.072	*	*
728	286.7	1.287	*	*
729	286.3	1.15	*	*
730	286.1	1.089	*	*
731	286	1.346	*	*
732	285.6	1.401	*	*
733	285.5	1.53	*	*
734	285.4	1.279	*	*
735	285.3	1.093	*	*
736	285	1.417	*	*
737	284.6	1.462	*	*
738	284.1	1.051	*	*
739	283.9	1.208	*	*
740	283.6	1.552	*	*
741	283	1.462	*	*
742	282.7	1.202	*	*
743	282.5	1.072	*	*
744	281.3	1.287	*	*
745	281	1.239	*	*
746	280.6	1.222	*	*
747	280.3	1.167	*	*
748	279.8	1.268	*	*
749	279.7	1.216	*	*
750	278.1	1.181	*	*
751	277.8	1.4	*	*
752	275.4	2.259	*	*
753	273.2	2.904	2.99	*
754	272.9	2.255	2.459	*
755	272.5	2.34	2.528	*
756	272	2.548	2.698	*
757	271.6	2.453	2.621	*
758	271.3	2.484	2.646	*
759	271.1	5.071	4.763	*
760	268.8	4.069	4.062	*
761	256.6	3.916	*	*
762	256.3	5.082	4.891	*
763	256	3.534	3.624	*
764	255.7	3.386	3.503	*
765	255.5	3.471	3.573	*
766	255.1	3.65	3.719	*
767	255	3.429	3.538	*
768	254.5	3.725	3.78	*
769	254.3	3.577	3.659	*
770	252	*	*	*

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
771	251.9	5.453	5.245	*
772	251.5	3.588	3.668	*
773	251.1	4.755	4.654	*
774	250.9	4.731	4.635	*
775	250.6	4.737	4.639	*
776	250.4	4.472	4.423	*
777	250.3	4.389	4.354	*
778	250.2	4.806	4.696	*
779	249.5	5.694	5.422	*
780	249	4.821	4.708	*
781	248.7	4.946	4.81	*
782	248.6	4.265	4.253	*
783	247.8	4.172	4.135	*
784	247.6	5.052	4.897	*
785	247	4.455	4.409	*
786	246.5	4.583	4.514	*
787	246.2	3.609	3.716	*
788	246.1	4.026	4.058	*
789	245.2	5.849	5.549	*
790	244.1	4.377	4.344	*
791	244	4.628	4.551	*
792	243.6	4.146	4.156	*
793	243	3.767	3.846	*
794	242.8	4.196	4.196	*
795	242.5	4.546	4.483	*
796	242.1	3.73	3.758	*
797	241.9	3.467	3.543	*
798	241.5	4.024	3.998	*
799	240.7	2.896	*	*
800	240.5	3.122	*	*
801	239.5	3.047	*	*
802	239.3	3.178	*	*
803	238.6	3.12	*	*
804	237.9	2.765	*	*
805	237.7	3.443	*	*
806	237.5	2.752	*	*
807	237.2	2.848	*	*
808	237.1	3.11	*	*
809	237	3.252	*	*
810	236.5	3.063	*	*
811	235.9	2.775	*	*
812	235.9	3.3	*	*
813	235.2	4.266	*	*
814	234.4	3.465	*	*
815	234.2	3.483	*	*
816	234.1	4.117	*	*
817	233.4	4.041	*	*
818	232.7	4.728	*	*
819	232.4	3.782	*	*
820	231.6	4.666	4.552	*
821	231.5	4.34	4.285	*
822	230.9	4.391	4.327	*
823	230.9	3.875	3.835	*
824	229	4.156	4.12	*
825	228.7	4.191	4.149	*
826	228.6	4.902	4.731	*
827	222.3	4.475	4.359	*
828	221.9	4.212	4.144	*
829	221.4	3.79	3.747	*
830	221.3	3.79	3.747	*
831	221.1	3.919	3.853	*
832	221	*	*	*
833	220.7	4.919	4.671	*
834	219.2	6.203	5.736	*
835	214.4	4.408	*	*

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
836	213.7	5.235	*	*
837	204.8	5.217	*	*
838	204.2	4.233	*	*
839	202.3	4.678	*	*
840	202	4.344	*	*
841	201.7	4.568	*	*
842	201.3	4.874	*	*
843	200.3	4.1	*	*
844	200	4.798	*	*
845	199.7	5.146	*	*
846	199.5	3.172	*	*
847	198.9	3.898	*	*
848	198.2	3.506	*	*
849	107.8	4.382	*	*
850	194.9	3.624	*	*
851	194.7	2.762	*	*
852	193.7	2.46	*	*
853	192.4	2.971	*	*
854	191.7	3.615	*	*
855	188.6	2.268	*	*
856	187	2.817	*	*
857	186.6	3.034	*	*
858	184.9	4.687	*	*
859	183.9	3.013	*	*
860	182.1	3.612	*	*
861	180.2	2.625	*	*
862	180	2.662	*	*
863	179.6	2.084	*	*
864	179.2	2.509	*	*
865	179	2.662	*	*
866	177.7	2.531	*	*
867	177.3	2.605	*	*
868	174.6	3.253	*	*
869	174	2.07	*	*
870	173.4	3.057	*	*
871	171.9	1.608	*	*
872	171.4	2.988	*	*
873	170.8	2.171	*	*
874	170.7	2.559	*	*
875	169.2	3.706	*	*
876	169.1	3.047	*	*
877	168.7	4.074	*	*
878	167.5	3.311	*	*
879	166	3.181	*	*
880	165.6	2.976	*	*
881	165.2	3.818	*	*
882	165.1	2.491	*	*
883	164.9	2.186	*	*
884	164.2	4.053	*	*
885	162.7	4.14	*	*
886	162.6	2.372	*	*
887	161.3	3.002	*	*
888	160.1	2.874	*	*
889	159.4	2.545	*	*
890	158.6	2.405	*	*
891	157.8	1.823	*	*
892	156.5	1.809	*	*
893	156.4	1.809	*	*
894	155.9	1.809	*	*
895	154.5	1.875	*	*
896	152.5	2.695	*	*
897	150.7	2.035	*	*
898	150.4	1.776	*	*
899	148.9	2.143	*	*
900	148.6	1.91	*	*

Appendix 3c

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
901	148.5	1.903	*	*
902	148.1	2.045	*	*
903	147.5	1.423	*	*
904	147.1	1.378	*	*
905	146.9	*	*	*
906	143.1	1.514	*	*
907	141.6	1.715	*	*
908	138.7	3.376	*	*
909	137.4	1.494	*	*
910	136.1	1.642	*	*
911	135.5	1.421	*	*
912	135.4	1.532	*	*
913	134.8	1.886	*	*
914	132.6	1.976	*	*
915	132.4	1.803	*	*
916	132	1.734	*	*
917	131.9	2.49	*	*
918	129.6	2.576	*	*
919	128	3.056	*	*
920	126.3	3.111	*	*
921	125.7	2.084	*	*
922	125.3	2.227	*	*
923	124.8	1.852	*	*
924	124.2	1.604	*	*
925	124	1.591	*	*
926	123.8	1.591	*	*
927	123.6	1.612	*	*
928	123.2	1.932	*	*
929	119.6	2.624	*	*
930	119.6	2.472	*	*
931	119.1	2.063	*	*
932	117.9	2.454	*	*
933	117.2	3.314	*	*
934	117.1	3.903	*	*
935	117	3.057	*	*
936	116.6	2.248	*	*
937	115.5	3.049	*	*
938	115	2.489	*	*
939	113	3.116	*	*
940	112.2	2.994	*	*
941	111.2	3.667	*	*
942	110.2	3.843	*	*
943	109.3	3.438	*	*
944	108.4	3.158	*	*
945	107.1	1.71	*	*
946	105.8	2.725	*	*
947	104.3	2.801	*	*
948	104.2	3.208	*	*
949	102.4	2.821	*	*
950	100.7	2.677	2.472	*
951	98.4	3.566	3.293	*
952	98.1	2.992	2.823	*
953	97.7	3.076	2.892	*
954	97.5	2.082	2.079	*
955	97.2	2.538	2.452	*
956	96.8	2.353	2.3	*
957	96.6	2.95	2.789	*
958	95.8	3.715	3.414	*
959	95.3	2.214	2.186	*
960	95	2.33	2.282	*
961	92.8	2.805	2.699	*
962	91.7	1.612	1.694	*
963	91.1	2.114	2.133	*
964	90.1	1.811	1.857	*
965	89.8	1.755	1.811	*

Stream Crossing Number	Distance from Longford	CV + AH without soil factors	CV + AH with soil erosion factor	CV + AH with both soil factors
966	89.7	1.858	1.895	*
967	88.7	1.881	1.914	*
968	88.6	1.922	1.948	*
969	87.5	2.088	1.995	*
970	86.9	1.951	1.883	*
971	86.3	1.72	1.694	*
972	85.3	1.583	1.594	*
973	84.6	1.435	1.473	*
974	83	1.877	1.704	*
975	81.1	1.384	1.433	*
976	80.6	1.494	1.537	*
977	79.9	1.716	1.702	*
978	78.1	1.327	1.384	*
979	78	1.272	1.339	*
980	77.6	1.705	1.693	*
981	76.6	2.12	2.193	*
982	74.8	2.358	2.388	*
983	74.6	2.202	2.26	*
984	72.9	2.693	2.662	*
985	71.9	3.314	3.213	*
986	71	3.246	3.114	*
987	70.2	2.978	2.895	*
988	69.7	2.723	2.687	*
989	69.3	2.284	2.327	*
990	67.4	2.832	2.804	*
991	67	2.615	2.627	*
992	66.1	3.012	2.835	*
993	65.5	2.355	2.269	*
994	65.4	2.408	2.458	*
995	64	2.085	2.165	*
996	63.1	1.996	2.091	*
997	61.2	1.928	2.036	*
998	59.4	2.058	2.143	*
999	51.4	1.703	1.729	*
1000	49.4	1.382	1.467	*
1001	44.9	1.328	1.422	*
1002	44	1.485	1.551	*
1003	43.9	1.357	1.446	*
1004	43.7	2.375	2.282	*
1005	37.9	1.196	1.292	*
1006	35.7	1.267	1.35	*
1007	33.2	1.714	1.745	*
1008	32.7	1.949	1.951	*
1009	25.6	2.09	2.068	*
1010	25.3	2.33	2.33	*
1011	25	1.54	1.618	*
1012	24.7	1.392	1.439	*
1013	23.4	1.416	1.329	*
1014	23	1.058	1.02	*
1015	22.4	1.058	1.02	*
1016	20.3	0.933	1.041	*
1017	19.9	0.933	0.895	*
1018	19.3	0.915	0.877	*
1019	17.2	1.055	0.995	*
1020	16.7	1.037	0.977	*
1021	16.6	1.037	0.977	*
1022	16.1	1.055	0.995	*
1023	9.1	2.045	2.074	*
1024	7.7	1.534	1.47	*
1025	6.1	1.698	1.575	*
1026	5.4	1.641	1.671	*
1027	5	1.692	1.717	*
1028	3.1	2.377	2.277	*