FLORA AND FAUNA ASSESSMENT

CENTRAL WEST REGIONAL ROAD/RAIL FREIGHT TERMINAL

PREPARED FOR

SLOBOBAX PTY LTD

JUNE 2005

GEOLYSE

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Report Title:	***Flora and Fauna Assessment***
Project:	Bathurst Freight Handling Terminal
Client:	*Slobobax Pty Ltd*
Report No.:	*205058_REP_002*
Preliminary/Final:	Final

Geolyse Pty Ltd and the authors responsible for the preparation and compilation of this report declare that we do not have, nor expect to have a beneficial interest in the study area of this project and will not benefit from any of the recommendations outlined in this report.

The preparation of this report has been in accordance with the project brief provided by the client and has relied upon the information, data and results provided or collected from the sources and under the conditions outlined in the report.

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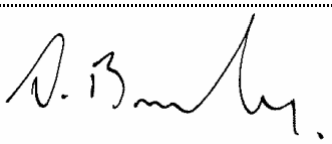
Signed:	
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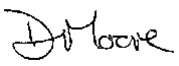
Signed:	
Date:	30 June 2005

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Introduction

1.1 PURPOSE OF THE REPORT

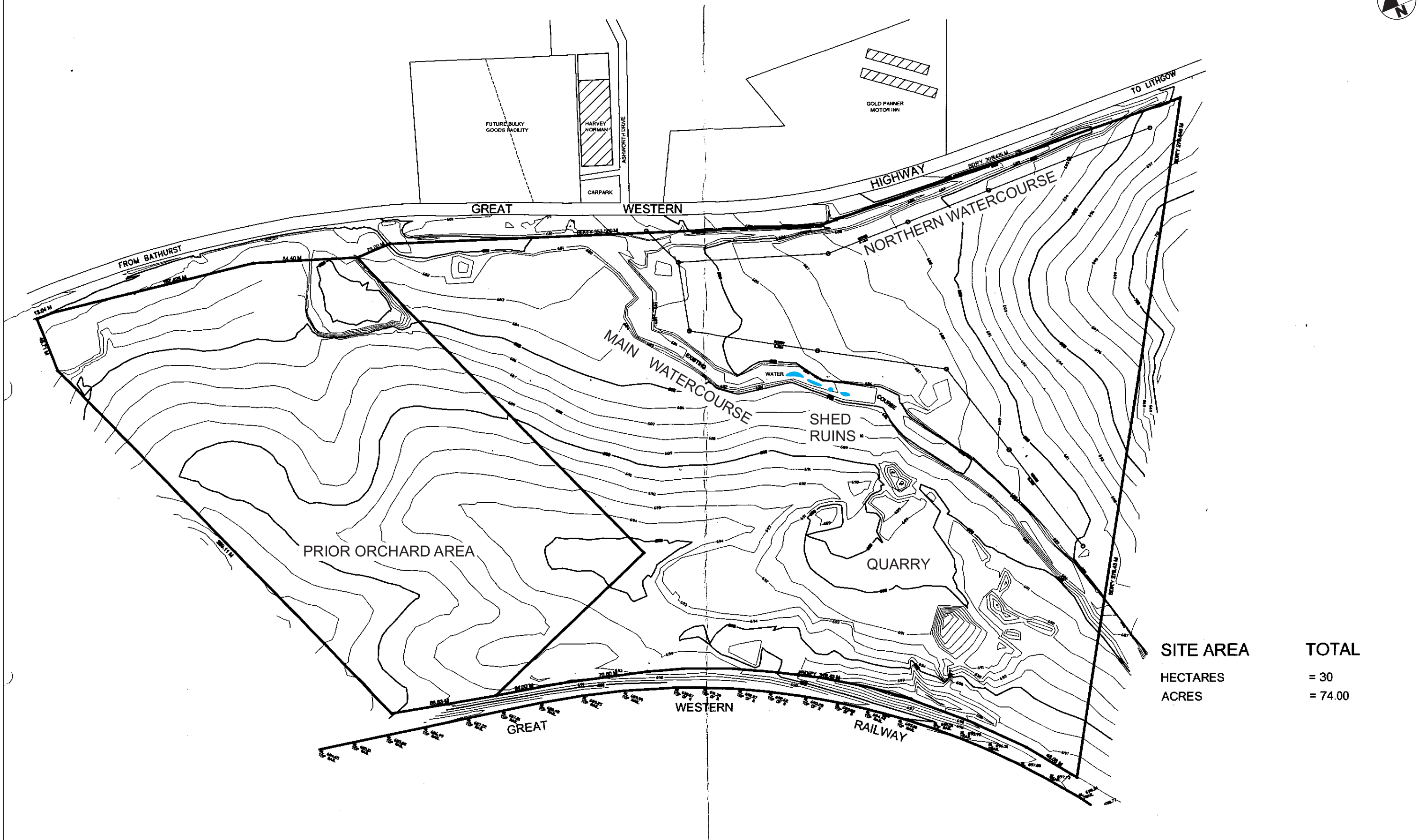
This ecological assessment was commissioned to support a development application for a proposed freight handling terminal situated between the Great Western Highway and the Great Western Railway, approximately four kilometres east of Bathurst. The site, which covers an area of approximately 30 hectares, has a northern frontage to the Great Western Highway of approximately 900 metres and a southern frontage to the Great Western Railway of 575 metres (**Figure 1**).

This assessment provides a description of the ecological features of the site and identifies ecological constraints and opportunities. The assessment examines the quality and potential of the site for native flora and fauna species, populations, ecological communities and their habitats. This includes threatened species which may have the potential to be affected by further development. An assessment is also provided on the significance of potential impacts.

1.2 REPORT FORMAT

This ecological assessment has been structured into seven sections;

- **Section 1** — explains the purpose and structure of the report.
- **Section 2** — details the desktop and field survey study methodology.
- **Section 3** — presents results of the survey.
- **Section 4** — clarifies impacts.
- **Section 5** — assesses significance of impacts.
- **Section 6** — identifies mitigative measures.
- **Section 7** — provides conclusions.



205058

GEOLYSE

0 25 50 75 100m

APPROXIMATE LOCATION OF STANDING POOLS IN WATERCOURSE

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SOURCE:

FIGURE 1
MAIN STUDY AREA

Methodology

2.1 TERRESTRIAL ECOLOGY

2.1.1 DATA COLLECTION

Prior to the field survey a search was conducted of the *Atlas of NSW Wildlife* (NPWS 2005) to identify threatened flora and fauna that have been recorded in the vicinity of the site. The area for the database search covered the 1:100,000 map sheet for Bathurst. Threatened species with the potential to occur in the area were also identified from listings in *Threatened Species of Western NSW* (Ayers, Nash and Baggett eds. 1999) as well as BIOCLIM predicted species lists. A search of the *Environment Protection and Biodiversity Conservation* database was also undertaken. Available literature detailing the distribution of threatened species (National Parks and Wildlife Service 1996; Briggs and Leigh 1996; Strahn 1995) was also reviewed to identify species that may occur in the region.

2.1.2 SITE INSPECTION

The field survey was conducted on 15th April 2005. The survey covered accessible land, rail and road frontages on and immediately adjacent to the proposed development area. At the time of the survey weather conditions were sunny, warm with developing storms. Air temperature averaged 26 degrees Celsius during the survey. Mild to warm weather experienced in the months preceding the survey, combined with localised summer storms in the locality over this time, provided adequate groundcover and standing water in small water-holding ponds on the site. The drainage lines on the site did not contain running water. The open nature of the site and the clearly defined boundaries of the narrow creek-line vegetative communities allowed for reconnaissance by foot across the entire site, access roads and immediately adjoining lands. Landform and vegetation units were located and correlated with topographic map and aerial photo details. Any specific locations, appearing to be more diverse or unusual (such as pools of water) were investigated in order to obtain an overview of community diversity.

Flora Survey

Approximately 10 percent of the study area had been disturbed by prior granite gravel quarrying operations (**Plate A1**). Exotic timbered areas consisted of the riparian creek corridor, shelter-belts and road corridor plantings. All areas were easily accessible and allowed for comprehensive assessment in terms of community composition; health; age status; habitat value for fauna and flora species; and overall conservation significance.

A description of the vegetation communities both within the site of the proposed road/rail freight terminal and the immediate surrounds, as well as a list of the flora species recorded during the survey, are provided in the results and discussion section of this report (**Section 3**). Consideration was given to locating threatened and rare plant species or their habitat that may exist or have potential to exist in the area.

Fauna Survey

The fauna survey component of the assessment included point survey, direct sightings, animal tracks, nesting sites, scats and other traces. All fauna species recorded during the survey are listed in **Table 3.2**.

Habitat assessment included the evaluation of the vegetation community's capacity to support fauna groups, including threatened species and their populations. The survey also targeted potential nesting or roosting sites (tree hollows, fallen logs, decorticating bark), forage potential, refuges, vegetative connectivity and diversity of plant species and structure.

2.2 AQUATIC ECOLOGY

At the time of the aquatic ecological assessment, surface water was limited to a series of small standing water pools located central to the site (**Figure 1**). Both the Bathurst and Orange offices of the Department of Infrastructure, Planning and Natural Resources (DIPNR) were contacted with the aim of sourcing current and/or historical records for surface water flows within the relevant section of Raglan Creek. Geolyse was informed that no such data exists.

Discussions with both the previous and current owners of the site have indicated that shallow running water was regularly encountered within the watercourse from the period 1973 to 2003. However, and likely as a result of prolonged dry climatic conditions within the catchment since this time, no flowing water was known to have occurred within this watercourse since 2003.

The appropriate level of investigation for aquatic ecology was assessed through the procedures outlined in the *Guidelines for Assessment of Aquatic Ecology in EIA, 1999* (the Guidelines). The project was identified as necessitating a 'Level 2' investigation. However, as a consequence of the predominantly dry watercourse, such an assessment would prove impracticable due to the inability to sample either spatially or temporally and the subsequent limitations imposed on both spatial and temporal controls. As such, no in-stream sampling of aquatic macroinvertebrate communities could take place. In accordance with the Guidelines, an assessment was subsequently made on the basis of the current status of the site with a precautionary approach applied in assessing the impacts of the proposed development. The assessment on aquatic ecology subsequently focuses strongly on the impacts of the proposed development on downstream receiving aquatic environments and on the potential for threatened fin-fish species and their habitat to occur within the study area.

2.2.1 DATA COLLECTION

No active trapping techniques were used to survey fin-fish species. The field survey included in-stream habitat evaluation for both protected and threatened species. Habitat evaluation included assessment of in-stream characteristics including extent of wetted habitat, aquatic vegetation, overhanging vegetation, bed composition and the presence of in-stream barriers. The creek banks, benches and beds were overgrown largely by terrestrial species, however allowed for access and comprehensive assessment in terms of in-stream habitat conditions.

Searches of the Department of Primary Industries – Fisheries databases were conducted to determine both expected and recorded sightings of both threatened and protected freshwater fin-fish species in the study area.

A search of the *Environment Protection and Biodiversity Conservation (EPBC)* online database (EPBC 2005) was undertaken to identify any threatened freshwater aquatic species of national significance that could occur in the area.

2.2.2 SITE INSPECTION

The fauna assessment was based on identification of habitat type, quality and potential. Habitat assessment included consideration of fauna of conservation significance and potential habitat of threatened fauna species that could occur in the locality.

Physico-chemical water quality measurements were obtained from the larger of the pools observed central to the site on 18th April 2005. No surface water was identified immediately upstream or downstream of the study site.

2.3 STUDY LIMITATIONS

The information provided in this report interprets recorded on-site conditions. The report should be read with an understanding that it is a professional interpretation of study area conditions based on a specific dated survey and data sets. This interpretation is representative of the organisation of flora and fauna of the site, however, cannot fully define variations due to seasonal, climatic or diurnal change.

Results

3.1 STUDY AREA

The study site is representative of the landscape of the Raglan-Kelso locality, consisting predominantly of lightly undulating open agricultural land with two narrow, intermittent watercourses extending from the east of the site and flowing to the middle of the site's Great Western Highway frontage. The south-eastern portion of the study area comprises a granite gravel quarry with numerous tracks and prior stockpiling sites. Shed remnants and dumps are located mid-way along the main creek course (**Figure 1**). Land located on the western end of the area has been used in the past for orchards. Land on the north-eastern side of the site fronting the highway has once been used for cropping. The aspect of the site tends to be towards the north-west on a slight slope of less than 7 percent. Local relief across the study area is less than 25m. The site does not appear to have been grazed in the last season. Sheep skeletal remains and old stock pads indicate that the site has been used by stock in the past.

The areas immediately surrounding the site are used for agricultural, industrial, residential, commercial and transport purposes. Land to the east and south is predominantly open rural land.

The site has been extensively cleared of native trees and shrubs with exotic trees occurring in tightly configured corridors confined within the two unnamed watercourses. Native tree species are scarce in the immediate locality. The site has had a long history of agricultural use.

Both intermittent watercourses contain semi-permanent waterhole soakage areas. Each of the watercourses is located near the top of the Raglan Creek catchment area and extend upstream no further than two kilometres to the east of the study area. These watercourses are unfenced and have been accessed by stock.

The area referred to as 'the study area' includes the 30 hectare site proposed for the Central West Regional Road/Rail Freight Terminal and extends approximately 50 metres outside of the site. The area of the proposed railway spur-line extension is also included in the study area.

3.2 TERESTRIAL ECOLOGY

3.2.1 FLORA

The site contains two dominant vegetation communities. These communities include agriculturally modified grassland or pastureland and a degraded riparian corridor (**Plate A2**). This degraded riparian community is comprised of exotic species and occurs as the tightly structured willow community present within the two watercourses. The surrounding landscape is dominated by pastureland with no

remnants of original native woodland remaining. A very high proportion of the original native grassland and woodland communities have been cleared from the locality and modified over a long and intense history of grazing and cropping activities. The existing communities have been modified to such an extent that barely any trace of remnant native lower stratum remains. A high proportion of replanted species in the immediate locality consists of exotic tree and shrub species.

3.2.2 GRASSLAND (AGRICULTURALLY MODIFIED)

The open pastureland structure is typical of the unimproved agricultural lands of the undulating lower hills in the Raglan locality. It consists of open cleared country with isolated corridors of planted exotic tree species typically located on paddock and road fringes as screen plantings and shelter-belts and also within or adjacent to watercourses. The existing trees and shrubs in the study area are strongly dominated by a range of exotics including Poplar, Willow, Radiata, Stone-fruit trees, Elm, African Boxthorn and Blackberry.

Fenced paddocks in the site are likely to have been grazed in the past. The ground cover species composition is evident of a prolonged grazing or cultivation history. The present grassland community has been partially mown across accessible flats and low slopes. Species commonly recorded throughout the grassland (pasture) areas include Bird Rape (*Brassica rapa*), Paterson's Curse (*Echium plantagineum*), Wild Oats (*Avena fatua*), Clover species (*Trifolium sp.*), Capeweed (*Arctotheca calendula*), Prickly Lettuce (*Lactuca serriola*), Phalaris (*Phalaris aquatica*), Curly Windmill Grass (*Enteropogon acicularis*) Kykuyu (*Pennisetum cladestinum*), Scotch Thistle (*Onopordum acanthium*), Saffron Thistle (*Carthamus lanatus*), Wheatgrass (*Elymus scaber*), Cocksfoot (*Dactylis glomerate*), Barley Grass (*Hordeum leporinum*) and Perennial Ryegrass (*Lolium perenne*). Ground-cover composition is patchy and reflects the on-site changes in grazing regime, aspect, slope and drainage.

Vegetation along the Great Western Highway frontage has been heavily modified by earthworks, alterations to drainage, weed management and mowing. Grassland within and adjacent to the Great Western Railway easement is less modified by grazing and cultivation impacts, however the ground vegetation composition in this area has been heavily influenced by drainage modification and invasive pasture-related species. A higher proportion of native forbs and grasses are present within the rail easement. Species recorded include Kangaroo Grass (*Themeda australis*), Vanilla Lily (*Arthropodium milleflorum*), *Lomandra* species, Wallaby Grass (*Danthonia* sp.,), White Top (*Austrodanthonia caespitosa*), Australian Carrot (*Daucus glochidiatus*), Poa tussock and Narrow-leaf Clover (*Trifolium angustifolium*). These species are interspersed with an exotic pasture-related community with prolific species such as Paspalum, Paterson's Curse and Bird Rape being common throughout the area.

A large proportion of the pasture-related grassland community of the study area reaches 100% ground cover. The study area is strongly dominated by introduced species and common, robust native species. Areas where water can collect and stand for longer periods such as pooling areas at the edge of the quarry and at the base of old borrow-pit sites contain additional species common to moist areas including Woodrush (*Luzula sp.*), Catsear (*Hypochaeris radicata*), Bog Sedge (*Schoenus apogon*) and

Knob Sedge (*Carex inversa*). Much of the disturbed areas on and around the quarry site are either clear of ground vegetation or support robust exotic pasture and weed species.

3.2.3 RIPARIAN CORRIDOR

The riparian corridor present on the site consists of a narrow and connective belt of willow-dominated vegetation, restricted to within the watercourse channels and on the immediate upper banks. This community is mostly connective, however openings occur where trees have been removed from the channel or where dense blackberry has restricted growth. Other tree and shrub species to occur within this community include poplar, fruit trees, ash, U*lmaceae* species, Blackberry, African Boxthorn, Sweet Briar (*Rosa rubiginosa*) and assorted garden associated shrubs. The willow dominated community of the watercourse extends into the lower bed of the creek and forms a dense mat of fallen trunks and roots in several stretches of the channel. The dense configuration of this vegetation provides a thick canopy which restricts ground cover and shrub species growth within the watercourse. Many bare areas on the upper banks show evidence of active erosion. Species growing on the banks and dry bed of the channels include many robust pastureland species and also include species typically associated with ephemeral watercourses. These include Knob Sedge, Tall Spike Rush (*Eleocharis sphacelata*), Common Rush (*Juncus usitatus*), Yorkshire Fog (*Holcus lanatus*) and Cumbungi (*Typha domingensis*). Dense upper canopy structure typically restricts the growth of aquatic associated species to scattered individuals. Areas where the canopy has been removed by clearing has allowed for small areas to become vegetated by small stands of reeds and sedges. Much of the watercourse bed and banks remain free of vegetation due to sediment deposition, dense mats of fallen willow leaves and roots, eroded bank walls and low light conditions.

Standing pools located within the watercourse are located immediately north of the disused farm sheds locally centrally within the study area. These pools may be semi-permanent, soak-fed ponding areas. The dense willows have restricted the growth of any aquatic or waters-edge vegetation. No aquatic associated reed or sedge-beds are present on the study area.

The degraded riparian corridor terminates at the point where the watercourse meets the Great Western Highway. It extends upstream along both channels becoming more fractured and open with high levels of erosion east of the study area.

The original native woodland found in the locality is likely to have consisted of a Yellow Box and *Allocasuarina* open woodland community. This original community has been extensively cleared and highly modified throughout the locality. No trace of this community is present on the study area.

A combination of grazing pressure and dense groundcover vegetation has prevented the successful regeneration and establishment of any native trees or shrubs. No native species revegetation has occurred on or in close vicinity to the study area.

Table 3.1 - Observed Flora List

Family Name	Botanical Name	Common Name
PAPAVERACEAE	*Papaver sp.* *	Poppy
PORTULACACEAE	*Portulaca oleracea*	Common Pigweed
CHENOPODIACEAE	*Chenopodium carinatum*	GreenCrumbweed
AMARANTHACEAE	*Alternanthera pungens* *	Khaki Weed
	Amaranthus sp.	Amaranth
POLYGONACEAE	*Polygonum aviculare* *	Wireweed
	Rumex brownii	Slender Dock
MALVACEAE	*Modiola caroliniana* *	Redflowered Mallow
	Sida sp.	Sida
ULMACEAE	*Aphananthe sp.*	Elm Tree
URTICACEAE	*Urtica incisa*	Scrub Nettle
SALICACEAE	*Populus alba* *	White Poplar
	Salix babylonica *	Weeping Willow
	Salix alba *	White Willow
	Salix matsudana *	Corkscrew Willow
BRASSICACEAE	*Brassica rapa* *	Bird Rape
	Hirschfeldia incana *	Hairy Brassica
	Raphanus raphanistrum *	Wild Raddish
	Capsella bursa-pastoris *	Shepherd's Purse
	Sisymbrium officinale	Hedge Mustard
ROSACEAE	*Rubus ulmifolius* *	Blackberry
	Rosa rubiginosa *	Sweet Briar
MALACEAE	*Malus domestica* *	Apple Tree
AMYGDALACEAE	*Prunus sp.* *	Fruit Tree
	Prunus armeniaca *	Apricot Tree
CAESALPINIOIDEAE	*Senna barclayana*	Pepper-leaf Senna
FABOIDEAE	*Trifolium pratense* *	Red Clover
	Trifolium angustifolium *	Narrow-leaf Clover
	Trifolium subterraneum *	Subterranean Clover
ZYGOPHYLLACEAE	*Tribulus terrestris* *	Cathead
APIACEAE	*Foeniculum vulgare* *	Fennel
	Daucus glochidiatus	Australian Carrot
	Conium maculatum *	Hemlock
ASTERACEAE	*Conyza bonariensis* *	Flax-leaf Fleabane
	Gnaphalium argentifolium	Cudweed
	Xanthium spinosum *	Bathurst Burr

Table 3.1 - Observed Flora List

Family Name	Botanical Name	Common Name
	Bidens pilosa *	Cobblers Pegs
	Arctotheca calendula *	Capeweed
	Silybum marianum *	Variegated Thistle
	Onopordum acanthium *	Scotch Thistle
	*Carthamus lanatus**	Saffron Thistle
	Hypochaeris radicata *	Flatweed
	Tragopogon porrifolius *	Salsify
	Chondrilla juncea *	Skeleton Weed
	Taraxacum officinale *	Dandelion
	Lactuca serriola *	Prickly Lettuce
SOLANACEAE	*Lycium ferocissimum* *	African Boxthorn
	Solanum nigrum *	Blackberry Nightshade
CONVOLVULACEAE	*Dichondra repens*	Kidneyweed
BORAGINACEAE	*Heliotropium europaeum*	Common Heliotrope
	Echium plantagineum *	Patterson's Curse
OLEACEAE	*Fraxinus sp.*	Ash *
SCROPHULARIACEAE	*Verbascum virgatum* *	Twiggy Mullein
	Veronica plebeia	Trailing Speedwell
PLANTAGINACEAE	*Plantago lanceolata* *	Ribwort (lambs tongue)
VERBENACEAE	*Verbena bonariensis*	Purpletop
LAMIACEAE	*Salvia verbenaca*	Wild Sage
	Marrubium vulgare *	Horehound
	*Prunella vulgaris *.*	Self-heal
LOMANDRACEAE	*Lomandra sp.*	Mat-rush
	Lomandra collina	Pale Mat-rush
ANTHERICACEAE	*Arthropodium milleflorum*	Pale Vanilla Lily
TYPHACEAE	*Typha domingensis*	Cumbungi
JUNCACEAE	*Juncus usitatus*	Common Rush
	Luzula sp.	Woodrush
CYPERACEAE	*Cyperus eragrostis*	Umbrella Sedge
	Eleocharis sphacelata	Tall Spike Rush
	Eleocharis acuta	Common Spike-rush
	Carex inversa	Knob Sedge
POACEAE	*Bothriochloa decipiens*	Red Grass
	Themeda australis	Kangaroo Grass
	Paspalum dilatatum *	Paspalum

Table 3.1 - Observed Flora List

Family Name	Botanical Name	Common Name
	Echinochloa oryzoides *	Hairy Millet
	Pennisetum cladestinum *	Kikuyu
	Chloris truncata	Windmill Grass
	Enteropogon acicularis	Curly Windmill Grass
	Cynodon dactylon	Couch Grass
	Sporobolus caroli	Fairy Grass
	Austrodanthonia caespitosa	White-top
	Agrostis sp.	Bent Grass
	Agrostis aemula	Blown Grass
	Avena sp *	Oats
	Avena fatua *	Wild Oats
	Holcus lanatus *	Yorkshire Fog
	Hordeum leporinum *	Barley Grass
	Festuca sp	Fescue
	Lolium perenne *	Perineal Ryegrass
	Briza maxima *	Quaking Grass
	Poa sp.	Tussock
	Poa sieberiana	Snowgrass
	Phalaris aquatica *	Phalaris
	Nassella trichotoma *	Serrated Tussock
	Austrostipa sp.	Speargrass
	Austrostipa setacea	Corkscrew Grass

*** denotes Introduced Species**

3.3 FAUNA

The observed fauna at the site was scarce. Low fauna populations are likely to be a consequence of the heightened levels of localised land degradation and limited habitat diversity. The observed native species that inhabit the site are predominantly species that are capable of adapting to high levels of both human and agricultural disturbances. The presence of feral predators such as cat, dog and fox was noted by recent bird-kill sites, tracks and scats. The presence of feral species would impact on any population and diversity of small terrestrial mammals, as well as small native birds that could utilise the more sheltered areas of the riparian corridor and denser grassed paddock areas. Arboreal resources for nesting native bird and roosting bat species are strongly competed for by more robust and prolific species.

3.3.1 BIRDS

All birds observed during the survey are common to the locality and are those typically associated with pasture, urban areas and cleared rural areas. The diversity of bird species recorded was low and more robust urban and agriculturally associated species use the area for foraging and shelter habitat. Species observed include Magpie, Currawong, Sparrow, Noisy Miner and Eastern Rosella. Small flocks of Starling were present along fence lines and on open pastureland to the east and west of the study area. An Australian Kestrel was observed foraging along the watercourse and also over open farmland adjacent to the rail corridor to the east of the study area. Small bird species including Weebill, Yellow Thornbill and Superb Blue Wren were observed in Blackberry and Willow Thickets within the main watercourse. Noisy Miners were present within the willow community toward the eastern boundary of the study area.

The exposed and large open areas of the site combined with the lack of intact native woodland corridors or large native remnants, substantially lowers the quality and diversity of habitat for a diverse population of native bird species. Diverse populations of smaller woodland birds are unlikely to find suitable habitat on the site.

The site is unlikely to provide important foraging for a diverse raptor population. No raptor nesting or feeding roost sites were identified. Common species including Australian Kestrel, Black Shouldered and Brown Falcon may opportunistically cover the site while foraging. The sparsity of broader and less disturbed woodland areas combined with a high level of human disturbance is likely to limit the availability of refuge and nesting habitat for both diurnal and nocturnal raptor species.

No important waterbird habitat exists, however the standing pools within the main watercourse have the potential to provide small areas of shelter. These riparian habitats are likely to provide poor nesting and foraging resources for waterbirds due to the lack of water-edge vegetation and potentially high predator populations.

3.3.2 MAMMALS

No small terrestrial native mammal species were observed or are likely to occur on the study area. This is due to a lack of habitat diversity and the broad areas of agricultural, urban and industrial land surrounding the study area. No hollow ground logs or rock outcrops exist on the site. Mobile terrestrial species may opportunistically visit the site during favourable seasons when ground cover provides suitable refuge, however it is likely that the open and disturbed nature of the site combined with residential and agricultural disturbances would discourage even the less timid and more robust native mammal species. Tracks and scats of introduced species including fox, dog, rabbit and cat were identified from the site.

3.3.3 AMPHIBIANS AND REPTILES

Habitat conditions are considered poor over the site for a diverse range of reptilian species. The primary reptilian habitat type consists of grass refuge, dense shrubs and old dump sites. The absence

of ground litter, logs and a lower shrub stratum lowers the habitat quality across the study area. The site does provide habitat for common species.

Two frog species were identified, including the Brown Froglet (striped form) (*Crinia parinsignifera*) and Spotted Marsh Frog (*Limnodynastes tasmaniensis*). All were recorded from the pools located within the main watercourse east of the shed ruins which are likely to be spring fed, providing near-permanent water in dry periods. The waterholes lack any dense edge vegetation such as grasses and reeds. Amphibian habitat diversity within the watercourses is likely to be restricted due to the relative remoteness of the water-holding springs in a landscape strongly impacted by agricultural and human associated disturbances. The dense cover of Willows combined with the lack of favourable aquatic associated habitat lowers habitat value for a diverse amphibian population within the study area.

Additional survey time was dedicated to diurnal call play-back sessions aimed at detecting the presence of common and threatened frog species in and near the standing pools of the central watercourse. No responses were recorded from threatened species.

3.3.4 MICROCHIROPTERAN BATS

Microchiropteran bat species may use the study area for opportunistic foraging, however, limited sources of preferred natural and sheltered roosting habitat significantly decreases habitat quality. Human built structures and small hollows present in old Willows would provide refuge and roosting habitat opportunities for bat species. Bat habitat quality throughout this relatively small and isolated riparian corridor is limited due to the absence of connective links, the broad exposed edges of this community, competition for hollows and lack of nearby broad areas of native woodland. Isolated habitat may provide opportunistic refuge and roosting habitat for more commonly occurring bat species which typically utilise an open pastureland/ urban dominated landscape.

Table 3.2 - Observed Fauna List

Amphibians	
Scientific Name	**Common Name**
Crinia parinsignifera	Brown Froglet
Limnodynastes tasmaniensis	Spotted Marsh Frog
Reptiles	
Scientific Name	**Common Name**
Ctenotus robustus	Skink
Ctenotus taeniolatus	Copper-Tailed Skink
Pseudechis porphyriacus	Red-bellied Black Snake
Mammals	
Scientific Name	**Common Name**
Mus musculus *	House Mouse
Canis familiaris *	Dog
Vulpes vulpes *	Fox

Felis catus *	Feral Cat
Oryctolagus cuniculus *	Rabbit
Birds	
Scientific Name	**Common Name**
Threskiornis spinicollis	Straw-necked Ibis
Elanus notatus	Black-shouldered Kite
Falco cenchroides	Australian Kestrel
Platycercus eximius	Eastern Rosella
Turdus merula *	Blackbird
Rhipidura leucophrys	Willy Wagtail
Cinclorhamphus cruralis	Brown Songlark
Malurus cyaneus	Superb Blue Wren
Smicrornis brevirostris	Weebill
Acanthiza nana	Yellow Thornbill
Manorina melanocephala	Noisy Miner
Pardalotus sp	Pardalote
Zosterops lateralis	Silvereye
Passer domesticus *	Sparrow
Sturnus vulgaris *	Common Starling
Gymnorhina tibicen	Australian Magpie
Strepera graculina	Pied Currawong
Corvus coronoides	Australian Raven
Fish	
Scientific Name	**Common Name**
Gambusia holbrooki	Mosquito Fish
*** Denotes Introduced Species**	

3.4 THREATENED SPECIES

Despite targeted searches for species or habitats that could support threatened flora species, consideration of bio-climatic range forecasts and a review of NPWS Wildlife databases, no vegetation communities or plant species of local, regional or state conservation significance were identified. It is highly unlikely that threatened flora species are present in the area. A long history of agricultural, earthworks and past grazing impact has actively removed a large proportion of native habitat and less common species from the site.

Further influences from highly invasive and prolific common species lower the potential of the site to provide favourable habitat for rare or threatened flora species.

Walked searches including areas along the ungrazed areas adjacent to the Great Western Railway easement, across open pasture-dominated paddocks and within open areas of the watercourses were

undertaken. These searches targeted the presence of rare and threatened species including *Prostanthera stricta, Philotheca ericifolia, Goodenia macbarronii, Thesium australe, Persoonia marginata* and *Lepidium hyssopifolium*. No evidence of these species or their known associated communities and species were identified.

Similarly, habitat survey techniques designed to detect the presence and assess the quality of available habitat indicate that no threatened fauna species are likely to find preferred or favourable habitat within the immediate locality. Specific habitat requirements for terrestrial threatened species were assessed during the field survey. These species include;

- Magpie Goose (*Anseranas semipalmata*)
- Turquoise Parrot (*Neophema pulchella*)
- Superb Parrot (*Polytelis swainsonii*)
- Regent Honeyeater (*Xanthomyza phrygia*)
- Black Chined Honeyeater (*Melithreptus gularis*)
- Koala (*Phascolarctos cinereus*)
- Common Bent-wing Bat (*Miniopterus schreibersii*)
- Yellow-bellied Sheathtailed Bat (*Saccolaimus flaviventris*)
- Greater Long-eared Bat (*Nyctophilus timoriensis*)
- Greater Broad Nosed Bat (*Scoteanax rueppellii*)

While the site may be included in fly-over zones for these species or opportunistic foraging visitations, resources are substantially limited and cut-off from broader areas of native habitat. No preferred or favoured habitat was identified within the immediate locality for these species.

It is considered that due to the sparsity of native trees and shrubs across the site, the degraded nature of the existing watercourses, site exposure, high disturbance level to the existing groundcover and localised residential, industrial, transport and agricultural impacts, it is unlikely that the area provides any long-term resources favourable or preferred for threatened fauna species.

3.5 AQUATIC ECOLOGY

3.5.1 STREAM WATER QUALITY

Table 3.3 - Stream Water Quality

Parameter	Unit of Measure	Result
Alkalinity	mg/L	270
Electrical Conductivity	µS/cm	798
pH	pH units	6.9
Temperature	ºC	15
Dissolved Oxygen	mg/L	0.17
Turbidity	NTU	1

Note:
Water quality measurements obtained in the field by qualified Environmental Scientist using properly calibrated instruments

The physico-chemical water quality in the larger of the standing pools (**Plate A3**) was assessed in the field on 18th April 2005.

Alkalinity levels were 270 mg/L. Such values are typical of surface waters and would also be considered to fall within the typical range of Australian reticulated drinking water supplies.

Electrical Conductivity (EC) levels were 798 µS/cm. The EC levels within this pool of water fall below the Interim Water Quality Objective (WQO) value of <1500 µS/cm specified for 'aquatic ecosystems' in the Macquarie-Bogan River catchment (DEC, online).

pH levels were 6.9 pH units. The observed levels fall within the desired range of 6.5-9.0 pH units specified for 'aquatic ecosystems' in the Macquarie-Bogan River catchment (DEC, online).

Turbidity levels were below the interim WQO value (<5 NTU) at low levels (high clarity) with only 1 NTU detected.

Although the diurnal range was not established, dissolved oxygen levels (obtained mid afternoon) were very low with only 0.17 mg/L detected. Such levels fall below the Interim WQO value of >6 mg/L for 'aquatic ecosystems' in the Macquarie-Bogan River catchment. Such levels are likely due to oxygen-depleting conditions as a result of the high amounts of decomposing organic matter observed within the pools of water sampled, combined with the stagnant flow conditions observed at the time of sampling.

3.5.2 AQUATIC FLORA

At the time of the survey, the northern watercourse was dry, containing a scattered vegetation community of ground species dominated by pasture and weed species. The main watercourse dissecting the study area contained isolated pools.

Much of the creek bed and lower banks are heavily shaded by a dense willow canopy. Many bare areas on the upper banks show evidence of active erosion. Species growing on the banks and dry bed of the channels include many robust pastureland species and also include species typically associated with ephemeral watercourses. These include Knob Sedge, Tall Spike Rush, Common Rush, Yorkshire Fog and Cumbungi. Dense upper canopy structure typically restricts the growth of aquatic associated species to scattered individuals. Areas where the canopy has been removed by clearing has allowed for small areas to become vegetated by small stands of reeds and sedges. Much of the watercourse bed and banks remain free of vegetation due to fine sediment deposition, dense mats of fallen willow leaves and roots, eroded bank walls and low light conditions.

No established native aquatic or wetland vegetation community is present on the study area.

3.5.3 AQUATIC ASSOCIATED FAUNA

In-stream habitat potential of the site is lowered by several factors. These include; the ephemeral nature of this watercourse and its relatively small upper catchment, in-stream physical barriers (eg. Blackberry thickets, willow root-masses, fence lines), a heavily shaded and eroded watercourse, sand/ silt bed composition and the absence of in-stream habitat such as reed beds, rocky pools and snags.

The pooling areas of the watercourse are heavily shaded and contain scarce aquatic associated vegetation. In times of flow, substantially ponded areas are likely to be short-lived due to the porous nature of the sand/silt bed.

Small isolated patches of in-stream vegetation occur where the canopy has been thinned or removed from the banks and bed. These areas are not associated with standing pools. During times of flow these areas may potentially provide suitable amphibian habitat, however the areas of in-stream vegetation are isolated and typically restricted in size.

Two frog species were identified, including the Brown Froglet (striped form) and Spotted Marsh Frog (**Section 3.3.3**). These species were recorded from the waterholes located within the main watercourse east of the shed ruins. Amphibian habitat diversity within the watercourses is likely to be restricted due to the relative remoteness of the water-holding springs in a landscape strongly impacted by agricultural and human associated disturbances. The dense cover of Willows combined with the lack of favourable aquatic habitat lowers habitat value for a diverse amphibian population within the study area.

Fin-fish habitat within the study area is very poor due to the presence of physical barriers and the ephemeral nature of the watercourses. The scarcity of long-standing pools along the channel restricts spawning and movement opportunities. *Gambusia holbrooki* were detected within the standing pools located in the main channel east of the shed ruins.

3.5.4 THREATENED AQUATIC SPECIES

Despite targeted searches for species or habitats that could support aquatic flora species of significance, consideration of bio-climatic range forecasts and a review of NPWS Wildlife database, no aquatic vegetation communities or plant species of local, regional or state conservation significance were identified. It is highly unlikely that threatened aquatic flora species are present in the area. A long history of community degradation has actively removed a large proportion of native habitat and less common species from the site.

Further influences from highly invasive and prolific common species lower the potential of the watercourses to provide favourable habitat for rare or threatened flora species.

Similarly, habitat survey techniques designed to detect the presence and assess the quality of available habitat indicate that no threatened aquatic fauna species are likely to find preferred or favourable habitat on the study area. Specific habitat requirements for terrestrial threatened species were assessed during the field survey.

It is considered that due to the highly degraded nature of the existing watercourses, site exposure and the modification of groundcover and riparian vegetation, it is unlikely that the area provides any long-term resources favourable or preferred for threatened aquatic fauna species.

The field survey also aimed to assess the quality of available habitat for threatened amphibian species within the study area. The subject species included the Green and Golden Bell Frog (*Litoria aurea*) and the Booroolong Frog (*Litoria booroolongensis*). Both species have been recorded as occurring in the Bathurst/ Kelso/ Georges Plains locality.

Available habitat within the watercourses is poor for these threatened frog species. These species were not detected within the study area. Flow within the channels is ephemeral and dependant upon local rainfall within a relatively small catchment. The watercourses are heavily shaded and absent of vegetated pools. The watercourse banks and beds consist of fine sedimentary alluvium and no coarse sediment or riffle areas are present in-stream. It is likely that predatory fish species such as *Gambusia holbrooki* occur throughout both watercourses during times of flow. Further, rehabilitation of the main watercourse with locally endemic plant communities (Guy Sturt and Associates, 2005) and the mimicking of 'natural' state stream 'roughness' (Whipps-Wood Consulting, 2005) is likely to improve habitat quality for frog species in the future.

Based on potential habitat resources within the immediate locality of the study area and the nearby locations of listed recordings, an 'Eight Part Test of Significance' has been undertaken for these amphibian species.

The site is located in a catchment where the threatened Trout Cod (*Maccullochella macquariensis*) and Murray Cod (*Maccullochella peelii*) may be present. However, given the available habitat quality of the ephemeral drainage depressions and the absence of any in-stream, large-deep pools, snags, rocky bed substrate and other preferred habitat, aquatic habitat value for native fin-fish is negligible. Known habitat for these species is not present. Known habitat for these species is generally restricted to the upper reaches of defined catchments that are more pristine and subject to less agricultural impacts such as fencing, cattle access and likely chemical usage. Further, it is highly unlikely that the proposed development would result in an impact upon the existing habitat available within the lower catchment areas for these threatened fin-fish species. Based on the known distribution of these species within the larger catchment to which the study area belongs, an 'Eight Part Test of Significance' has been carried out for these fin-fish species.

3.6 MATTERS OF NATIONAL SIGNIFICANCE

An EPBC Act Protected Matters Report was undertaken on the 16th April 2005. This involved a search based on a defined area extending in a radius of approximately 15km around the study area.

- The area is not part of, or in the vicinity of, any listed world heritage areas.
- The area is not part of, in the vicinity of, or immediately connected to, any listed wetlands of international significance. The watercourses present on the study area fall within the catchment area of the Macquarie Marshes Nature Reserve. However, development within the study area is unlikely to directly or indirectly impact on any listed wetlands of international significance.
- *Eucalyptus pulverulenta, Lepidium hyssopifolium, Philotheca ericifolia, and Thesium australe* are listed as threatened flora species for the locality, however on-site habitat is not considered suitable for these species. These species were not observed within the study area and it is unlikely that these species would occur within the study area. No flora species classified as 'Extinct in the Wild' or as 'Critically Endangered' are listed for the locality.
- The Swift Parrot (*Lathamus discolor*), Superb Parrot (*Polytelis swainsonii*), Australian Painted Snipe (*Rostratula australis*), Regent Honeyeater (*Xanthomyza phrygia*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Long-eared Bat (*Nyctophilus timoriensis*), Spotted-tail Quoll (*Dasyurus maculatus maculatus*), Broad-headed Snake (*Hoplocephalus bungaroides*) and Murray Cod (*Maccullochella peelii peellii)* are listed, however none of these species are likely to inhabit the study area nor are they likely to find favourable habitat in the study area.
- No fauna species classified as 'Extinct in the Wild' or as 'Critically Endangered' are listed for the locality.

- No listed 'Critically Endangered' or 'Endangered' ecological communities occur in the area. Grassy White Box Woodlands are known to occur within the broader region. The communities present on the study area do not constitute a Grassy White Box Woodland.

The site does not provide habitat resources important for listed migratory terrestrial species, including White-bellied Sea-Eagle (*Haliaeetus leucogaster*), White Throated Needletail (*Hirundapus caudacutus*), Regent Honeyeater (*Xanthomyza phrygia*), Satin Flycatcher (*Myiagra cyanoleuca*), Latham's Snipe (*Gallinago hardwickii*), Painted Snipe (*Rostratula benghalensis*), Fork-tailed Swift (*Apus pasificus*), White Egret (*Ardea alba*) or Cattle Egret (*Ardea ibis*).

The site does not provide habitat resources important for listed migratory wetland species including Latham's Snipe (*Gallinago hardwickii*) and Painted Snipe (*Rostratula benghalensis*).

The development is unlikely to modify or inhibit the conservation of biodiversity within the locality or broader region. The proposed works would not have a *significant impact* on any matters of national environmental significance.

Impacts

This section of the report identifies potential on-ground and in-stream impacts which are likely to result from the proposed development.

Habitat and community quality to be impacted is considered low because:

- there is a low diversity of vegetation due to species removal, ingression and invasion from grazing, cropping, prior clearing, soil degradation and erosion impacts; and
- habitat potential has been significantly compromised as a result of high levels of existing and prior agricultural and quarrying disturbances and also high levels of surrounding residential, industrial, and transport related impacts on the study area.

4.1 ON-GROUND WORKS

Flora

- Disturbance or removal of up to approximately 30 ha of vegetation. This vegetation is comprised predominantly of ground species associated with a pastureland community.

Fauna

- Removal of approximately 30 hectares of low quality, open pastureland.
- Removal of exotic trees, shrubs and bushes which potentially provide low quality avian, reptilian, mammalian and micro-bat habitat resources.

4.2 IN-STREAM WORKS

Aquatic Flora

- The removal or disturbance of small isolated stands of common, aquatic associated vegetation from the main watercourse.
- The removal or disturbance of approximately 800 metres of degraded riparian corridor vegetation from the two watercourses on the study area. This vegetation consists predominantly of exotic tree, shrub and bush species and a sparse pastureland associated understorey.

Aquatic Fauna

- The modification of low quality in-stream habitat through partial removal of in-stream exotic vegetation, removal of barriers, partial covering of the main watercourse and complete covering of the northern watercourse, and alteration of bank and bed topography.

Significance of Impacts

5.1 INTRODUCTION

On the basis of the field survey and a review of available data it is considered that no threatened flora or fauna species are likely to be impacted by the proposed development.

Levels of past clearing, grazing, current agricultural, industrial and urban disturbances significantly limit the potential occurrence of many threatened species within the study area. Further, it is likely that competition is high as a result of more common species being able to better utilise the existing habitat, given the levels of disturbance present.

The direct removal of existing habitats is restricted to degraded exotic dominated communities. This would not result in impacts on native habitat or connectivity between important areas of habitat throughout the immediate locality.

On the assumption that mitigative measures listed in the following section are incorporated with the development design, potential flora and fauna impacts associated with development of the subject land are unlikely to be significant. Existing habitat quality is poor as a result of the diminished diversity of native vegetation due to past clearing, grazing, cropping, weed infestation and common species ingression.

5.2 SIGNIFICANT FLORA

All potentially occurring threatened flora species were identified and researched prior to the field study. Habitat assessment and site inspection led to some of these species being excluded from further consideration. This was based on comparison of preferred and known habitat to that available on the study area. The disturbance or removal of ground, shrub and tree vegetation by the proposed development is unlikely to have a significant impact on flora as the vegetation of the study area is considered to have a low floristic conservation and habitat value.

Based upon bioclimatic range-data, ROTAP listings, the National Parks & Wildlife Service's Atlas of NSW Wildlife data-base, habitat assessment of the broader locality and connective habitat types, the threatened species targeted during the survey included *Prostanthera stricta, Philotheca ericifolia, Goodenia macbarronii, Thesium australe, Persoonia marginata* and *Lepidium hyssopifolium*. The field survey did not detect the presence of any of these threatened flora species.

It is unlikely that any other threatened or rare flora species would occur within the site or be at risk of disturbance by the proposed development due to the history and intensities of prior and existing

disturbances. Cumulative impacts from grazing, clearing, cropping, weed invasion, erosion and compaction significantly lowers the likelihood of occurrence of threatened flora species.

5.3 SIGNIFICANT FAUNA

No threatened fauna species were detected inhabiting the area. The existing lower stratums and groundcover vegetation has been heavily modified through a long history of grazing, cropping, compaction and active clearing. The area provides negligible habitat values for threatened species, their populations or ecological communities. The primary habitat resource provided is the narrow and confined degraded riparian corridors within the two eroded watercourses that cross the study area.

Foraging, breeding and movement resources are considered to be very poor for significant bird, mammal and reptile species. The floristic structure of the site has a relatively low diversity which is dominated by exotic species. No intact native dominated stratum remains on the study area. The impacts associated with the close proximity of a large urban area are also likely to impact upon the connectivity and distribution of many less common species in the area.

A total of three terrestrial fauna species were identified as having the potential to occur on the study area. These species include microchiropteran bat species which may opportunistically forage over the study area or utilise small hollows within human-built structures or in trees on site.

- Common Bent-wing Bat (*Miniopterus schreibersii*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Greater Long-eared Bat (*Nyctophilus tmoriensis*)

The primary impacts for these species is the loss of potential foraging areas, the modification of existing refuge, the removal of exotic shrub and tree species which may provide habitat for insect prey and an increase in human associated disturbances within existing habitat.

These species have been included in the test of significance due to a combination of potential habitat availability in the locality and/or bioclimatic relevance.

It is considered that due to the highly degraded nature of the existing watercourses, site exposure and the modification to groundcover and riparian vegetation it is unlikely that the area provides any long-term resources favourable or preferred for threatened aquatic fauna species.

Two amphibian species species have been recorded in the locality of the study area. These include the Green and Golden Bell Frog (*Litoria aurea*) and Booroolong Frog (*Litoria booroolongensis*).

Litoria aurea was last recorded in the area in 1973. Nearby recordings were made from the Macquarie River in the vicinity of the Denison Bridge and from a location immediately east of Kelso. Both these sites are located less than five kilometres from the study area and have connective catchments.

Litoria booroolongensis has been recorded from the Fish River to the south and the Macquarie River to the west of the study area. These recordings were made in 2000 and 1996 respectively. Both sites are located within 10 kilometres of the study area.

Based on potential habitat resources within the immediate locality of the study area and the nearby locations of listed recordings, an 'Eight Part Test of Significance' has been carried out for these amphibian species.

The site is located in a catchment where the threatened Trout Cod (*Maccullochella macquariensis*) and Murray Cod (*Maccullochella peelii*) may be present. However, given the available habitat quality of the ephemeral drainage depressions and the absence of any in-stream, large-deep pools, snags, rocky bed substrate and other preferred habitat, aquatic habitat values for native finfish is negligible. Known habitat for these species is not present. Based on the known distribution of these species within the same catchment system present on the study area, an 'Eight Part Test of Significance' has been carried out for these fin-fish species.

5.3.1 TERRESTRIAL FAUNA – EIGHT PART TEST

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

Common Bent-wing Bat (*Miniopterus schreibersii*)

This microchiropteran bat species occupies a range of habitats from grasslands through to subtropical rainforests. The species are typically found in well-timbered valleys. The species establishes maternity colonies in caves and also special wintering colonies, transient colonies and diurnal roost colonies. The species will utilise mines, caves, stormwater tunnels and occasionally inside of buildings.

The species forages with level, fast flight above the canopy or high over open areas. The species hibernates during winter months and is also known to go into a torpor state during short periods of the summer.

The study area has few available roosting habitats for this species. There is a limited area of riparian woodland with scattered small-hollow bearing trees on site however no cave or mine habitat is present. While the site offers few refuge or roosting resources, the species may opportunistically forage within the habitat of the study area and in the remnants present in the locality. Nearby small farm dams and open pasturelands may potentially provide this species with suitable watering and foraging sites. Similar foraging habitat is abundant in the locality.

The proposed development would not impact on the availability of any refuge and roosting habitat for this species. Movement corridors or the availability of foraging habitat for this bat species would not be impacted.

Greater Broad-nosed Bat (*Scoteanax rueppellii*)

This bat species is a low, slow flying bat, foraging in direct lines catching beetles and other large, slow-flying insects. The species has also been recorded preying on other small bat species. The species has most commonly been recorded from the gullies and river systems draining the Great Dividing Range. The species range extends to the coast and may also venture inland to approximately

100 kilometres west of the Great Dividing Range. Although inhabiting a variety of habitats from woodland through to moist and dry eucalypt forest to rainforest, the species is rarely recorded at altitudes above 500 meters.

It is unlikely that this species inhabits the study area other than for opportunistic movement patterns or foraging passes. The study area has few preferred roosting habitats for this species and the species is rarely recorded at the elevation of the study area. There is an absence of large hollow bearing trees on site. While the site offers limited small-hollow refuge or roosting resources, the species may opportunistically forage within the habitat of the study area and in the locality. Small farm dams and open pasturelands may potentially provide this species with suitable watering and foraging sites. Similar foraging and roosting habitat is available in the immediate locality.

The proposed development would not impact on the availability of any refuge and roosting habitat for this species. Movement corridors or the availability of foraging habitat for this bat species would not be impacted.

Eastern False Pipistrelle, Greater Long-eared Bat (*Nyctophilus tmoriensis*). Recent studies indicate that, in addition to the Tasmanian subspecies, three geographically distinct forms exist across southern Australia, indicating that what is called *Nyctophilus timoriensis* may represent a species complex. Apart from its occurrence in the tall forests of far south-western Western Australia and Tasmania, it is found in woodland and mallee across the arid and semi-arid regions (Strahan, ed, 1995).

The species is typically recorded from the dry open woodlands and around River Red Gum lined watercourses and lakes on the inland plains of the semi-arid zone. The species has a bioclimatic range which extends to the foot-slopes of the Great Dividing Range. The species has been recorded roosting in tree hollows, under loose bark, in the mud nests of Fairy Martins, and in buildings. Threats to this species include clearing, grazing and predation (Ayres *et al.*, 1999).

While small-hollow habitat availability is limited across the study area, the mobility of this species allows it to gain access to many forms of habitat available across the broader locality. It is likely that the distribution of these species over the study area is responsive to insectivorous prey availability. It is unlikely that this species inhabits the study area on a long-term basis. While the site offers limited refuge or roosting resources, the species may opportunistically forage over the degraded riparian corridor habitat of the study area and in the locality. Small farm dams and open pasturelands may potentially provide this species with suitable watering and foraging sites. Similar foraging habitat is available in the locality.

The proposed development would not impact the availability of any preferred refuge and roosting habitat for this species. Movement corridors or the availability of foraging habitat for this bat species would not be impacted.

It is highly unlikely that development activities associated with the proposed development would impact on any viable local population of these threatened species. No preferred or critical breeding, movement or foraging habitat resource would be impacted. The proposed development would not be

likely to disrupt the life cycle of these threatened species such that a viable local population is likely to be placed at risk of extinction. No areas containing mature woodland remnants would be impacted.

b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

The proposed development would not compromise the viability of any endangered population.

(c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed

One Threatened Ecological Community is listed for the region. This community is a White Box, Yellow Box, Blakely's Red Gum Woodland. The community is listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995*. This community is not present on the study area. It is highly unlikely that the proposed development would modify or remove an area of known habitat that in either a local or regional context is unique or important for the conservation of any threatened community or species habitat. An area of known habitat would not be modified as a result of the proposal.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No area of known habitat would become isolated from currently interconnecting or proximate areas of similar or preferred habitat. The development would not isolate any area of known interconnecting habitat or proximate areas of habitat.

· **Whether critical habitat will be affected**

The *Threatened Species Conservation Act*, *1995*, defines critical habitat as habitat declared under Part 3 of the Act. No critical habitat was identified on site.

f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region

There is insufficient information available on individual threatened species to determine whether these species are 'adequately represented in conservation areas'. Due to the lack of data the only option is to consider all species inadequately conserved within the region. The site's relatively isolated status precludes it from being considered optimum habitat for the threatened species identified. Furthermore, the scale of the proposed development is unlikely to have a significant adverse impact on future opportunities to ensure the conservation of these species within the region. The proposed works are not considered a threat to the conservation of any of these species.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The *Clearing of Native Vegetation* has been listed by the NSW Scientific Committee as a key threatening process (Sept. 2001). 'Native Vegetation' is defined by the NSW Scientific Committee as being '*made up of plant communities comprising primarily indigenous species, the composition and structure of which reflects the interactions between plant species, between plants and fauna, and the environment'*.

The proposed clearing of native vegetation on the study area may include the removal of areas of pasture associated grassland from the study area. While native ground species are present within the ground communities on the study area, the grassland community is not comprised primarily of indigenous species.

The potential impact upon any threatened and rare flora species within the existing communities of the locality is likely to be negligible. It has been established through field survey sessions, literature searches and available data that the likelihood of threatened species impact within the proposed development area is very low. The dominant native species within the proposed impact areas are comprised of more robust and prolific species, commonly associated with agricultural grazing lands.

The clearing of any native vegetation from the study area would not result in the following:

- Destruction of habitat resulting in the loss of local populations;
- Removal of diverse shrub or ground components;
- Native riparian zone degradation;
- Increased habitat for invasive species; and
- Change in soil biota or hydrology.

The removal of existing grassland from the site is unlikely to threaten the survival or evolutionary development of the listed threatened flora species. No unique community or significant native vegetation area would be removed from the study area.

The *Invasion of Native Plant Communities* by Exotic Perennial Grasses has been listed by the NSW Scientific Committee as a Key Threatening Process (2003). Exotic perennial grass species are those that are not native to NSW and have a life span of more than one growing season.

A relatively small number of exotic perennial grass species threaten native plant communities in NSW and one prominent species occurs on and near the study area which is listed as species of concern. This species is Phalaris (*Phalaris aquatica*).

Phalaris is a widespread and very common species within the pastureland communities of the study area and surrounding locality. It occurs as dense monospecific stands and as a widespread component of the pastureland areas of the study area. The species is a highly invasive grass species in the immediate locality due to favourable growing conditions and the absence of other robust native ground species.

Exotic grass species including Phalaris are common components of the pastures in the broader locality. The viability and dominance of these species is influenced by grazing regimes, management and soil-type.

The control of existing populations in and adjacent to the proposed impact area along with ongoing maintenance to lower the potential for invasive species to establish will need to be a key consideration of the development and planning process. It is highly unlikely however, that the development will initiate the invasion of exotic perennial grasses into any native dominated community in the immediate locality of the study area.

The proposed development is unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of any species. The proposal would not contribute to any of the threatening processes listed in the *Threatened Species Conservation Act, 1995.*

(h) Whether any threatened species, population or ecological community is at the limit of its known distribution

The study area does not provide resources or features of significance with regards to the distributional limits or habitat requirements of threatened species. Further, the study area is not located on the periphery of any of the geographical ranges, vegetation based habitat zones, botanical divisions or climatic zones identified as known distribution parameters for threatened species.

5.3.2 AQUATIC ASSOCIATED FAUNA – EIGHT PART TEST

A total of four aquatic or amphibian fauna species were identified as having a low potential to occur within the study area. These include the following:

- Green and Golden Bell Frog (*Litoria aurea*)
- Booroolong Frog (*Litoria booroolongensis*).
- Trout Cod (*Maccullochella macquariensis*)
- Murray Cod (*Maccullochella peelii*)

The primary impacts for these species is the disturbance of potential low-quality movement, refuge and foraging areas within /or immediately adjacent to the unnammed watercourse.

These species have been included in the test of significance due to nearby recording data, potential sub-optimal habitat availability in the locality and/ or bioclimatic relevance.

(a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Green and Golden Bell Frog (*Litoria aurea*)

This species is a large (45 to 100mm), mainly aquatic species found among vegetation within or at the edges of permanent water (streams, swamps, marshes, lagoons, dams and ornamental ponds). The species has been found under debris on low, frequently flooded river flats. Tadpoles are relatively large with long tails and take approximately six weeks to develop.

The species was formerly distributed from the NSW north coast, southward along the NSW coast and extending into Gippsland in Victoria. The species range once spread westward to Bathurst, Tumut and the ACT. The species was considered widespread and abundant, however declines in the late 1970's and 80's resulted in a scattered series of isolated populations. Many of these coastal populations have also dramatically declined or disappeared.

Litoria aurea was last recorded in the area in 1973. Nearby recordings were made from the Macquarie River in the vicinity of the Denison Bridge and from a location immediately east of Kelso. Both these sites are located less than five kilometres from the study area and have connective catchments.

The species inhabits sites with a still, shallow, ephemeral, unpolluted water body. Habitat vegetation includes a grassy area nearby and aquatic plants (preferably Bullrushes, *Typha* sp.). The preferable water body is un-shaded and free of Mosquito Fish and other predatory fish. Substrate material consists of sand or rock with a range of available diurnal shelter sites, including vegetation and rocks. Some known sites within the Greater Sydney region consist of highly disturbed sites including brick pits, disused industrial sites, landfill areas and even cleared land.

Threats to this species include habitat destruction, alterations to drainage patterns, drought, disease, climate change, use of pesticides and herbicides, salination, predation by exotic fish (particularly *Gambusia holbrooki*) and loss of breeding habitat by infilling and destruction of wetland areas.

An assessment of habitat values indicates that it is highly unlikely that the study area supports a viable local population of threatened species. The creek channel contains only isolated areas of reeds with few sedges present. No established stands of Bullrushes are present. The creek is heavily shaded and steeply incised. *Gambusia* species are present in large numbers within standing pools of the main watercourse. While changes to the biodiversity and floristic composition may change in response to seasonal factors, it is unlikely that the watercourses or adjacent banks would contain significant breeding or refuge habitat for the species.

Booroolong Frog. (*Litoria booroolongensis*)

The Booroolong Frog is a small dull grey to brown frog with darker flecks and mottling and a creamy-white belly.

The species is an amphibious frog known only from the tablelands and slopes of New South Wales. It typically inhabits rocky western-flowing creeks and their headwaters, although a small number of animals have also been recorded in eastern-flowing streams. It is a seasonal breeder which is found on or under rocks and debris of suitable streams. Although nocturnal, this species can also be found on rocks in or near the water during daylight hours.

Surveys of western-flowing streams from the Northern Tablelands conducted over the past 15 years have failed to locate these frogs in all but one locality, although historical records indicate they were once widespread. It is suspected that the species is regionally extinct in all but the south of this area. Previously known populations within the Blue Mountains are no longer able to be located.

The Booroolong Frog has been historically recorded from numerous localities within and between tributaries of the Macquarie and Lachlan Rivers. Surveys throughout this region have failed to locate the species along many of these streams. Recordings of the species indicate that the Booroolong Frog may persist along the Turon River and Winburndale Creek within the Winburndale Nature Reserve. *Litoria booroolongensis* has been recorded from the Fish River to the south and the Macquarie River to the west of the study area. These recordings were made in 2000 and 1996 respectively. Both sites are located within 10 kilometres of the study area.

In the south of its range, it is suspected that tadpoles of the Booroolong Frog are vulnerable to predation by both the Brown Trout and Rainbow Trout. These exotic predatory fish are known to prey on the tadpoles of at least four other riverine Litoria species, despite their being unpalatable to native predatory fish. The introduction of these trout species is a threat to this species. Other potential predatory fish species include European Carp, goldfish, Redfin Perch and Mosquito Fish.

Other potential threats to the species include habitat disturbance, land clearing, stock grazing and chytridiomycosis disease.

An assessment of habitat values indicates that it is highly unlikely that the study area supports a viable local population of this threatened species. The watercourses present on the study area contain poor value habitat for the species on the study area with scarce loose debris and no rocky bed areas. The creek is heavily shaded with steep, deeply incised banks. *Gambusia* species are present within the standing pools of the creek course. While changes to the biodiversity and floristic composition may change in response to seasonal factors, it is unlikely that the watercourses would contain significant breeding or refuge habitat for the species.

Trout Cod (*Maccullochella macquariensis*)

The Trout Cod was once common throughout much of the Murray-Darling system. It is thought that there are now only two reproducing populations; one in the Murray River and one in Seven Creeks in Victoria. It is a territorial predator and its preferred habitat is deep holes with juveniles sheltering under boulders and debris (McDowell, 1993; Merrick and Schnida, 1984). Habitat consists of deep, slow flowing waters with mud or sand sub-strata with abundant snags and woody debris. Habitat also includes in-stream cover in the form of woody snags and overhanging banks. The species are often found in deeper pools but smaller fish have been found amongst boulders, under logs and other cover in shallower waters.

While in-stream works are proposed to be undertaken in minimal to potentially moderate fish habitat, no significant habitat is likely to be impacted for this species. It is unlikely that the viability of any population of Trout Cod within the catchment would be disrupted to the extent that the species would be placed at the risk of extinction. This is due to;

- the absence of habitat for the species within the study area or within the immediate catchment;
- The poor quality of the watercourses for movement and spawning habitat;
- existing in-stream barriers would be removed by the proposed development, improving fin-fish movement along the watercourse; and
- removal or thinning of dense overhanging willows, improving in-stream vegetation diversity and associated stream ecology and integrity.

An assessment of in-stream fish habitat values indicates that it is highly unlikely that the study area supports a viable local population of the Trout Cod. The watercourses present on the study area contain poor value in-stream habitat for the species with no deep in-stream holes, loose debris, boulders and hollow logs. The creek is heavily shaded with steep, deeply incised banks. It is unlikely that either watercourse would contain significant breeding or refuge habitat for the species.

- **Murray Cod (*Maccullochella peelii*)**

The Murray Cod is a species that is not listed under the *NSW Fisheries Management Act 1994,* however is listed as vulnerable under the *Environment Protection and Biodiversity Act, 1999*. Murray Cod have been recorded in the Macquarie River Catchment (NSW Fisheries records). Murray Cod are found in habitats ranging from small upland streams in the upper western slopes of New South Wales to the generally turbid, low gradient, slow-flowing rivers and creeks of the western plains. Within these

habitats, Murray Cod are generally found in or near deep holes and prefer habitats containing refuge such as rocks, fallen trees, stumps, clay banks and hanging vegetation. The Murray Cod is known to become very active before spawning in spring to early summer, when water temperatures rise above 20°C.

It is unlikely that the lifecycle of the Murray Cod (including the larval stage) will be disrupted to the extent that a viable local population is likely to be placed at risk of extinction. This is due to:

- the poor quality of the watercourses for movement and spawning habitat;
- Existing in-stream barriers would be removed by the proposed development; and
- Dense overhanging willows would be thinned or removed.

An assessment of in-stream fish habitat values indicates that it is highly unlikely that the study area supports a viable local population of the Murray Cod. The watercourses present on the study area contain poor value in-stream habitat for the species with no deep in-stream holes with loose debris and logs. The creek is heavily shaded with steep, deeply incised banks. It is unlikely that either watercourse would contain significant breeding or refuge habitat for the species.

Based on the above factors, the proposed development would not be likely to disrupt the life cycle of these threatened amphibian and fin-fish species such that a viable local population is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

The proposed development would not compromise the viability of any endangered population. The proposed works are unlikely to substantially degrade the existing aquatic biology of the watercourses. Recommended mitigation measures associated with the works are likely to improve habitat resources of the existing channels.

The proposed project will not substantially degrade any potential amphibian or fin-fish habitat. The connectivity of existing waterways would not be broken. No important habitat required for movement, breeding or sheltering for these listed aquatic species is present on the study area.

It is unlikely that the life cycle of these species would be disrupted by the development such that the viability of any population is likely to be significantly compromised.

(c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

A significant area of known aquatic associated habitat would not be modified as a result of the proposal.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No area of known habitat would become isolated from currently interconnecting or proximate areas of similar or preferred habitat. The proposed works would not isolate any area of known interconnecting habitat or proximate areas of habitat. While the removal of trees ad shrubs from the watercourses may fragment the connectivity of the willow-dominated corridor, it is unlikely that linked or proximate riparian habitat is suitable for threatened species, threatened populations or ecological communities.

(e) Whether critical habitat will be affected.

The *Threatened Species Conservation Act*, *1995*, defines critical habitat as habitat declared under Part 3 of the Act. No critical habitat was identified on site.

(f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

There is insufficient information available on individual threatened species to determine whether these species are 'adequately represented in conservation areas'. Due to the lack of data the only option is to consider all species inadequately conserved within the region. The existing condition of habitat within the watercourse channel on the study area precludes it from being considered optimum habitat for these threatened amphibian species. Furthermore, the scale of the proposed development is unlikely to have a significant adverse impact on future opportunities to ensure the conservation of these species within the region. The proposed works are not considered a threat to the conservation of these species.

(g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

One key threatening process listed under Schedule 6 of the *NSW Fisheries Management Act, 1994* is relevant to the proposal. This is 'The degradation of native riparian vegetation along NSW watercourses'. Mitigation measures are required to minimise damage to riparian vegetation by clearly marking access points, and replanting and supplementing any riparian vegetation that is removed. The proposed works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of any species. The proposal would not contribute to any of the threatening processes listed in the *Threatened Species Conservation Act, 1995.*

The potential impact upon any threatened and rare aquatic species within the existing communities of the locality is negligible. It has been established through field survey sessions, literature searches and available data that the likelihood of threatened species impact within the proposed development area is very low.

No unique aquatic associated community or significant native vegetation area would be removed from the study area.

The proposed works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of any species. The proposal would not contribute to any of the threatening processes listed in the *Threatened Species Conservation Act, 1995.*

(h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The study area is located on the western edge of the known existing distributional range of the Green and Golden Bell Frog.

It has been established that the study area is unlikely to provide resources or features of significance with regards to the distributional limits or habitat requirements of this threatened species. Further, the potential of the proposed works to impact on habitat suitable for the Green and Golden Bell Frog is low. No preferred habitat would be modified or removed from the study area.

Historical records include the range of the Trout Cod to extend down the Murray to Mildura and to the north along the Macquarie River catchment. Restocking programs have been undertaken in the Trout Cod's range including the Turon River, upper Macquarie, Murrumbidgee, Broken, Goulburn, Ovens and Mitta Mitta Rivers. Released fish have maintained populations with some preliminary evidence of spawning. The Macquarie River, therefore, is not at a limit of distribution for the Trout Cod.

The natural distribution of the Murray Cod is throughout most of the Murray-Darling system. The Macquarie River is in the central eastern part of its distribution. This species is also actively restocked with hatchery bred fish throughout the Murray-Darling system. The Macquarie River, therefore, is not at a limit of distribution for the Murray Cod.

Mitigation Measures

6.1 INTRODUCTION

This section of the report identifies measures that could be undertaken as part of the proposed development in order to minimise impacts on flora and fauna and provide beneficial outcomes in terms of biodiversity values.

6.2 ON-GROUND WORKS

The following measures would assist in minimising the potential impacts on terrestrial flora, fauna and habitat disturbances associated with the proposed development.

- Any species used for landscape plantings within the riparian corridor should be endemic to the local area, consistent with the objectives and planning principals behind Bathurst Regional Council's *Vegetation Management Plan ,2003 (Terra Consulting 2003)*. Shrub and tree species chosen for planting within the riparian corridor and other areas within the study area should include species both suited to the locality as well as to soil and landscape factors. Selection should also consider species which have proven viable in already established local plantings. Suitable species lists have been prepared by Guy Sturt and Associates (2005).
- Weed monitoring and management is required during and after works. Invasive species including African Boxthorn, Blackberry, Cathead and Serrated Tussock must be controlled and removed from site. Stock-piling, transportation of soil and movement of machinery would need to be undertaken in a manner so as to minimise inadvertent transportation of weeds.

6.3 IN-STREAM WORKS

The following measures would assist in minimising the potential impacts on aquatic associated flora, fauna and habitat disturbances associated with the proposed development.

- Works undertaken within the watercourses would be carried out during periods of nil to low flow and during seasonal conditions where the likelihood of high flow events is low.
- The removal of vegetation from the channel and banks of the watercourse would be staged to prevent the complete removal of habitat from the channel at any one time. Staged removal of willows lining the channel could involve clearing of the northern bank first, followed by bank formation, revegetation and stabilisation before clearing of the southern bank. The aim of this process is to maintain in-stream and riparian habitat resources during the succession of works within the riparian zone.

- Any in-stream reed or sedge areas would be retained during in-stream works to provide habitat opportunities for aquatic species. The existing semi-permanent pool areas located within the main watercourse central to the site should also be conserved until final in-stream work is completed.
- Problematic terrestrial weeds such as Blackberry would be removed from the watercourse channels and controlled early in the development process.
- Car-bodies, metal and dumped rubbish would be removed from the riparian zone.
- Fish passage within the main watercourse would be maintained at all times throughout the proposed works.
- Appropriate and recommended culverts/ crossings would be used for the main (Class 2) channel type based on guidelines for fish passage (*Fish Passage Requirements for Waterway Crossings/ Fishnote: Policy and Guidelines for Fish Friendly Waterway Crossings*) NSW Fisheries 2003.
- In-stream weed species (including willows) would be managed and controlled during the life of the freight terminal facility.
- Watercourse banks and in-stream plantings would consist of suitable native species including appropriate non-invasive Sedge, Rush and shrub species. Proposed re-vegetation species would be guided by known riparian vegetation species lists obtainable from the Department of Infrastructure, Planning and Natural Resources.
- All outlet structures would be designed and constructed in accordance with the guideline: *Stormwater Outlet Structures to Streams* (*for pipes, culverts, drains and spillways – Version 1*).
- The establishment of water quality ponds, designed to include shoreline emergents, deepwater emergents and submerged macrophytes, and the installation of stormwater pollution devices and/ or gross pollutant traps, would assist in negating the ongoing potential for water quality impacts on Raglan Creek.

Conclusion

The conservation value of the site is poor due to a long history of urban, industrial and agricultural land use practices and very high levels of clearing throughout most of the original native vegetation stratum. The narrow and degraded riparian corridors occurring in the central and northern areas of the study area provide limited habitat resources for the immediate locality. Opportunities exist during the rehabilitation of the main watercourse to improve in-stream habitat for aquatic associated species such as amphibians. Furthermore, areas fringing the On Site Detention Basins (Guy Sturt and Associates, 2005) would provide for further, alternative amphibian habitat.

The proposed development would not have a significant impact on the ecology of the study area, and would not contribute to a cumulative affect on the local or regional ecology.

A field survey has established that no ROTAP or regionally significant flora species are likely to be present on the site. Consideration of bio-climatic range forecast data, a search of NPWS Atlas of NSW Wildlife database and an assessment of potential habitat indicates that while threatened fauna species may opportunistically utilise the site there is no preferred or favoured habitat resource at risk.

This ecological assessment concludes that the proposed Central West Regional Road/Rail Freight Terminal is unlikely to result in a significant impact on threatened species, populations or ecological communities, or their habitats.

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Appendix A

PLATES

PLATE A1. Granite gravel quarry located within the study area.

PLATE A2. Riparian corridor and agriculturally modified grassland communities within the study area.

PLATE A3. Pool from which water quality measurements were obtained on 18th April 2005.