Appendix K

Plain's Wanderer Impact Assessment

Plains Wanderer Species Impact Statement

Deniliquin Ethanol Plant EIS

Plains Wanderer Species Impact Statement

Deniliquin Ethanol Plant EIS

Client: Dongmun Greentec Pty. Ltd

ABN: 11 158 522 000

Prepared by

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Reviewed by	Dan Simmons

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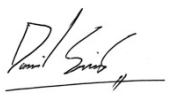
0	28/08/2015	Issued for Adequacy	Dan Simmons Principal Ecologist	
1	02-Oct-2015	Final	James MacDermott Practice Leader - Approvals	

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Declaration

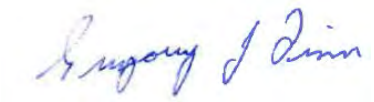
This Species Impact Statement for the Deniliquin Ethanol Plant Project has been prepared in accordance with Sections 110 of the NSW *Threatened Species Conservation Act 1995*, and the Director General's Requirement (DGR's) issued on 23 December 2013 by the Department of Planning and Infrastructure, now the Department of Planning and Environment, under the EP&A Act.

It is signed by the principal author of the statement (URS/AECOM) and the proponent of the proposed activity (Dongmun Greentec Pty. Ltd.).

David Gatfield

Ecologist

URS Australia Pty Ltd



Greg Finn

Director

Dongmun Greentec Pty. Ltd.

Executive summary

An Environmental Impact Statement (EIS) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of Dongmun Greentec Pty. Ltd. (Proponent), for a State Significant Development application for the construction and operation of an ethanol production facility at Deniliquin, NSW (the Project). The proponent is seeking approval for the development of an ethanol plant capable of producing 115 mega litres annually including several grain storage silos, a wastewater treatment facility and a workshop area.

Approval for the Project is being sought under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). AECOM has prepared an EIS pursuant to the requirements of the EP&A Act and the Environmental Planning and Assessment Regulation 2000. The EIS was prepared in accordance with the Director General's Requirement (DGR's) issued on 23 December 2013 by the Department of Planning and Infrastructure, now the Department of Planning and Environment, under the EP&A Act.

Investigations undertaken during the EIS identified the need to prepare a Species Impact Statement (SIS) to support the EIS application. This SIS documents the potential impacts of the Deniliquin Ethanol Plant Project on the plains wanderer (*Pedionomus torquatus*) and associated habitat in accordance with Section 109(1) of the *Threatened Species Conservation Act 1995* (TSC Act).

The assessment process initially involved a review of existing regional and site specific biodiversity data from a range of sources including scientific literature, biodiversity databases, aerial mapping and existing ecological reports. Following the desktop review, a field assessment was undertaken to identify the biodiversity values occurring within the Project Site and ground truth desktop results. Field surveys were undertaken in accordance with industry standards and guidelines.

The field survey determined the following biodiversity values to be present:

- Four plant communities, covering approximately 106.4 ha of the 120 ha Project Site. The plant communities mapped within the Project Site are:
    - Plant Community 1 (PC1): Derived native tussock grassland of *Enteropogon ramosus*, *Chloris truncata*, *Rytidosperma* spp. and *Austrostipa* spp. on orange-brown clay loam plains.
    - Plant Community 2 (PC2): Woodland of *Eucalyptus largiflorens* over open shrubland of **Lycium ferocissimum* over grassland of *Poaceae* sp. and *Cyperus* sp. with scattered tussocks of *Enteropogon ramosus*.
    - Plant Community 3 (PC3): Open sedgeland of *Eleocharis pusilla* and *Juncus* sp., with scattered *Enchylaena tomentosa* and *Sclerolaena muricata*.
    - Plant Community 4 (PC4): Low open forest of *Eucalyptus camaldulensis* (regrowth) over grass and herb land of **Romulea rosea* and *Einadia nutans*.
- No plant communities identified correspond to Threatened Ecological Communities (TEC's) at either a State or Commonwealth level.
- No flora species listed under the TSC Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded during the field survey. A likelihood assessment identified eight threatened flora species having an 'unlikely' or 'low' possibility of occurring within the Project Site.
- Two noxious weeds listed as Class 4 weeds under the *Noxious Weeds Act 1974* (NW Act) were identified at low densities within the Project Site.
- Four distinct fauna habitat areas were identified during the assessment:
    - waterbodies (dam)
    - black box woodland
    - grass and sedgelands
    - river red gum regrowth woodland.
- No threatened or migratory fauna species were recorded during the field survey. A likelihood assessment identified three migratory species, seventeen birds and one frog with a 'low' likelihood of utilising the Project

Site, and one bird species, the plains wanderer was determined to have a 'Moderate' likelihood of occurring within the Project Site.

Following the identification of biodiversity values, an expanded literature review of the plains wanderer was undertaken to adequately assess the potential impact of the Project on identified habitat. This review identified that the Project Site is situated outside of recognised core habitat areas for the species. Furthermore, it was determined that potential habitat within the Project Site was analogous with 'secondary' habitat for the species following review of habitat criteria developed as part of a regional mapping project (Roberts and Roberts, 2001).

With consideration of the information above, a significant impact assessment has been undertaken. The significant impact assessment identifies a potential impact on 17.3 ha of secondary plains wanderer habitat through vegetation clearing activities.

Given the sedentary nature of the species and the low abundance estimate of the local population, it is considered that the potential impact to secondary habitat on the Project Site may significantly impact the local population, if primary habitat becomes unsuitable.

The removal of 17.3 ha of secondary habitat is deemed unlikely to significantly increase fragmentation of habitat within the region. Furthermore, it is considered unlikely that the Project will exacerbate current threats from predation (i.e. foxes) due to the existing establishment of these species and the Projects proximity to existing cropping land uses.

The proponent is committed to maintaining positive biodiversity outcomes through implementing plains wanderer habitat offsets. Proposed offsets will be in accordance with the NSW biobanking offsets methodology and will be guided by current recovery and conservation objectives and expert advice. The implementation of biodiversity offsets will ensure the extent of plains wanderer habitat in the Riverina region is maintained and enhanced.

The SIS determined that potential exists for the Project to have a significant impact on the local population of plains wanderer, particularly if primary habitat in the immediate region becomes unsuitable, in times of drought, or from grazing practices. However, minimisation of impacts through measures such as a reduced Project Footprint and the co-location of the Project Footprint with existing, adjacent disturbances will ensure other threatening process such as fragmentation, increased predation risk and disruption of dispersal corridors is minimal. Furthermore, the application of offsets, guided by current recovery and conservation objectives and expert advice, will ensure a positive biodiversity outcome is achieved.

1.0 Introduction

This Species Impact Statement (SIS) has been prepared for the plains wanderer (*Pedionomus torquatus*) and is to be read in conjunction with Chapter 8 – Biodiversity of the Deniliquin Ethanol Plant Environmental Impact Statement (EIS).

This SIS is written in accordance with Section 109(1) of the TSC Act and has been signed by the principal author and the applicant in accordance with Section 109(2).

1.1 Scope of assessment

The aim of this SIS was to document the potential impacts of the Project on the plains wanderer (*Pedionomus torquatus*) and associated habitat in accordance with Section 109 (1) of the *Threatened Species Conservation Act 1995* (TSC Act). In meeting the aim, the objectives of the SIS assessment were to:

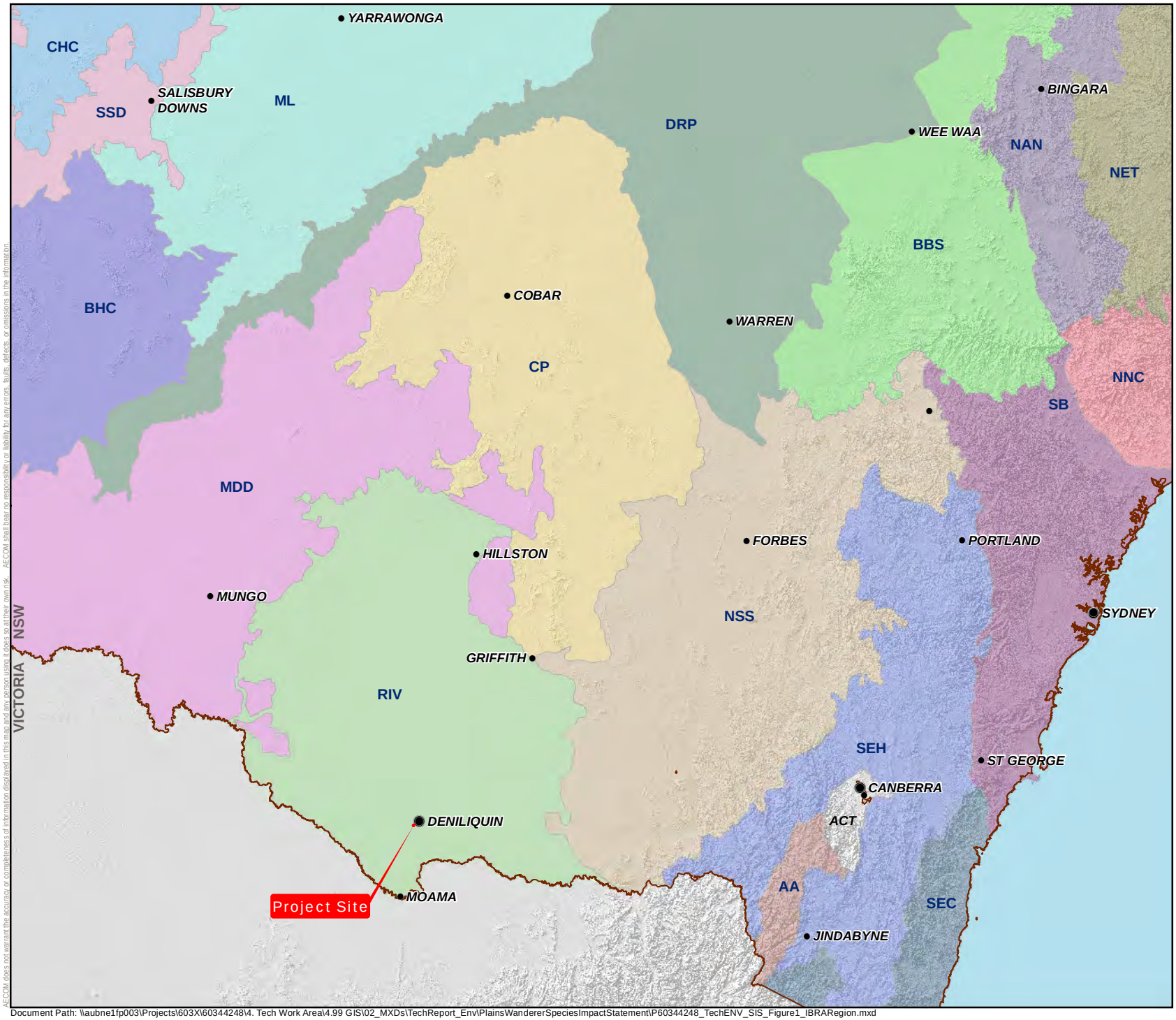
- Present a description of the action proposed.
- Provide a general description of the threatened species known or likely to be present in the area that is the subject of the action and in any area that is likely to be affected by the action.
- Undertake an assessment of which threatened species known or likely to be present in the area are likely to be affected by the action.
- Determine the extent of plains wanderer (and habitat) that is adequately represented in conservation reserves (or other similar protected areas) in the region.
- Review the distribution of the plains wanderer to determine if it is at the limit of its known distribution (in relation to the Project).
- Provide a full description of the type, location, size and condition of the habitat (including critical habitat) of the plains wanderer, as well as the distribution and condition of similar habitats in the region.
- Determine the likely effect of the Project on the plains wanderer, including, if possible, the quantitative effect of local populations in the cumulative effect in the region.
- Describe any feasible alternatives to the Project that are likely to be of lesser effect and provide reasons justifying the carrying out of the Project in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development.
- Identify any additional approvals that must be obtained under any other Act or law before the Project may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the plains wanderer.

1.2 Project area

The Project is located in the Murray region of south western New South Wales. The Project Site is approximately 5.5 kilometres (km) south west of the township of Deniliquin. The Project Site is located on approximately 120 hectares (ha) of land over lots 234, 272 and 273 on DP 756325, Deniliquin-Barham Road.

The Project Site is located within the central portion of the Riverina Interim Biogeographical Regionalisation for Australia (IBRA) Region (Thackway and Cresswell V. 8.0) in south west New South Wales (NSW), within the Murray Fans Subregion (Figure 1). This bioregion is dominated by river channels, floodplains, backplains, swamps, lakes and lunettes that are all of Quaternary age.

The Murray Valley Regional and National Park system is the closest protected area to Deniliquin (Figure 2), extending from the Deniliquin township, 6 km to the east of the Project Site, south and east along the Edward and Murray Rivers, and joining up with the Barmah National Park, over the border in Victoria.



Plains Wanderer Species Impact Statement

FIGURE 1
Interim Biogeographical Regionalisation for Australia (IBRA) Region

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 50 100 150
Kilometres

LEGEND

- Cities / Towns (selection)
- Project Site
- State Boundary

Riverina Interim Biogeographical Regionalisation for Australia (IBRA) Region

- AA, Australian Alps
- BBS, South Brigalow
- BHC, Broken Hill Complex
- CHC, Channel Country
- CP, Cobar Peneplain
- DRP, Darling Riverine Plains
- MDD, Murray-Darling Depression
- ML, Mulga Lands
- NAN, Nandewar
- NET, New England Tableland
- NNC, NSW North Coast
- NSS, NSW SouthWestern Slopes
- RIV, Riverina
- SB, Sydney Basin
- SEC, South East Corner
- SEH, South Eastern Highlands
- SSD, Simpson-Strzelecki Dunefields

Data Sources:
1. Roads, Railway, Parks, Drainage, Suburbs: @ Street Pro, 2011
2. Base Map Layer: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3. NSW Interim Biogeographic Regionalisation of Australia (IBRA), Version 4.1 @ Office of Environment and Heritage (OEH) 2012-11-21

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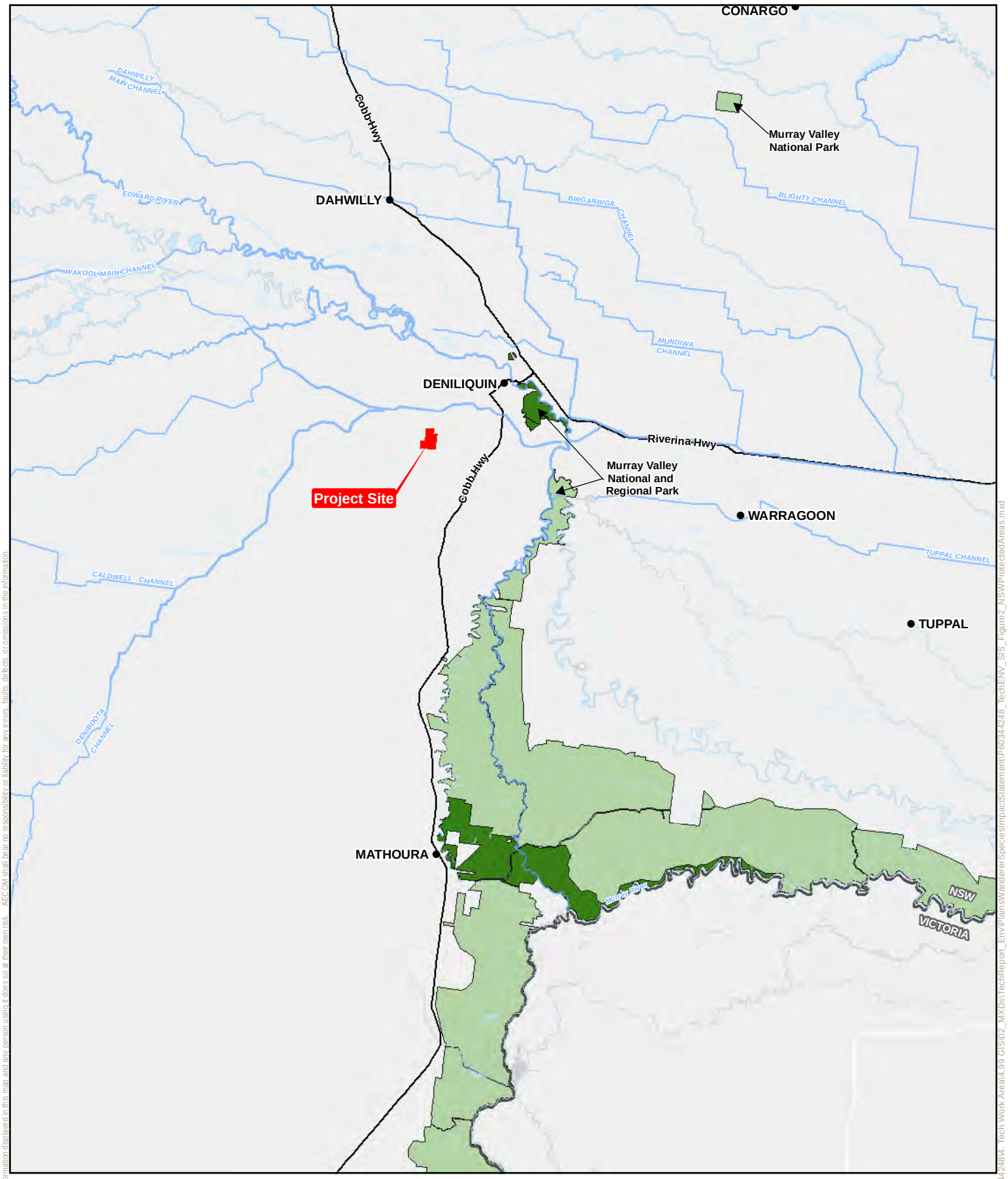
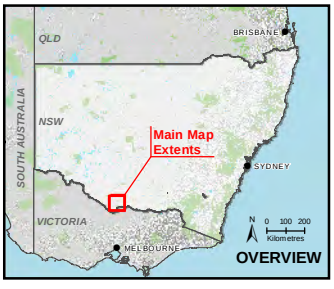
NSW Protected Areas





LEGEND

- Locality
- Major River / Watercourse
- Minor Watercourse
- Highway; Freeway
- Project Site
- State Boundary

NSW Protected Areas

- Regional Park
- National Park
- Nature Reserve

Data Sources:
1. Roads, Railway, Parks, Drainage, Suburbs: @ Street Pro, 2011
2. Base Map Layer: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3. Parks and Reserves: An area of land, the boundaries of which have been determined by the Governor by proclamation in the Government Gazette, which has been reserved for various protection purposes defined in instruments administered by Department of Environment and Climate Change (Parks & Wildlife Division).

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DATUM GDA 1994, PROJECTION MGA ZONE 55

N
0 2.5 5 7.5
Kilometres

FIGURE 2

A4

1.3 Project description

An Environmental Impact Statement (EIS) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of Dongmun Greentec Pty. Ltd. (Proponent), for a State Significant Development (SSD) application for the construction and operation of an ethanol production facility at Deniliquin, NSW (the Project). The Proponent is seeking approval for the development of an ethanol plant capable of producing 115 mega litres (ML) annually including several grain storage silos, a wastewater treatment facility and a workshop area.

Approval for the Project is being sought under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). AECOM has prepared an EIS pursuant to the requirements of the EP&A Act and the Environmental Planning and Assessment Regulation 2000. The EIS was prepared in accordance with the requirements of the Director General's Requirement (DGRs) issued on 23 December 2013 by the Department of Planning and Infrastructure, now the Department of Planning and Environment (DP&E), under the EP&A Act.

The Project will operate 24 hours per day, seven days a week for 330 day per year with a scheduled shut down period. The Project will process approximately 300,000 tonnes (t) of locally grown grain of wheat per annum. Utilising the carbohydrate in the wheat, the primary output from the production is fuel graded ethanol, which will be sold to the major petroleum companies as additive to regular ULP to produce E10, or exported. The additional saleable co-products of the ethanol production process will be a dried distiller grain with solubles (DDGS), syrup and liquid fertiliser. These will be sold as high nutrient agricultural protein meal and agricultural fertiliser.

The Project will generate approximately 350 jobs during construction and up to 50 permanent jobs during the operation and ongoing management of the Project. The following key infrastructure/process sets has been included within the Project's conceptual design:

- Closed system grain milling
- Liquefaction of grain flour
- Fermentation
- Distillation and dehydration
- Centrifuge and drying of dried distiller's grain.
- A boiler to remove odours generated by the production process.
- An anaerobic digestion area to treat liquid compost by-product
- A site office, control room and maintenance room
- A storage area and silos for input grain.
- A storage area for dried distillers grain output
- A storage area for solid waste from anaerobic digestion
- An on-site ethanol storage area
- A staff car parking area
- Onsite bio-retention basin.

CNG will be piped to the site via a proposed Elgas facility located between the Project Site and the airport (to the east). The plant will be constructed on site. All materials will be transported to the site via the existing road and rail network. Products will be distributed using existing rail and road networks, 70 percent by rail and 30 percent by road.

2.0 Legislative requirements

2.1 NSW Threatened Species Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) is the main law protecting threatened species, populations and ecological communities in New South Wales (NSW). The TSC Act in conjunction with the Threatened Species Conservation Regulation 2010 (TSC Regulations) contains a framework for listing these species, populations and ecological communities.

Section 94 of the TSC Act lists seven factors (referred to as the 7-part test) which are used to assess potential impacts of proposed developments on threatened species, populations (including their habitats) or ecological communities. This assessment of the impact must be undertaken in accordance with section 5A of the EP&A Act. Should a 7-part test conclude that a significant impact on a listed threatened species, population or ecological community is likely; a Species Impact Statement (SIS) must be prepared.

The plains wanderer (*Pedionomus torquatus*), listed as 'Endangered' under the TSC Act, has been identified as having a 'Moderate' likelihood of occurring within the Project Site and thus a 7-part test was undertaken. This 7-part test concluded that the potential exists for the Project to have a significant impact on the plains wanderer, and thus a SIS has been prepared.

2.2 NSW Biodiversity Offsets Policy for Major Projects

Biodiversity offsets provide benefits to biodiversity to compensate for adverse impacts of an action. They assist in achieving long-term conservation outcomes while providing development proponents with the ability to undertake actions that have unavoidable impacts on biodiversity. The NSW Biodiversity Offsets Policy for Major Projects provides a standard method for assessing impacts of major projects on biodiversity by determining offset requirements.

To arrive at a conclusion that offsets are required, the Project requires a biodiversity assessment of the Project Site to be complete. The Project must then consider all reasonable measures to avoid and minimise impacts on biodiversity before considering offsetting them. Once all reasonable measures to avoid and minimise have been considered, an impact assessment on the values should be undertaken. If residual adverse impacts on biodiversity values are determined through the impact assessment, then offsets will be required.

The EIS identified the Project as having the potential to cause residual adverse impacts on the plains wanderer and thus offsets will be required.

2.3 Environmental Protection and Biodiversity Conservation Act 1999

No signification impacts to MNES under the EPBC Act have been identified for the Project, and thus a referral to the Federal Environment Minister is not required.

3.0 Initial ecology assessment

As part of the EIS, ecological values were assessed in a two part process comprising an initial desktop review of biodiversity data and secondly, a targeted field survey to identify the ecological values present at the Project Site and ground truth desktop results. A summary of methods employed and results for the terrestrial ecology assessment are outlined below.

3.1 Summary of methods

3.1.1 Desktop review

To identify the existing environmental values of the Project Site, publically available datasets, government publications, other published literature and previous field studies (unpublished) were consulted. The information sources included, but are not limited to:

- 'Protected Matters Search Tool' (PMST) for modelled habitat of threatened species and ecological communities and migratory species, protected under the EPBC Act 1999 (DoE, 2015).
- New South Wales (NSW) Office of Environment and Heritage (OEH) 'BioNet' for records of threatened and migratory species and endangered populations (OEH, BioNet, 2015).
- Atlas of Living Australia (ALA) database for records of threatened and migratory species (ALA, 2015).
- NSW Vegetation Information System (VIS) maps for location of modelled remnant vegetation.

3.1.2 Field assessment

3.1.2.1 Flora survey

A flora field survey was undertaken by AECOM on the 1 and 2 June 2015. The purpose of this survey was to describe the terrestrial flora and vegetation within the Project Site. The Project Site was traversed and the vegetation sampled at seven locations. Three detailed grassland assessment sites were completed, as well as two rapid grassland sites. A further two detailed cover transects sites were also established in each of the two woodland patches identified within the Project Site.

The detailed grassland assessment sites covered a plot area of 50 x 10 m, with 10, 1 m x 1m quadrats established along the tape at 5 m intervals to record species cover abundance at each site.

3.1.2.2 Fauna survey

A general fauna survey was also undertaken on the 1 and 2 June 2015. The survey was completed to characterise the fauna assemblages in the Project Site and the habitat available for threatened fauna. The survey was completed by walking and recording all vertebrate species encountered, using binoculars where necessary.

Areas of interest identified as part of the desktop survey were visited and assessed on the ground for the presence of habitat for threatened fauna. Consideration was given to the quantity of suitable habitat for each threatened species potentially found within, and adjacent to, the Project Site and its degree of connectivity to similar habitat. Areas of interest for habitat and the immediate surrounds were searched for general signs of fauna, such as nests, feathers, scats. Active microhabitat searches such as lifting of woody debris and loose rocks was undertaken to search for reptiles, frogs and small mammals.

3.2 Summary of results

3.2.1 Flora survey

3.2.1.1 Vegetation

The field survey identified four plant communities within the Project Site, with native vegetation covering approximately 106.4 ha of the 120 ha Project Site. The plant communities mapped within the Project site include:

- Plant Community 1 (PC1): Derived native tussock grassland of *Enteropogon ramosus*, *Chloris truncata*, *Rytidosperma* spp. and *Austrostipa* spp. on orange-brown clay loam plains.
- Plant Community 2 (PC2): Woodland of *Eucalyptus largiflorens* over open shrubland of **Lycium ferocissimum* over grassland of Poaceae sp. (new annual grass) and Cyperus sp. with scattered tussocks of *Enteropogon ramosus*.
- Plant Community 3 (PC3): Open sedgeland of *Eleocharis pusilla* and *Juncus* sp., with scattered *Enchylaena tomentosa* and *Sclerolaena muricata*.
- Plant Community 4 (PC4): Low open forest of *Eucalyptus camaldulensis* (regrowth) over grass and herb land of **Romulea rosea* and *Einadia nutans*.

The derived native tussock grassland covers a majority of the Project Site, covering 101 ha. The vegetation condition was identified as in in a 'Poor' to 'Very Poor' condition. None of the plant communities identified correspond to Threatened Ecological Communities (TEC's) at either a State or Commonwealth level.

3.2.1.2 Flora Diversity

The field survey recorded 39 flora species from 33 genera and 15 families. Of the 39 flora species identified, 28 were identified as native species and 11 non-native species. No threatened flora species were recorded. The threatened flora likelihood of occurrence assessment identified five species that have a 'Low' chance of occurring within the Project Site (Appendix A), these species are:

- mossgiel daisy (*Brachyscome papillosa*)
- winged peppercress (*Lepidium monoplocoides*)
- chariot wheels (*Maireana cheelii*)
- slender darling pea (*Swainsona murrayana*)
- silky swainson-pea (*Swainsona sericea*).

Given the above species were determined to have a 'low' likelihood of occurrence, a 7-part significant impact assessment or an EPBC Act Significant Impact Assessment is not warranted.

Two Noxious weeds listed as Class 4 weeds under the Noxious Weeds Act 1974 (NW Act) were identified at low densities within the Project Site:

- African boxthorn (*Lycium ferocissimum*) (Class 4)
- Bathurst Burr (*Xanthium spinosum*) (Class 4).

3.2.2 Fauna survey

3.2.2.1 Fauna habitat assessment

Four distinct fauna habitat areas were identified during the assessment, including:

- waterbodies (dam)
- black box woodland,
- grass and sedgelands
- river red gum regrowth woodland.

3.2.2.2 Fauna diversity

Thirty-one fauna species were recorded during the field survey, including five mammals and 26 birds. The fauna species present within the Project Site are those species that are suited to traversing and persisting within a modified agricultural landscape. Such species are necessarily tolerant of disturbance, and typically are common in abundance and have a widespread distribution.

No threatened or migratory fauna species were recorded during the field survey. A likelihood assessment identified 56 threatened and migratory fauna species occurring, or potentially occurring within 10-20 km radius of the Project Site. Of these, 55 were considered to have an 'Unlikely' or 'Low' likelihood of occurring within the Project Site. One bird species, the plains wanderer (*Pedionomus torquatus*) was determined to have a 'Moderate' likelihood of occurring within the Project Site, given the presence of potential habitat within the Project Site (Plant Community 1). The fauna likelihood of occurrence assessment is presented in Appendix A.

Two pest species were observed within the Project Site and include:

- European fox (*Vulpes vulpes*)
- European rabbit (*Oryctolagus cuniculus*).

4.0 Determination of affected species

The likelihood of occurrence assessment reviewed desktop results and current species literature against the biodiversity values ground-truthed within the Project Site.

The threatened flora likelihood assessment (Appendix A) determined that all species had an 'unlikely' or 'low' likelihood of occurring within the Project Site given the existing levels of disturbance and lack of suitable habitat.

The threatened fauna likelihood assessment Appendix A resulted in the plains wanderer (*Pedionomus torquatus*) species having a 'moderate' likelihood of occurrence given the presence of potential habitat within the Project Site. All other species recorded an 'unlikely' or 'low' occurrence rating.

5.0 Affected species information

5.1 Plains wanderer (*Pedionomus torquatus*)

5.1.1 Conservation status

EPBC Status: Critically Endangered

TSC Act Status: Endangered

5.1.2 Species description

The plains wanderer is a small, quail-like bird that measures 15-19 cm in length and has a mass of 40-95 grams when fully grown (Marchant and Higgins, 1993 in Threatened Species Scientific Committee (TSSC), 2015). Adult birds exhibit different plumage between sexes. The females are distinguishable by their rufous breastband and white-spotted black collar, while males are plainer in plumage with light brown colouration above, covered in brown rosettes, and fawn to white colouration below, covered in blackish crescents (Pizzey and Knight, 1997 in TSSC, 2015). Both sexes have a cream-coloured iris, a cream to pale yellow bill and cream to pale yellow legs and feet, though females are again more brightly coloured (Marchant and Higgins, 1993 in TSSC, 2015).

The plains wanderer is known to inhabit semi-arid, lowland native grasslands that typically occur on hard red-brown soils (DoE, 2015). The grassland habitat structure appears to play a more important role than plant species composition with preferred habitat typically comprising 50 percent bare ground, 10 percent fallen litter, and 40 percent herbs, forbs and grasses (OEH, 2015). Typically grassland habitat of the plains wanderer is less than 5 cm high, but vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10-20 cm apart (OEH, 2015). During prolonged drought, the denudation of preferred habitats may force birds into more marginal habitat comprised of denser and taller grasslands that become temporarily suitable (OEH, 2015).

The plains wanderer is capable of breeding in its first year, breeding in solitary pairs (Baker-Gabb *et al.*, 1990 in TSSC, 2015). The nest is a hollow or 'scrape' that is scratched into the ground and lined with grass (Harrington *et al.*, 1988, in TSSC, 2015). The nests are placed amongst native grasses and herbs, or sometimes amongst crops (Harrington *et al.*, 1988, in TSSC, 2015). Clutch-size is usually four eggs, but can range from two to five (Bennett, 1983, in TSSC, 2015). The young are primarily attended by the male, and sometimes by the female, becoming independent at about two months of age.

5.1.3 Distribution

The plains wanderer has been recorded across scattered sites within west-central Queensland, southern New South Wales, north central Victoria and eastern South Australia (DoE, 2015; Garnett et al. 2010). Core habitat for the species is the western Riverina region of south western New South Wales, with the majority of recent records occurring within this region (DoE, 2015).

The main reason cited for the decline in the numbers and distribution of plains wanderers in all eastern States has been the conversion of native grasslands to dense introduced pasture or croplands (DoE, 2015). If native grasslands are not overgrazed or cultivated then plains wanderers are largely sedentary, though there is some recent evidence to suggest that birds may not remain sedentary during prolonged drought conditions.

The plains wanderer is not at the limit of its known distribution.

5.1.3.1 Land tenure

The plains wanderer has mostly been recorded on privately-owned land (DoE, 2015). No reserve is known to contain a viable population, but the species has been recorded in Diamantina Lakes National Park and Astrebla Downs National Park in Queensland, Willandra National Park (which is largely unsuitable) and Oolambeyan National Park in NSW, Terrick Terrick National Park in Victoria, and on Boolcoomatta Station in SA, which has been the site of many plains wanderer records in recent decades and has recently been added to the national reserve system (DoE, 2015). Plains wanderer has been recorded in small numbers from some Travelling Stock Reserves (NPWS, 2002b).

Oolambeyan National Park and Terrick Terrick National Park (NSW) both have active management programs for the conservation of the plains wanderer, with periodic and ongoing light grazing by sheep employed to help maintain a suitable grassland structure. Boolcoomatta Station is also planned to be actively managed in future for the conservation of the plains wanderer (Baker-Gabb 2006, pers. comm.).

5.1.4 Abundance

5.1.4.1 Regional abundance

Garnett *et al.* (2011) estimated the total number of mature individuals of plains wanderers to be 2000. However, since publication of this estimate, a 95 percent decline has been recorded in the species' Victorian stronghold of the Patho Plains (Baker-Gabb, 2014 in TSSC, 2015), and a 84 percent decline recorded in the NSW Riverina region (Wilson et al., 2014 in TSSC, 2015), since this time.

5.1.4.2 Local abundance

A submission by the OEH estimated the total population size of plains wanderers to be approximately 250 birds (or less) in the core part of its Riverina range (OEH, 2015 in TSSC, 2015). It is estimated that the total number of mature individuals of plains wanderer may now be less than 1000 (Baker-Gabb, 2015 in TSSC, 2015).

5.1.5 Key threats

Key threatening processes to the plains wanderer identified in the recovery plan include:

- Habitat loss due to cultivation of native grassland, causing fragmentation of habitats and subsequent isolation of populations.
- Overgrazing of native grasslands by domestic livestock and rabbits (*Oryctolagus cuniculus*), particularly during drought conditions, can result in the temporary displacement of the species from areas of preferred habitat on a local or regional scale, and an increase in the rate of mortality (DoE, 2015).
- Predation by foxes and feral cats has been identified as a potential threat, particularly around cultivated land, where greater numbers of mice might help to sustain larger predator populations.

5.1.6 Recovery plans

A draft recovery plan has been prepared for the species (Baker-Gabb 2002). Furthermore, primary conservation objectives and recommended conservation and management actions have been developed within the EPBC conservation advice (2015) for the species.

The following recovery actions have been recommended in the draft national recovery plan (Baker-Gabb 2002):

- Improve knowledge on the distribution and abundance of the species by undertaking surveys, population monitoring and habitat mapping in all four states in which the Plains wanderer is known to occur.
- Determine areas of critical habitat in Queensland, Victoria and South Australia (critical sites, termed 'Core Areas', have already been established in NSW) and implement actions to ensure the conservation of the species in these areas.
- Maintain and enhance the quality of habitat by providing information to land-owners, providing input on clearing applications for important sites, monitoring sites with important habitat, and identifying and managing areas of critical habitat.
- Establish new reserves and private refuge areas through the acquisition of land or properties of high conservation value and liaise with, and provide incentives to, landowners to encourage the implementation of favourable management protocols.
- Undertake surveys to establish benchmarks for population size and breeding success, and implement monitoring at selected sites to track population trends. In conjunction with monitoring, tests should be undertaken to determine and monitor the impact of locust-spraying operations on Plains wanderer populations.
- Undertake a Population Viability Analysis for the species throughout its entire range.
- Increase community awareness by engaging volunteers in the recovery effort, and by providing annual reports on the status of the recovery effort to participants, the general public and media.
- Ensure the continued operation of the recovery team and management of the recovery effort.

The primary conservation objectives listed in TSSC (2015) include:

- Reverse the long-term trend of population decline and increase numbers to a level where there is a viable, wild breeding population of plains wanderers, even in poor breeding years.

- Maintain key plains wanderer habitat in a condition that maximises survival and reproductive success, and provides refugia during periods of extreme environmental fluctuation.

5.1.7 Potential habitat extent

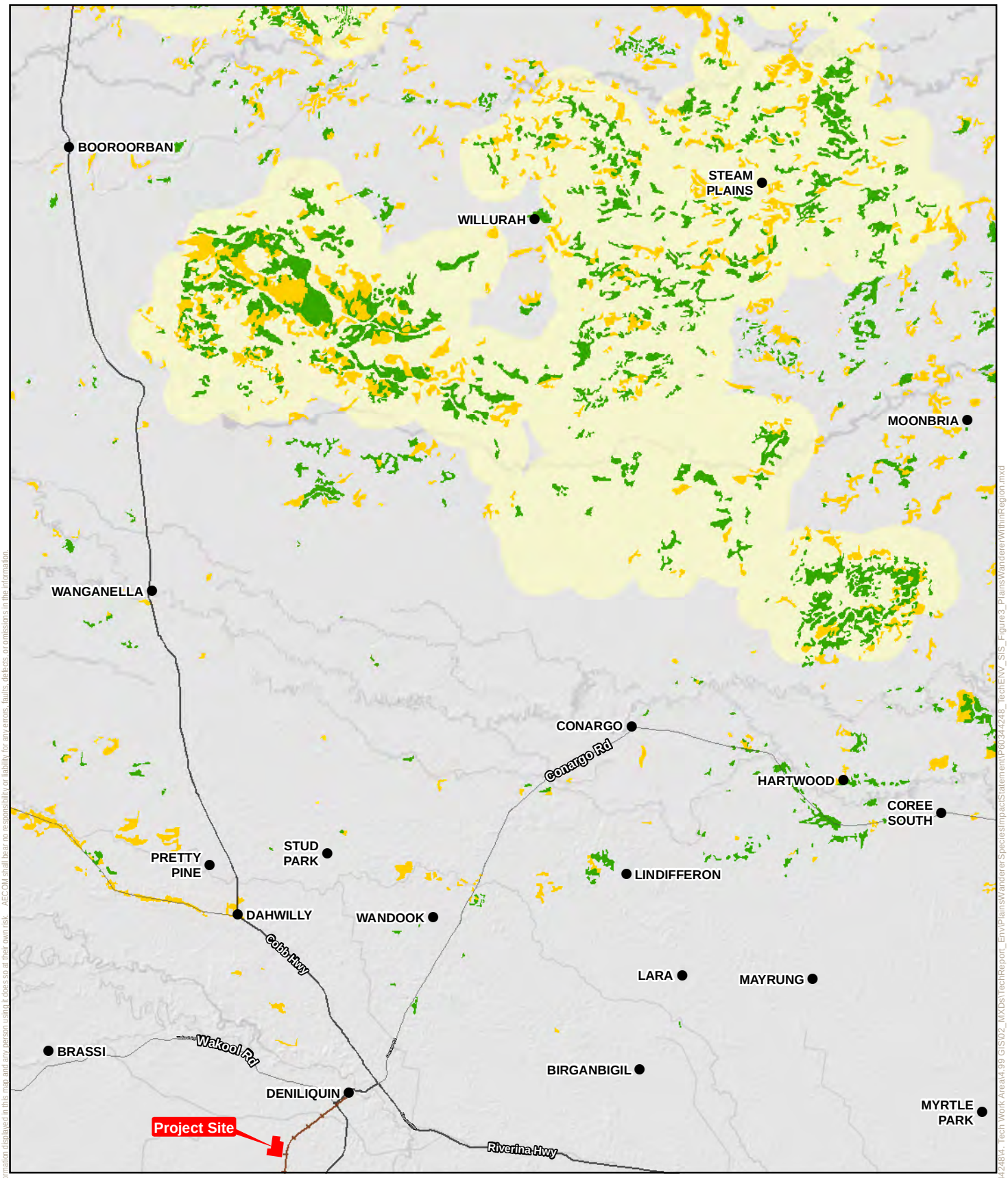
5.1.7.1 Potential habitat within the region

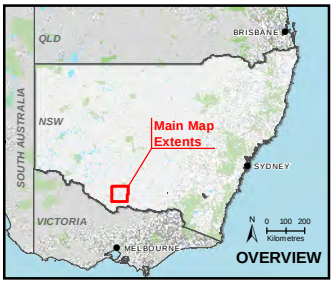
As outlined in Section 5.1.2, habitat for plains wanderer occurs within the semi-arid, lowland native grasslands that typically occur on hard red-brown soils (DoE, 2015). The grassland habitat structure appears to play a more important role than plant species composition with preferred habitat typically comprising 50 percent bare ground, 10 percent fallen litter, and 40 percent herbs, forbs and grasses (OEH, 2015). Typically grassland habitat of the plains wanderer is less than 5 cm high, but vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10-20 cm apart (OEH, 2015). During prolonged drought, the denudation of preferred habitats may force birds into marginal denser and taller grassland habitats that become temporarily suitable (OEH, 2015).

Within the western Riverina region, core habitat areas which comprise primary and secondary habitats were identified during an aerial photo interpretation mapping project conducted by the former NSW NPWS. These areas are depicted within Figure 3.

The habitat mapping project identified approximately 2.3 percent of the mapping area as primary habitat suitable for the plains wanderer all year round (OEH, 2015). A further 4.3 percent of the mapping area comprised denser, secondary habitat that may be periodically occupied, particularly during drought or extended periods of heavy grazing when primary habitat areas can become too sparse.

Plains wanderer habitat within the Region





LEGEND

- Railway
- Freeway; Highway
- Main Road
- Project Site
- Plains Wanderer Primary Habitat
- Plains Wanderer Secondary Habitat
- Plains Wanderer Core Area

Data Sources:
1. Roads, Railway, Parks, Drainage, Suburbs: @ Street Pro, 2011
2. Canvas/World_Light_Gray_Base: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3. Plains Wanderer Primary Habitat, Secondary Habitat and Core Area @ Office of Environment and Heritage (OEH), 2011
Map derived from Roberts, I. & Roberts, J. (March 2001). Plains wanderer (Pedionomus torquatus) Habitat Mapping - Including Woody Vegetation and other Landscape Features. Riverina Plains - NSW NPWS.

AECOM
www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 55

N 0 2.5 5 7.5 Kilometres

FIGURE 3

A4

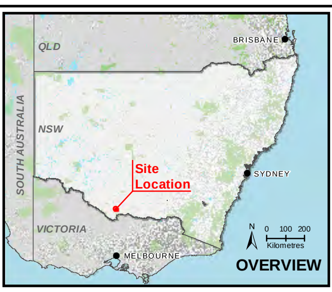
5.1.7.2 Potential habitat within the Project Site

Within the Project Site, 101.1 ha of potential plains wanderer habitat (native tussock grassland on orange-brown clay loam plains) was recorded (Figure 4). Detailed grassland surveys within the habitat noted recent disturbances including clearing, grazing, irrigation and the cultivation of wheat. As a result, the recorded grassland diversity was low and exotic species were interspersed throughout.

Tussock grassland within the Project Site was noted to support 19 percent bare ground, 21 percent litter and 60 percent herbs, forbs and grasses. Comparison of field results with habitat criteria outlined in the plains wanderer habitat management guide (Parker and Oliver, 2006) result in the categorisation of habitat within the Project Site as between ‘slightly too dense’ to ‘much too dense’.

Given the recorded structure of the potential habitat and habitat mapping criteria developed by Roberts and Roberts (2001), it is considered that this grassland is ‘secondary’ habitat for the species. Whilst secondary habitat is sub-optimal in comparison to primary habitat, it is known to be utilised by the plains wanderer during periods of drought or overgrazing when primary habitat is unsuitable. It should also be noted that the appropriate management of secondary habitat can be undertaken via managed grazing to reduce the density of grass and litter down to ‘ideal’ primary habitat levels (Parker and Oliver, 2006).

Potential Plains Wanderer Habitat within the Project Site



LEGEND

- Potential Plains Wanderer Habitat
- Cadastral Boundaries
- Project Site
- Project Footprint

Data Sources:
1.Imagery: © 2015 DigitalGlobe © 2015 GeoEye Earthstar Geographics SIO © 2015 Microsoft Corporation
2. Roads, Railway, Drainage, Suburbs, Parks, Localities: @ Street Pro, 2011
3. Key Map Base Layer: ESRI Online
4. Site Boundary: based on CAD Drawingd prepared by DONGMUN I.R.S. Co. Ltd.
5. Environmental Data: AECOM, 2015

AECOM
www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 55

N
0 50 100 150
Metres

FIGURE 4

A4

Document Path: \\aubne1fp003\Projects\603X\60344248\4. Tech Work Area\4.99 GIS\02_MXDs\TechReport_Env\PlainsWandererSpeciesImpactStatement\P60344248_TechENV_SIS_Figure4_PlainsWandererWithinPrjSite.mxd

6.0 Assessment of potential impacts

6.1 Potential impacts on biodiversity values

The main construction activities involved with the development of the Project will be site clearance, earthworks and facilities construction. The construction phase is expected to take 14 to 16 months. The operation phase of the Project will involve the day to day running of the Project. The Project will need to operate 24 hours a day, seven days a week with a scheduled four week annual shutdown to allow for plant maintenance.

Potential impacts from the construction and operation of the Project on biodiversity values and thus the plains wanderer include:

- Loss of habitat
- Mortality during clearing
- Noise, light and dust.

6.1.1 Loss of habitat

During this phase, the predominant impacts on flora and fauna will be the direct impacts associated with site clearance and the removal of native vegetation. With regards to the plains wanderer, 17.3 ha of potential secondary habitat would be removed during the clearing process.

6.1.2 Mortality during clearing

Encounters between fauna and site traffic and machinery may potentially occur throughout all phases of the Project, with heightened risk of mortality occurring particularly during the clearance of vegetation. The clearing of vegetation generally has a greater impact on ground dwelling fauna and arboreal mammals. Fauna spotter personnel will be required during clearing to minimise this potential impact. Preclearance surveys for plains wanderer individuals or breeding places will ensure the risk of mortality to this species is mitigated.

6.1.3 Noise, light and dust

The potential impacts on biodiversity values during all phases include disturbance from noise, light and vibration. Fauna will generally move away from noise and light sources as these may be perceived as a threat. Acclimatisation by some species is likely to occur over the medium to long term.

6.2 Assessment of potential significant impacts

A seven part test was undertaken to determine the significance of the potential impacts identified above with respect to the plains wanderer. The seven part test is detailed below.

6.2.1 Seven part test

Table 1 Plains wanderer 7-part test

Plains wanderer 7-part test
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction Overall within the Riverina region, the majority of recent records for the plains wanderer occur in a number of identified core habitat zones north of Deniliquin (OEH, 2015). Within these zones, primary and secondary habitat types have been identified. A submission by the OEH estimated the total population size of plains wanderers to be approximately 250 birds (or less) in the core part of its Riverina range (OEH, 2015 in TSSC, 2015). The Project Site is situated approximately 45 km south of this identified core habitat. As defined in OEH (2007) a local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas that are known or likely to utilise habitat in the study area. The viable life cycle of the species is the capacity to successfully complete the stages of reproduction, growth, development, ageing and death under normal conditions (OEH, 2007). Given the above, the local population can be defined as plains wanderer populations that may potentially occur within the Project Site or the immediate surrounds. The identified populations north of Deniliquin are considered a

Plains wanderer 7-part test
regional population for the purposes of this significance assessment. The plains wanderer has been recorded in the locality, with two records obtained in 2011 situated approximately 2.5 km east of the Project Site, and the likelihood of occurrence assessment undertaken for the species in the EIS, identifies the likelihood of occurrence on site as 'Moderate', with areas of suitable secondary habitat present. Field surveys have determined within the Project Site, 101 ha of plains wanderer potential habitat (native tussock grassland on orange-brown clay loam plains) was recorded. The detailed grassland surveys within the habitat noted recent disturbances including clearing, grazing, irrigation and the cultivation of wheat. As a result, the recorded grassland diversity was low and exotic species were interspersed throughout. The plains wanderer preferred habitat typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Tussock grassland within the Project Site was noted to support 19% bare ground, 21 % litter and 60 % herbs, forbs and grasses. Comparison of field results with habitat criteria outlined in the *Plains wanderer habitat management guide* (Parker and Oliver, 2006) result in the categorisation of habitat as between 'slightly too dense' to 'much too dense'. Given the recorded structure of the potential habitat within the Project Site and habitat mapping criteria developed by Roberts and Roberts (2001), it is considered that this grassland is 'secondary' habitat for the species. Whilst secondary habitat is sub-optimal in comparison to primary habitat, secondary habitat is known to be utilised by the plains wanderer during periods of drought or overgrazing when primary habitat is unsuitable. The potential impact to the plains wanderer secondary habitat on the Project Site as a result of clearing activities for surface infrastructure is 17.3 ha. Given the sedentary nature of the species and the low abundance estimate of the local population, it is considered that the potential impact to secondary habitat may significantly impact the local population, should it be required as an alternate habitat if primary habitat becomes unsuitable.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction Not applicable, the plains wanderer population is not listed as an Endangered population under the TSC Act.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction Not applicable.
d) in relation to the habitat of a threatened species, population or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality Plains wanderer habitat within the broader region has been significantly modified with the conversion of native grasslands to dense introduced pasture or croplands (DoE, 2015). As a result, existing plains wanderer habitat in the broader region is scattered, with limited connectivity between habitat sites. The Project will directly impact 17.3 ha of potential habitat for the plains wanderer. The Project Footprint has been designed to ensure the remaining potential habitat areas (within the Project Site) are not fragmented or isolated with infrastructure proposed to be situated in the northern areas of the site. Furthermore, existing disturbances to the north and west will ensure that the Project does not isolate suitable plains wanderer habitat that may occur outside the Project Site. The Project is unlikely to significantly increase the fragmentation of habitat within the region, with the site currently being surrounded by irrigation and cropping on the northern and western boundaries. Dispersal of the species is unlikely to be significantly interrupted, due to the colocation of surface infrastructure with existing disturbances. No potential habitat was identified to the north or west of the Project Site. Given this, the isolation of potential habitat from the Project is not expected to increase.

Plains wanderer 7-part test
As outlined above, the field assessment of potential habitat within the Project Site has determined the potential habitat on site meets the criteria for 'secondary' habitat. Secondary habitat is important to the survival of the plains wanderer during periods where primary habitat may become unsuitable, such as periods of drought or overgrazing. The site is situated outside of core habitat areas (Roberts and Roberts, 2001) and so is considered unlikely to be important to plains wanderer populations north of Deniliquin. However, recent records to the east of the site suggest plains wanderer inhabit, or have inhabited, the immediate locality and thus potential secondary habitat within the Project Site may support a breeding pair of plains wanderer. Given the sedentary nature of the species and the low abundance estimate of the local population, it is considered that the potential impact to secondary habitat may significantly impact the local population, should it be required as an alternate habitat if primary habitat becomes unsuitable.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly) No core habitat declared under the TSC Act is mapped for the species. The action will not to have an adverse effect on core habitat mapped by Roberts and Roberts (2001), situated approximately 45 km north of the Project Site.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan A draft recovery plan has been prepared for the species (NSW NPWS, 2002). Primary conservation objectives and recommended conservation and management actions have also been developed within the EPBC conservation advice (TSSC, 2015) for the species. Recovery objectives as per NSW NPWS (2002) are: - Establishing an effective recovery team to administer and organise the recovery effort. - Maintaining the extent and enhancing the quality of plains wanderer habitat. - Locating and protecting plains wanderer habitat in areas not yet surveyed. - Securing a key area(s) of native grassland biodiversity through the purchase of one or more large reserves of at least 20,000 ha, and containing not less than 5,000 ha of habitat suitable for plains wanderer. - Halving the decline in the plains wanderer in NSW due to overgrazing during droughts, and increasing numbers in 10,000 ha of habitat by enhanced management. - Assessing the relative impact of different management regimes and controlling threatening processes. The proponent is committed to maintaining positive biodiversity outcomes through implementing targeted habitat offsets for the plains wanderer. Proposed offsets will be in accordance with the NSW biobanking offsets methodology and will be guided by current recovery and conservation objectives. The implementation of biodiversity offsets will ensure the extent of plains wanderer habitat in the Riverina region is maintained and enhanced. Given this, the Project is considered in keeping with recovery objectives.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process Key threatening processes to the plains wanderer are: - Historical loss of habitat from clearing and pasture improvement; - Prolonged drought or overgrazing will also result in a loss of habitat due to the reduction of suitable ground cover; - Fox predation and developments that lead to elevated numbers of foxes represent a significant threat. Increased mouse densities that are associated with irrigated cereal crops such as rice can cause an increase in fox numbers; - High intensity fire completely destroys suitable habitat; - Pesticides, including those used in locust control, such as fipronil and fenitrothion, have the potential to impact on plains wanderers either directly or via their food supply; - Feral cats may be a predator of the plains wanderer; and - Rabbits can cause damage to plains wanderer habitat (OEH, 2015). The potential impacts on 17.3 ha of plains wanderer secondary habitat will contribute to the loss of habitat as a threatening process. However, it is recognised that this habitat occurs outside identified core habitat areas (Roberts and Roberts, 2001) and did not constitute primary habitat at the time of survey. Furthermore, the proponent is committed to maintaining positive biodiversity outcomes through habitat offsets. Proposed offsets will be in accordance with the NSW biobanking offsets methodology and will be guided by current recovery and

Plains wanderer 7-part test
conservation objectives. The Project will not be undertaking grazing of grassland habitat and thus overgrazing of the grasslands within the Project Site will be avoided. Predation by foxes and feral cats has been identified as a potential threat, particularly around cultivated land, where greater numbers of mice might help to sustain larger predator populations. Given the Project Site is currently within 2 km of cultivated land, the current potential impacts from predators are unlikely to be exacerbated from the proposed action.
Conclusion The seven part assessment of impacts on the plains wanderer has identified a potential impact on 17.3 ha of secondary habitat through vegetation clearing. The Project is situated outside recognised core habitat areas, which are situated approximately 45 km to the north of the site. Given the sedentary nature of the species and the low abundance estimate of the local population, the potential impact to secondary habitat may significantly impact the local population should it be required as an alternate habitat, in circumstances where primary habitat become unsuitable in times of drought, or through over grazing. The removal of 17.3 ha of secondary habitat is considered unlikely to significantly increase the current level of fragmentation of habitat within the region. Furthermore, it is considered unlikely that the Project will exacerbate current threats from predation (i.e. foxes) due to the existing establishment of these species and the Project's proximity to existing cropping land uses. The proponent is committed to maintaining positive biodiversity outcomes through the implementation of plains wanderer habitat offsets. Proposed offsets will be in accordance with the NSW biobanking offsets methodology and will be guided by current recovery and conservation objectives and expert advice. The implementation of biodiversity offsets will ensure the extent of plains wanderer habitat in the region is maintained and enhanced. Given the above, potential exists for the Project to have a significant impact on the local population of plains wanderer, particularly if primary habitat in the region becomes unsuitable. However, a reduced Project Footprint and co-location of potential impacts with existing, adjacent disturbances will ensure other threatening process such as fragmentation, increased predation risk and disruption of dispersal corridors is minimal. Furthermore, the implementation of habitat offsets, guided by current recovery and conservation objectives and expert advice, will ensure a positive biodiversity outcome is achieved.

7.0 Mitigation of potential impacts

Measures for the management of potential impacts have been developed as part of the EIS assessment. These measures are presented below, with specific mitigation measures for the plains wanderer. Using an impact management hierarchy, potential impacts must be avoided in the first instance, then reduced or minimised using mitigation measures where avoidance is not achievable. Environmental offsets are employed as a measure to address any residual impacts. The proposed measures for managing potential impacts on the Project Site are detailed below.

7.1 Avoidance

The design of the Deniliquin Ethanol Plant has been modified substantially to reduce the Project Footprint from 68 ha to 25.6 ha. This modification was implemented in an effort to reduce the extent of vegetation clearing within plains wanderer habitat. The reconfiguration of the Project Site has relocated infrastructure into a consolidated area in the north of the Project Site away from the recognised plains wanderer secondary habitat found in the south of the site.

7.2 Mitigation

7.2.1 General mitigation measures

The following mitigation measures will be implemented to reduce the potential impact on biodiversity values:

- The clearing of vegetation shall be managed through a vegetation management plan.
- Weed hygiene procedures to be followed during the construction phase, with particular emphasis on limiting the spread or movement of the noxious weed species African boxthorn and Bathurst burr.

- African boxthorn and Bathurst burr will be removed from the construction footprint pre-construction.
- Continued weed hygiene and monitoring procedures will be followed throughout the life of the Project, and documented in a weed management plan.
- An ecologist will supervise felling of hollow bearing trees and translocate animals to approved sites.
- Native vegetation clearance will be staged, so as to allow animals recourse to move away.
- Trees will be felled outside the main bird-nesting season, i.e. in winter months.
- Landscaping will use endemic native species where possible.
- Implementation of appropriate speed limits and fencing to minimise fauna mortality.

7.2.2 Plains wanderer mitigation measures

The general mitigation measures outlined above will assist in reducing potential impacts on the plains wanderer habitat. The following specific mitigation measures will also be implemented to minimise the potential impacts to plains wanderer:

- A plains wanderer species management plan will be developed prior to any works being undertaken. The species management plan will identify mitigation and monitoring procedures throughout the life of the Project.
- A preclearance survey for plains wanderer and plains wanderer breeding places will be undertaken prior to any clearing activities. The species management plan will identify procedures to be followed should breeding places be identified.
- The clearing extent within plains wanderer habitat will be clearly delineated to ensure no over-clearing occurs.
- Staff training toolboxes will be delivered to all staff associated with the clearing and management of plains wanderer habitat.
- Permanent lighting will be directed away from adjacent plains wanderer habitat.
- Efforts to minimise noise will be undertaken where possible (i.e. mufflers on machinery).

7.3 Offsetting

The proponent is committed to maintaining positive biodiversity outcomes through implementing plains wanderer habitat offsets for residual impacts. The proposed offset will be undertaken with consideration to, and in accordance with, the:

- Biodiversity Offsets Policy for Major Projects
- Framework for Biodiversity Assessment
- NSW Biodiversity Banking and Offsets Scheme.

Offsets for the plains wanderer will be guided by current recovery and conservation objectives, and expert advice. The proposed offset for the plains wanderer will target primary and secondary habitat types, with preference given to habitat within recognised core habitat areas (Roberts and Roberts, 2001).

8.0 Description of feasible alternatives

The design of the Deniliquin Ethanol Plant has been modified substantially to reduce the Project Footprint from 68 ha to 25.6 ha. This modification was implemented as a feasible alternative to the original Project design in an effort to reduce the extent of vegetation clearing required to avoid potential impacts to the plains wanderer. No other alternatives are considered feasible for a further reduction of the impact footprint.

9.0 Additional information

9.1 Qualifications of assessor

Detailed curriculum vitae's for all staff involved in this impact assessment are provided in Appendix B.

9.2 Other approvals required for the development

No other approvals are anticipated.

9.3 Licensing matters

The survey work performed for this assessment was carried out under the following licences:

- NSW National Parks and Wildlife Act, 1974 - Scientific Licence number SL100659
- NSW Animal Research Act, 1985 - Certificate of Approval by the Animal Care and Ethics Committee.

9.4 Section 110 (5) reports

Relevant threatened species profiles, threated species guidelines and environmental impact assessment guidelines were consulted in the compilation of this report.

10.0 Conclusions

The Project is situated outside recognised core habitat areas and is thus unlikely to have a negative impact on these habitat zones. The species impact assessment on the plains wanderer has identified a potential impact on 17.3 ha of secondary habitat through the vegetation clearing activities. Given the sedentary nature of the species and the low abundance estimate of the population in the region, the potential impact to secondary habitat may significantly impact the local population should primary habitat become unsuitable (in times of drought or from grazing practices), and should the secondary habitat be required as an alternate habitat for breeding purposes,.

The removal of 17.3 ha of secondary habitat is unlikely to significantly increase fragmentation of habitat within the region. Furthermore, it is considered unlikely that the Project will exacerbate current threats from predation (i.e. foxes) due to the existing establishment of these species and the Project's proximity to existing cropping land.

The proponent is committed to maintaining positive biodiversity outcomes through the implementation of plains wanderer habitat offsets. Proposed offsets will be in accordance with the NSW biobanking offsets methodology and will be guided by current recovery and conservation objectives and expert advice. The implementation of biodiversity offsets will ensure the extent of plains wanderer habitat in the Riverina region is maintained and enhanced.

Given the above, potential exists for the Project to have a significant impact on the local population of plains wanderer, particularly if primary habitat in the immediate region becomes unsuitable. However, a reduced Project Footprint and colocation of potential impacts with existing, adjacent disturbances will ensure other threatening process such as fragmentation, increased predation risk and disruption of dispersal corridors is minimal. The application of offsets, guided by current recovery and conservation objectives and expert advice, will also warrant a positive biodiversity outcome.

11.0 References

Department of the Environment (2015). Pedionomus torquatus in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: [http://www.environment.gov.au/sprat]

Department of Environment and Climate Change (2008) Revised NSW Draft Recovery Plan for the Plains wanderer (Pedionomus torquatus). DECC, EPRG South Branch, Queanbeyan

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Office of Environment and Heritage New South Wales (OEH) (2012). Plains wanderer profile. NSW Government. Available on the Internet: [http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10588]

Roberts, I. and Roberts, J. (2001) Plains wanderer (Pedionomus torquatus) Habitat Mapping Including Woody Vegetation and Other Landscape Features, Riverina Plains, New South Wales. Unpublished report to New South Wales National Parks and Wildlife Service.

TSSC (2015) Conservation advice for the Plains-wander (Pedionomus torquatus), prepared for consideration to the Department of the Environment, Threatened Species Scientific Committee

Appendix A

Threatened species likelihood assessments

Appendix A Threatened species likelihood assessments

The likelihood of occurrence assessments for threatened flora, fauna and ecological communities were based on:

- previous records of threatened species from the database searches
- habitat data collected during the field survey
- the current (known) distribution range of these species
- the presence and condition of suitable habitat occurring within the locality.

The criteria to assess the likelihood of threatened flora, fauna and migratory species is presented in Table 1.

Table 1 Likelihood assessment criteria

Likelihood	Assessment Criteria
Present	- Species observed within the Project Site or recently recorded. - Preferred habitat is present within the Project Site.
High	- Species has been recently recorded within the Project Site or adjoining landscape. - The Project Site contains the species' preferred habitat and is likely to support a population of the species.
Moderate	- Species has not been recorded within the Project Site but previously recorded in the surrounding landscape. - The Project Site contains the species' preferred habitat although generally it is in a poor or modified condition.
Low	- Species has not been recorded within the Project Site, and has not been observed in the surrounding landscape or at least not recently. - Some habitat is present in the Project Site although it is generally of poor or modified condition. - The species may infrequently visit the Project Site, or overfly the Project Site, but would not reside, roost or otherwise depend on habitats within the Project Site.
Unlikely	- Species has not been recorded within the Project Site or observed in the surrounding landscape, and there is no habitat available within the Project Site to suggest the species may occur even on a temporary basis.

The likelihood assessments for threatened flora, fauna, and TECs are presented in Tables 2 – 3.

Table 2 Threatened flora likelihood assessment

Species	Life-Strategy[1]	Flowering	Distribution and Habitat	Image	Likelihood of Occurrence
ASTERACEAE					
Mossgiel Daisy *Brachyscome papillosa* TSC: Vulnerable EPBC: Vulnerable	P	June-Dec	*Brachyscome papillosa* has been recorded from Mossgiel to Urana, in south western NSW, from sites at Jerilderia, Hay Plain, Willandra Lakes, and north to Ivanhoe. A western outlier occurs at Byrnedale Station, north of Menindee (TSSC, 2008a). This species is known to occur on clay soil plains in association with *Atriplex vesicaria* and *Maireana aphylla*, grasslands and in *Eucalyptus macrocarpa – Callitris* sp., woodlands (TSSC, 2008a).	 (Australian National Botanic Gardens, 2015)	**Low** A record for this species has been recorded within the surrounding landscape, however the record date is from 1949 (ALA, 2015). Appropriate habitat for this species exist onsite, although it is in a 'Poor' condition.
BRASSICACEAE					
Winged Peppercress *Lepidium monoplocoides* TSC: Endangered EPBC: Endangered	A	Sept-Jan	*Lepidium monoplocoides* is distributed on the inland plains of south eastern Australia, occurring from northern NSW to western Victoria (Mavromihalis, 2010a). This species occurs in open, sparsely vegetation sites on heavy clay, or clay-loam soil. Plant communities include grasslands, wetlands and floodplain woodlands, and chenopod shrublands dominated by *Atriplex, Maireana* and *Nitraria*. *Lepidium monoplocoides* occurs in association with a range of herbs and grasses including *Rytidosperma* spp., and *Austrostipa* spp. (Mavromihalis, 2010a).	 (Mavromihalis, 2010a)	**Low** Project Site has natural grassland on clay-loam soils. Grazing is a major threat to this species, as it is highly palatable; the grazing history of the site reduces the quality of habitat for this species. A record for this species has been identified within the area, however the record date is from 1945 (ALA, 2015).

Species	Life-Strategy[1]	Flowering	Distribution and Habitat	Image	Likelihood of Occurrence
CHENOPODIACEAE					
Chariot Wheels *Maireana cheelii* TSC: Vulnerable EPBC: Vulnerable	P		The current distribution of *Maireana cheelii* is in the western Riverina bioregion, between Hay and Deniliquin, extending as far west as Moulamein, and possibly as far east as Jerilderie and Morundah. It also occurs in north west Victoria (Mavromihalis, 2010b). *Maireana cheelii* commonly occurs in chenopod and grassland communities on heavy clay soils. Common species include *Maireana pentagona*, *Maireana excavata*, *Nitraria billardierei*, *Austrostipa nodosa*, *Erodium crinitum* and *Hyalosperma semisterlie*. In NSW the species appears to favour heavier grey soil supporting *Atriplex vesicaria*. It often occur (Mavromihalis, 2010b).	 (Mavromihalis, 2010b)	**Low** A majority of the site occurs on red clay-loam soils, which is not the favoured soil type for this species in NSW, and the common species co-occurring with this species are not present within the Project Site. However records for this species have been identified within the area, however they were from the 1930 and 1940s (ALA, 2015).
FABACEAE					
Slender Darling Pea *Swainsona murrayana* TSC: Vulnerable EPBC: Vulnerable	P	Sept-Dec	*Swainsona murrayana* occurs from South Australia through south west Victoria and central NSW to south east Queensland (DECC 2005, CPBR 2008 cited in (TSSC, 2008b). This species is found in grassland, herbland and open Black-box woodland in association with *Maireana* spp., *Rytidosperma* spp., and *Austrostipa* spp. It grows in heavy grey or brown clay loam, or red cracking clays (TSSC, 2008b).	 Photo by David Parker	**Low** Appropriate habitat occurs within the Project Site; however the condition of the habitat is 'Poor'. A record of this species has been located close to the Project Site, however it was from 1973 (ALA, 2015).

Species	Life-Strategy[1]	Flowering	Distribution and Habitat	Image	Likelihood of Occurrence
FABACEAE					
Silky Swainson-pea *Swainsona sericea* TSC: Vulnerable	P	Sept-Nov	In NSW, *Swainsona sericea* has been recorded from the northern to the southern tablelands and further inland on the slopes and plains (OEH, 2015). *Swainsona sericea* is found in natural temperate grasslands, box-gum woodlands and sometimes in association with *Callitris* spp. Its habitat on the plains is unknown (OEH, 2015).	 (Australian National Botanic Gardens, 2015)	**Low** Its habitat type on the plains is unknown. There are records for this species in the areas, however they are from the 1930s and 1970s (ALA, 2015).
ORCHIDACEAE					
Rigid Spider Orchid *Caladenia tensa* EPBC: Endangered	PG	Sept-Nov	*Caladenia tensa* is widespread in and surrounding the Little Western Desert in western Victoria, and known from southeast South Australia (Todd, 2000). This species is known to occur in Callitris pine/Yellow gum woodland and mallee on sands and sandy loams (Todd, 2000).	 Photo by Glen Rudolph	**Unlikely** No appropriate habitat within the Project Site. This this species has not been previously recorded from NSW.

Species	Life-Strategy[1]	Flowering	Distribution and Habitat	Image	Likelihood of Occurrence
POACEAE					
Spear Grass *Austrostipa metatoris* TSC: Vulnerable EPBC: Vulnerable	P	Flowers in response to rain (likely Sept-Nov)	*Austrostipa metatoris* occurs in NSW, along the Murray Valley near Balranald and the central-western slopes near Lake Cargelligo (TSSC, 2008c). This species grows in sandy areas of the Murray Valley, habitats including sandhills, sand ridges, undulating plains and flat open mallee country, with red to red-brown clay-loam to sandy-loam soils. Common species include *Eucalyptus populnea*, *E. intertexta*, *Callitris glaucophylla*, *Casuarina cristata* and *Dodonaea viscosa* (TSSC, 2008c). Note: opposite photo is of closely related species *Austrostipa eremophila.*	 (Simon & Alfonso, 2011)	**Unlikely** No appropriate habitat within the Project Site, and no records for the area.
Spear Grass *Austrostipa wakoolica* TSC: Endangered EPBC: Endangered	P	Flowers in response to rain (likely Sept-Nov)	*Austrostipa wakoolica* occurs within the floodplains of the Murray River tributaries of central-western and south western NSW (TSSC, 2014). This species grows in open woodland on grey silty clay or sandy loam, in association with *Callitris glaucophylla*, *Eucalyptus microcarpa, Eucalyptus populnea, Austrostipa eremophila*, *Austrodanthonia eriantha, Einadia nutans, Hyalosperma glutinosum* subsp. *glutinosum* and *Crassula* species (TSSC, 2014)	 (OEH, 2015)	**Unlikely** No appropriate habitat within the Project Site, and no records for the area.

[1] Life Strategy: P=Perennial, PG = Perennial Geophyte, A = Annual

Table 3 Threatened and migratory fauna likelihood assessment

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
MAMMALS					
Antechinomys laniger Kultarr		E	Open arid, treeless plains and claypans, gibber, sandy desert (Menkhorst & Knight, 2004). Shelters in tree hollows or stumps, soil cracks, saltbush and spinifex tussocks and animal burrows (OEH, 2015).	Historic record from 1883 located 6 km from Project Site	**Unlikely** Project Site does not support suitable habitat for this species.
Lasiorhinus krefftii Northern Hairy-nosed Wombat	E	Presumed Extinct in NSW	Once widespread in NSW. Deniliquin population believed to have become extinct in early 1900s (OEH, 2015).	Historic record from 1884 located 5.5 km from Project Site	**Unlikely** Project Site does not support suitable habitat for this species.
Nyctophilus corbeni South-eastern long-eared bat	V	V	The distribution of *Nyctophilus corbeni* includes south-eastern Australia primarily through the Murray-Darling Basin and the western slopes of the Great Dividing Range. The habitat of eastern long-eared bat comprises primarily a range of woodland vegetation types but also includes open forests and vine thickets (Churchill, 2008). This species is typically considered an "inland" species and is a bat of forests and woodlands, heavily dependent on tree hollow habitat in which it roosts (Churchill, 2008).	Species recorded within 20 km of site (1988) & PMST	**Unlikely** Project Site does not support suitable habitat for this species.
Petrogale penicillata Brush-tailed rock wallaby	V	E	Inhabits rock piles and cliffs with numerous crevices and ledges in vegetation ranging from rainforest to dry sclerophyll forest.	Historic record within 25 km of the site (1911)	**Unlikely** Project Site does not support any habitat for this species.
Phascogale tapoatafa Brush-tailed phascogale		V	Prefers open forest and woodland with sparse ground cover, but historically utilized habitats ranging from rainforest to the fringe of the mallee. Nests in tree hollows.	Species has been recorded within 8.5 km of the site (1989)	**Unlikely** Project Site does not support suitable extensive woodland habitat for this species.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
MAMMALS					
Phascolarctos cinereus Koala	V	V	Sclerophyll forest and woodland on foothill plains and riverine forests in central NSW and north central Victoria (Menkhorst & Knight, 2004).	1989 & PMST	**Unlikely** Project Site does not support suitable extensive woodland habitat for this species.
BIRDS					
Anthochaera phrygia Regent honeyeater	E & Mi	CE	The range of the regent honeyeater previously extended throughout south eastern Australia, from Adelaide in South Australia to roughly Dalby in Queensland, and inland around 300 km to the western foothills of the Great Dividing Range (Garnett & Crowley, 2000; Menkhorst, 1999). The species no longer occurs in South Australia or western Victoria, and within its extant range, the regent honeyeater is patchily distributed, and occurs only at low densities (Oliver D. , 1998a). Regent honeyeaters are strongly associated with box-ironbark eucalypt associations, and appear to prefer wetter more fertile areas, such as broad river valleys, creek flats and lower slopes, within this vegetation community (Menkhorst, 1999). A large proportion of these forest types have been cleared for agriculture, leaving only patches of natural vegetation in a predominantly agricultural landscape. These remnants are frequently located on the least fertile sites and have been heavily harvested for timber in the past. Riparian she-oak (*Casuarina cunninghamiana*), and the associated mistletoe, also appears to be important, particularly in years when flowering is poor in the surrounding eucalypt woodlands (Oliver D. , 1998b).	PMST	**Unlikely** Project Site does not support suitable habitat for this species.
Apus pacificus Fork-tailed swift	Mi		Aerial over a wide range of habitats, from inland to coast; spring-summer non-breeding migrant.	PMST	**Low** May fly over site occasionally.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Ardea alba Great egret	Mi		Freshwater and brackish wetlands and watercourses, intertidal mudflats, inland lakes, swamps and rivers; also farm dams, irrigation drainages and artificial wetlands.	PMST	**Low** May occasionally visit dam to north east of site but no breeding habitat present.
Ardea ibis Cattle egret	Mi		Freshwater wetlands and watercourses, pastures and croplands, especially where drainage is poor. Occasionally also tidal flats and estuaries.	PMST	**Low** May occasionally forage in pastures but no suitable breeding habitat present.
Ardeotis australis Australian Bustard		E	Open grassland, grassy woodland, occasionally pastoral land and crops (Simpson, 2004). Occasional vagrants are still seen as far east as western slopes and riverine plain but breeding restricted to north west NSW.	Species has been recorded within 1 km of the site (2008)	**Low** May very occasionally visit to forage in pastures.
Botaurus poiciloptilus Australasian bittern	E	E	Occurs mainly in densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands. Favours wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. Prefers permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate.	Species has been recorded within 20 km of the site (2009) & PMST	**Unlikely** Project Site does not support suitable habitat for this species.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Burhinus grallarius Bush stone-curlew		E	Open forests and woodlands with a sparse grassy ground layer and fallen timber.	Species has been recorded within 2.5 km of the site (2008)	**Low** Project Site does not support extensive woodland habitat.
Calidris ferruginea Curlew Sandpiper		E	Coast of NSW, especially Hunter estuary and occasionally Murray-Darling basin freshwater wetlands, and sometimes inland.	Species has been recorded within 5.5 km of the site (2005)	**Unlikely** Project Site does not support suitable habitat for this species.
Certhionyx variegates Pied honeyeater		V	Arid habitat, flowering shrubs, especially Mulga and mallee, spinifex and eucalypt woodlands. Feeds on nectar of emu-bushes, also mistletoes, saltbush berries, seeds and insects.	Species has been recorded within 7.5 km of the site (2006)	**Unlikely** Project Site does not support suitable habitat for this species.
Circus assimilis Spotted harrier		V	Open grassland, open grassy woodlands, crops, open shrublands and occasionally heathland or scrublands and foraging over open water.	Species has been recorded within 4 km of the site (2011)	**Low** Project Site habitat is unsuitable for breeding but species could hunt over dam to north east of site.
Climacteris picumnus Brown treecreeper		V	Prefers open eucalypt woodland, often along watercourses and drainages, typically lacking a dense understorey but with substantial fallen timber and logs. Sometimes also margins of wooded areas. Forages on tree trunks and on or near ground.	Species has been recorded within 6 km of the site (2009)	**Low** Project Site does not support extensive woodland habitat.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Daphoenositta chrysoptera Varied Sittella		V	Sclerophyll forest, woodland, inhabits most of mainland Australia except treeless deserts and open grasslands (Simpson, 2004; OEH, 2015).	Species has been recorded within 7 km of the site (2013)	**Unlikely** Project Site does not support suitable habitat for this species.
Epthianura albifrons White-fronted Chat		V	Low vegetation in saline coastal and inland areas; crops (Simpson, 2004).	Species has been recorded within 3.5 km of the site (2007)	**Low** Project Site supports some foraging habitat but unlikely to support suitable nesting habitat.
Falco hypoleucos Grey falcon		E	Lightly timbered plains, woodland and watercourses in arid areas; occasionally occurs nearer to coast as rare visitor.	Species has not been recorded within 10 km of the site since 1955	**Unlikely** Project Site does not support suitable habitat for this species.
Falco subniger Black Falcon		V	Woodland, scrub, shrubland and grasslands in arid and semi-arid zones (Simpson, 2004).	Species has been recorded within 7.5 km of the site (2009)	**Low** May fly over/hunt occasionally.
Gallinago hardwickii Latham's snipe	Mi		Wet grasslands and pastures, open and wooded swamps; spring-summer non-breeding migrant.	PMST	**Unlikely** Project Site does not support suitable habitat for this species.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Glossopsitta pusilla Little lorikeet		V	Tall open forest, woodland, orchards, parks and street trees (Simpson, 2004). Isolated flowering trees in open country also used.	Species has been recorded within 6.5 km of the site (2007)	**Low** Project Site does not support extensive woodland habitat.
Grantiella picta Painted honeyeater		V	Open box-ironbark forests, eucalypt and casuarina woodlands and well vegetated watercourses, particularly where trees are infested with mistletoe; mainly spring-summer migrant to south-eastern Australia.	Species has been recorded within 4.5 km of the site (2005)	**Unlikely** Project Site does not support suitable habitat for this species.
Glossopsitta porphyrocephala Purple-crowned lorikeet		V	Dry eucalypt forests, woodlands and shrublands and mallee, also parks and suburban gardens. In NSW it is uncommon with scattered records in box-ironbark woodlands, river red gums and mallee (OEH, 2015).	Species has been recorded within 5.5 km of the site (2013)	**Low** Species may occasionally forage in flowering box trees.
Grus rubicunda Brolga		V	Largely associated with ephemeral freshwater and brackish wetlands, grasslands, floodplains, irrigated pastures and saltmarsh.	Species has been recorded within 6.5 km of the site (2008)	**Low** Species may occasionally forage when areas periodically inundated.
Haliaeetus leucogaster White-bellied sea eagle	Mi		Occupies all coastal areas extending inland through main waterways, coastal islands, and coastal lakes and along some inland rivers. It forages primarily for fish over large areas of open water.	Species has been recorded within 6 km of the site (1979) & PMST	**Unlikely** Project Site does not support suitable habitat for this species.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Hieraaetus morphnoides Little eagle		V	Most open forest, woodland and scrub types; open agricultural landscapes (Simpson, 2004).	Species has been recorded within 3.5 km of the site (2014)	**Low** Species may hunt over Project Site
Hirundapus caudacutus White-throated needletail	Mi		Aerial, mainly eastern Australia often associated with coastal and mountain regions; spring-summer non-breeding migrant.	PMST	**Unlikely** Species may fly over site occasionally.
Lathamus discolor Swift parrot	E	E	Breeds in Tasmania, late spring-summer; occurs as non-breeding migrant to mainland south-eastern Australia mainly autumn-early spring. Generally prefers Box-Ironbark forests and woodlands inland of the Great Dividing Range; sometimes other forests and woodlands in coastal and sub-coastal areas.	PMST	**Low** Species may occasionally forage in flowering box trees.
Lophochroa leadbeateri Major Mitchell's cockatoo		V	Singly, in pairs or small flocks in arid eucalypt, mulga, casuarina or native pine woodlands and shrublands of arid and semi-arid areas; occasionally in saltbush and grasslands adjacent to woodlands. Often near fresh water; require large hollow trees for breeding.	Species has been recorded within 6 km of the site (1995)	**Low** Project Site may support some foraging habitat but scattered trees not suitable for breeding.
Lophoictinia isura Square-tailed kite		V	Primarily found within 250 km of the coast and shows a preference for timbered watercourses. A canopy specialist, it primarily hunts over open forest, woodlands and mallee communities that are rich in passerines, especially honeyeaters, as well as over adjacent heaths and other low scrubby habitats and in wooded towns.	Species has been recorded within 5 km of the site (1983)	**Unlikely** Species may fly over site occasionally.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Melanodryas cucullata cucullata Hooded robin		V	Lowlands and foothills. Inhabit a range of vegetation, particularly with fallen timber and logs, including open eucalypt forests and box-ironbark woodlands, mallee and mulga woodlands, cypress pine woodlands, mallee heaths with scattered trees and often clearings adjacent to woodlands and forests.	Species has been recorded within 8.5 km of the site (1994)	**Unlikely** Project Site does not support suitable habitat for this species.
Merops ornatus Rainbow bee-eater	Mi		Occur in many wooded habitats with an annual rainfall of less than 800 mm, often along vegetated watercourses and cuttings or banks along watercourses.	Species has been recorded within 6 km of the site (2005) & PMST	**Unlikely** Project Site does not support suitable habitat for this species.
Myiagra cyanoleuca Satin Flycatcher	Mi		Mainly in wet forests and dense woodlands, particularly with tall canopy of eucalypts with an understorey of tea-trees and wattles along streams. Seasonal visitor (mainly spring) to drier inland woodlands, coastal areas and occasionally gardens and parklands.	PMST	**Unlikely** Project Site does not support suitable habitat for this species.
Neophema pulchella Turquoise parrot		V	Inhabits arid to semi-arid areas within mallee and acacia (Mulga) scrublands/open woodlands with spinifex and saltbush ground covers. Occurs in both recently burnt and older growth mallee. Known to occur within the Murray Local Land Services (LLS) region.	Species has been recorded within 7.5 km of the site (1998)	**Low** Species may occasionally forage below box trees.
Ninox connivens Barking owl		V	Open forests and woodlands on lowlands and foothills, including box-ironbark forest, riparian woodlands and treed watercourses; occasionally wooded farmlands.	Species has been recorded within 5.5 km of the site (1998)	**Unlikely** Project Site does not support suitable habitat for this species.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Numenius phaeopus Whimbrel	Mi		Coastal lakes, estuaries, tidal mudflats and sandflats, mangroves and saltmarshes; occasionally fresh or brackish lakes near coast; mainly spring-summer non-breeding migrant.	Species has been recorded within 8 km of the site (1985)	**Unlikely** Project Site does not support suitable habitat for this species
Oxyura australis Blue-billed duck		V	Well vegetated freshwater swamps, large dams, lakes. Typically on more open waters in winter.	Species has been recorded within 3.5 km of the site (2005)	**Low** This species may occasionally visit dam to the north east of Project Site in winter months.
Pachycephala inornata Gilberts whistler		V	Occurs in a range of NSW habitats with a dense shrub layer, especially mallee shrublands, but also box-ironbark woodlands, Cypress Pine, Belah woodlands and River red Gum woodlands along the Murray, Edwards and Wakool Rivers (OEH, 2015).	Species has been recorded within 7 km of the site (2005)	**Unlikely** Project Site does not support suitable habitat for this species
Pandion cristatus Eastern Osprey	Mi		Coastal areas.	PMST	**Unlikely** Project Site does not support suitable habitat for this species.
Pedionomus torquatus Plains-wanderer	V, -		Low, open native grasslands, typically with a short sward with extensive inter-tussock spaces and high diversity of small herbs; sometimes in unimproved pastures or crops. Most known local populations of this species occur in private native grasslands which have low-level grazing combined with some degree of exposed ground. This species is sensitive to disturbance and management of native habitat areas are considered critical to its persistence. Threatening processes that accompany human activity such as introduced predators are known to have a significant impact on the species.	Species has been recorded within 2.5 km of the site (2011) & PMST	**Moderate** Suitable habitat are present within the Project Site.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Petroica boodang Scarlet robin		V	Commonly found in eucalypt woodland and forest from sea level to 1000 m, particularly the more open habitats with grassy and shrubby understories.	Species has been recorded within 5 km of the site (1994)	**Unlikely** Project Site does not support suitable habitat for this species.
Petroica phoenicea Flame robin		V	Broad coastal band around the south-east corner of the Australian mainland, from southern Queensland to just west of the South Australian border. Cropped paddocks, parkland near woodland, nests in low open forests, roosts in dense scrub, citrus orchards and small flocks disperse in autumn-winter (Simpson & Day, 2004).	Species has been recorded within 7.5 km of the site (2007)	**Low** Species may occasionally forage in grasslands at edge of Project Site and near scattered mature trees with shrubs and fence lines.
Plegadis falcinellus Glossy ibis	Mi		Mainly margins of freshwater wetlands and nearby grasslands and pastures; sometimes estuaries and brackish lakes. Mainly spring-summer breeding migrant to south-eastern Australia.	Species recorded within 5 km of the site (1995)	**Unlikely** Project Site does not contain suitable habitat.
Polytelis swainsonii Superb parrot	V	V	River Red Gum, Black Box and other eucalypt woodlands and timbered watercourses; sometimes in pastures, stubbles, clearings and wooded farmland and often killed on roads when feeding on spilt grain.	Species has been recorded within 1.5 km of the site (2011) and PMST	**Low** Species may occasionally forage in flowering box trees but scattered trees in Project Site isolated from nearby open woodland areas.

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Pomatostomus temporalis temporalis Grey-crowned babbler (eastern subspecies)		V	Inland open forests, woodlands and scrublands, particularly with an open shrub layer, little ground cover and plenty of fallen timber and leaf litter, including along roadsides and around better vegetated farms. Serious declines in settled areas of south-eastern Australia.	Species has been recorded within 8 km of the site (2008)	**Unlikely** Scattered trees isolated and not connected to roadside trees or open woodland areas making habitat unfavourable
Rostratula australis Australian painted snipe	E & Mi	E	This species is found in wet environments, either with mud or covered with water, which favour its primary food resources. The species is omnivorous, feeding on seeds, plant material and invertebrates. The decline of the Australian Painted Snipe appears to be linked to the loss of habitat and degradation of environmental attributes of preferred habitats (i.e. wetting/drying/flooding and littoral zone destruction) within the Murray Darling Basin which is thought to contain historic core breeding areas. Depending upon the localities of wetlands habitats, the species may temporarily use human altered environments for feeding. However these areas are unlikely to be utilised as breeding sites because of their size, presence of introduced predator pressure from foxes, cats, and dogs, and dynamics (ephemeral vs. permanent) of wetland for breeding purposes.	Species recorded within 4.5 km of the site (1992) & PMST.	**Unlikely** Project Site does not contain suitable habitat
Stagonopleura guttata Diamond firetail		V	Open grassy eucalypt or cypress pine woodlands, acacia shrublands and edges of farmland or grassland close to wooded or lightly timbered areas. Often in wooded areas close to watercourses.	Species has been recorded within 7 km of the site (2005)	**Low** Species may occasionally forage in grasslands at edge of Project Site and near scattered mature trees with shrubs and fencelines

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
BIRDS					
Stictonetta naevosa Freckled duck		V	Large, well vegetated swamps and wetlands, including ephemeral open lakes when inundated.	Species has been recorded within 3.5 km of the site (2005)	**Low** Species may occasionally visit dam to the north east of Project Site in non-breeding/drought periods
Tyto novaehollandiae Masked Owl		V	Inhabits forests, woodlands, timbered waterways and sometimes open country on the fringe of these areas. Also inhabit caves. Found in a band around coastal Australia, generally not more than 300 km inland.	Species has been recorded historically within 5 km of the site (1955)	**Unlikely** Project Site does not support suitable extensive woodland habitat for this species.
FISH					
Bidyanus bidyanus Silver Perch	CE		Rivers, lakes and reservoirs, preferring in or below fast-flowing waters and rapids/races and usually forming aggregations near the surface. Water temperatures ranging from 2°C to 35°C with optimal between 23-28°C.	PMST	**Unlikely** Project Site does not support suitable habitat for this species
Craterocephalus fluviatilis Murray hardyhead	V		Occurs in still and slow-flowing waters including billabongs, lakes and margins and backwaters of lowland rivers.	PMST	**Unlikely** Project Site does not support suitable habitat for this species

Species	EPBC Act status[1]	TSC Act status[1]	Ecology	Most recent record /PMST Results	Likelihood of Occurrence
FISH					
Maccullochella peelii peelii Murray cod	V		Small clear, rocky, upland streams with riffle and pool structure on the upper western slopes of the Great Dividing Range to large, meandering, slow flowing, often silty rivers in the alluvial lowland reaches of the Murray Darling Basin.	PMST	**Unlikely** Project Site does not support suitable habitat for this species
Macquaria australasica Macquarie Perch	E		Deep, rocky holes with considerable cover and flowing water over unsilted cobble and gravel substrate.	PMST	**Unlikely** Project Site does not support suitable habitat for this species.
AMPHIBIANS					
Litoria raniformis Growling grass frog	V	E	Permanent lakes, swamps, dams, offline creek pools, and lagoons or very wet areas in woodland and shrubland; often in waterbodies with dense standing (e.g. Eleocharis., Juncus, Typha, Bolboschoenus) and floating vegetation (e.g. Triglochin, Potamogeton).	PMST	**Unlikely** Project Site does not support suitable breeding habitat, potential aquatic foraging habitat is present to the north east and Project Site grasslands could act as terrestrial habitat.

[1] CE=Critically Endangered, E = Endangered, V = Vulnerable, Mi = Migratory

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Appendix B

Qualifications of assessors

Curriculum Vitae

Dan Simmons

Principal Environmental Scientist

Areas of Experience

- Ecological impact assessment and mitigation planning
- Biodiversity offsets and threatened species management
- Vegetation management and ecological restoration
- Baseline terrestrial and aquatic flora/fauna surveys

Career Summary

Dan is a Principal Environmental Scientist and the Ecology Team Manager at URS in Brisbane, Queensland. With over 16 years' experience in environmental management and biological studies, Dan has been responsible for the project management, coordination and preparation of numerous ecological assessments, impact management plans, biodiversity offset assessments, significant species management and monitoring plans, vegetation management plans, and ecological restoration projects. This work has been undertaken for a wide range of clients including industrial and corporate projects and government authorities in Australia and Indonesia.

Career Details

As the URS ecology team leader, Dan provides technical direction, team management and oversees the implementation of a variety of environmental management studies and biological assessments including baseline aquatic and terrestrial vertebrate fauna and vascular flora surveys, significant species monitoring programs, ecological impacts studies and rehabilitation plans.

URS- 2004 to 2015.

Selected Ecological Studies and Impact Assessments

- **Bowen Gas Project EIS, Arrow Energy**
  Project Manager of the EIS and technical director of ecology studies, for the development of the Bowen CSG fields, central Queensland.
- **Bow Energy CSG and Pipeline EIS, Bow Energy -**
  Project Manager of EIS and technical director of ecology studies for the development of the CSG fields and the Blackwater to Gladstone pipeline, central Queensland
- **GLNG Field Management Protocols and Constraints Mapping, Santos -** Development of environmental constraints mapping, threatened species potential habitat mapping, and field management / site scouting protocols, for the ongoing environmental assessment of CSG field operations to gain SEWPaC EIS approval.

- **Ecological Studies and Impact Assessment, Santos -** Gladstone LNG terrestrial/aquatic ecological studies, impact assessment, regulator liaison, EPBC referral, biodiversity offset strategy for the GLNG plant facility, gas transmission pipeline and coal seam gas extraction fields

Qualifications

Bachelor of Applied Science - Environmental Resource Management, Southern Cross University, 1998

Dan Simmons.*Principal Environmental Scientist*

Vegetation Management and Rehabilitation

- **Riparian Vegetation Monitoring, Alcan Gove -** Study Coordinator, undertook annual vegetation monitoring program for potential effects of groundwater drawdown on riparian vegetation communities, Gove Peninsula Northern Territory
- **Mine Rehabilitation Plan, BMA -** Preparation of terrestrial ecology component of rehabilitation plan for the Goonyella Riverside Mine, Bowen Basin, central Queensland
- **Riparian Rehabilitation Plan, Newlands Coal -** Prepared riparian rehabilitation plan for the diversion of Suttor Creek, Bowen Basin, central Queensland
- **Riparian Rehabilitation Plan, BMA -** Prepared riparian rehabilitation plan for the diversion of Lotus Creek, Norwich Park coal mine, Bowen Basin, central Queensland
- **Vegetation Monitoring, Carpentaria Gold -** Study Coordinator, vegetation monitoring program for effects of groundwater seepage on riparian and terrestrial vegetation communities, Ravenswood Goldmine, Central Queensland
- **Vegetation Rehabilitation Monitoring, Amaca -** Study Coordinator, bi-annual vegetation monitoring of rehabilitation on the Canaipa sand mine lease, North Stradbroke Island, Queensland
- **Agnes Waters Vegetation Management Plan, Miriam Vale Shire Council -** Undertook vegetation survey and prepared riparian stream maintenance plan and dune vegetation rehabilitation plan for Agnes Creek, Queensland central coast
- **Waterway Rehabilitation Plan, Brisbane City Council -** Undertook ecological Assessment, prepared riparian rehabilitation plan and provided construction supervision for Haase Place Waterway Bellbowrie, south east Queensland
- **Waterway Rehabilitation Plan, Brisbane City Council -** Reviewed ecological Assessment and prepared riparian rehabilitation plans for Stable Swamp Creek, Coopers Plains, south east Queensland
- **Site Rehabilitation Plan, Noosa Business Centre -** Baseline studies and preparation of a vegetation management plan and site rehabilitation specifications for the Noosa Shire Business Centre

Professional History

Senior Associate Environmental Scientist, URS, 2010 - present

Associate Environmental Scientist, URS, 2007 - 2010

Senior Environmental Scientist, URS, 2006 - 2007

Project Environmental Scientist, URS, 2004 - 2006

PBE, Consultant Ecologist, PBE, 2002 - 2004

Research Assistant (part time), Qld Parks & Wildlife Service, Conservation Unit, 2001

Research Assistant & Biology Tutor, Southern Cross University NSW, Faculty of Resource Science and Management, 2000

Field Ecologist, Greenloaning Biostudies, Environmental Consultancy, 1999

Ranger (Educational Guide), NSW National Parks & Wildlife Service, 1997 - 1998

Curriculum Vitae

David Gatfield

Ecologist

Areas of Experience

- Ecological assessments
- Significance impact assessments
- EVNT flora and fauna identification
- EIS preparation
- Fauna habitat condition assessments
- Environmental sensitive areas
- Weed and feral animal biology

Qualifications

Bachelor of Science - Conservation, Biology and Marine Biology, Griffith University, 2009

Career Summary

David is an Ecologist with five years' experience in the planning and implementation of flora and fauna surveys. He is also experienced in the preparation of ecological investigations, environmental management plans, offset strategies and environmental impact statements.

Recently at URS, David has been responsible for the baseline ecology field surveys and preclearance surveys within South East Queensland, liaising with local and state authorities. David has extensive experience within the Bowen and Surat Basin and is currently the study lead on an offset delivery program targeting and assessing habitat for threatened fauna species.

Career Details

Project Ecologist, URS

David has had strong emphasis on baseline terrestrial vertebrate fauna surveys and environmental impact studies within the Bowen and Surat Basin, Queensland. David has more recently be involved in undertaking preclearance flora surveys and EVNT flora field studies in whilst on secondments within the CSG industry.

Some key projects David was involved in include:

Ecologist, Marine Industry Park EIS, LDC, Darwin, Northern Territory, 2015

Baseline terrestrial vertebrate fauna studies, including EVNT identification and fauna habitat assessments

Ecologist, Western Surat Gas Project, Senex, Surat Basin Queensland 2015

Baseline terrestrial vertebrate fauna studies, including EVNT identification and fauna habitat assessments

Ecologist, Red Hill Project, BMA, Bowen Basin Queensland 2015

Terrestrial habitat conditions surveys within the Red Hill mine and proposed offset site locations.

Ecologist, United Fuel Terminal, United Petroleum, Pinkenba Queensland, 2015

Ecological assessment within a proposed fuel terminal site, including marine plant mapping. Regulator liaison required for areas within the Brisbane City Council biodiversity overlay.

Ecologist, Queensland Solar Farm Assessment, FRV Services Australia, Queensland 2015

Baseline flora and fauna surveys undertaken within three proposed solar farms. Determination of potential impacts on ecological values and liaison with regulatory agencies. An EPBC referral was also completed as part of the Project.

Ecologist, Gladstone Liquefied Natural Gas Project (GLNG) Migratory Shorebirds Surveys, GLNG, Curtis Island, Queensland 2011-2015

For the project David was responsible for monitoring of international migratory shorebird species, impact assessment and mitigation for the GLNG gas processing plant on Curtis Island.

Environmental Officer (Ecologist) APLNG Project, Origin Energy, Surat Basin Gas Fields, Queensland September 2014

Secondment environmental officer role within the Origin E&A team. The role required the provision of environmental advice and supervision for lease pad construction. Furthermore, David was responsible for ensuring active drill rigs were complying with environmental requirements.

Ecologist, Landspraying While Drilling (LWD) Trial Program, Origin Energy, Condabri and Combabula Gas Fields, Queensland 2014

Baseline vegetation studies across LWD trial properties, requiring accurate species identification, density and cover estimates.

Aquatic Ecologist, Arrow Bowen Gas Project SEIS, 2014

Detailed desktop assessment of aquatic ecology values following the revision of the Project description and subsequent location of the water treatment facilities.

Ecologist, Arrow Bowen Gas Project SEIS, 2013 - 2014

David was responsible for the delivery of SEIS reporting requirements including revised vegetation mapping, impact assessment and submission responses

Environmental Officer (Ecologist), APLNG Project, WDS Limited Secondment, September – December 2013

Secondment role with WDS undertaking preclearance ecological surveys as well as providing advice on ecological matters, such as rehabilitation monitoring methods.

Environmental Advisor (Ecology), GLNG Project, Saipem Australia Secondment, April 2012 – July 2013

Secondment role with Saipem providing advice on ecological and environmental constraints. Tasks and responsibilities at Saipem included preclearance flora and fauna surveys and associated impact assessments, provision of advice to construction personnel and management of the native plant seed collection field program.

Ecologist, Jet Fuel Pipeline Project, Caltex Australia, Brisbane, Queensland, 2014

Ecological assessments along the proposed pipeline route to support the development approval process. Assessment included species identification, vegetation mapping, fauna habitat identification and subsequent reporting.

Ecologist, Lake Macdonald Upgrade Risk Assessment, Seqwater, Sunshine Coast, Queensland, 2013

For this project, David was responsible for delivering a detailed characterisation of environmental and ecological values of the site for inclusion within engineering risk assessment matrices.

Ecologist, New Lenton Coal Project, New Hope Coal, Bowen Basin, Queensland 2013

For the project, David responsibilities included the baseline terrestrial vertebrate fauna studies. These studies included EVNT identification and fauna habitat assessments.

Ecologist, Goonyella Riverside Coal Mine Expansion Baseline Ecological Studies and Impact Assessment, BMA, Bowen Basin, Queensland 2011-2012

David's duties on this project included baseline terrestrial vertebrate fauna studies, impact assessment and mitigation.

Ecologist, SoE Project Migratory Bird Impact Assessment and Pathway Mapping, Rio Tinto Alcan, 2012

Migratory bird studies and indicative migratory pathway mapping within and around Cape York Peninsula, Northern Queensland. David was also responsible for the subsequent reporting, impact assessment and mitigation.

Ecologist, Caval Ridge Mine Rail Spur Ecology Assessment, BMA, Bowen Basin, Queensland, 2012

Responsible for undertaking flora and fauna assessment within the proposed rail spur. The assessment included species identification, vegetation mapping, fauna habitat identification and impact assessment and mitigation.

Ecologist, Bow Energy CSG fields and gas transmission pipeline EIS, BOW Energy, Queensland, 2011

David was responsible for terrestrial ecology field studies, impact assessment and mitigation within the proposed CSG fields. David undertook both flora and fauna studies along the proposed gas transmission pipeline.

Professional History

Project Ecologist, URS Australia Pty Ltd, 2013 - Present

Graduate Ecologist, URS Australia Pty Ltd, 2011 - 2013

Research Assistant, Griffith University, 2010

Volunteer Research Assistant, Griffith University, 2008 - 2010

Education and Training

First Aid Certificate, 2015

Four-Wheel Drive and Defensive Driving Course

Occupational Health and Safety Construction Card

Standard 11, Generic Induction to Coal Core and Basic Fire Fighting

AECOM

Dongman Greentec Pty Ltd
02-Oct-2015

Plains Wanderer Offset Strategy

Deniliquin Ethanol Plant EIS

Plains Wanderer Offset Strategy

Deniliquin Ethanol Plant EIS

Client: Dongman Greentec Pty Ltd

ABN: 11 158 522 000

Prepared by

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URS Australia Pty Ltd

02-Oct-2015

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Prepared by	David Gatfield
Reviewed by	Dan Simmons

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			Name/Position	Signature
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0	02-Oct-2015	Final	James MacDermott Practice Leader - Approvals	

Table of Contents

Executive summary

The New South Wales Government Biodiversity Offset Policy 2014 requires the provision of environmental offsets for significant residual impacts to threatened species and associated habitat.

This offset strategy outlines the Deniliquin Ethanol Plant (the Project) strategy for providing environmental offsets for residual impacts to plains wanderer secondary habitat. The objective of this strategy is to identify the approvals and offset delivery pathway for the Project as well as facilitate discussion between the Proponent and New South Wales Office of Environment and Heritage on suitable offsets for residual impacts incurred by the Project.

This offset strategy presents the Project's commitment to avoiding and minimising potential impacts on biodiversity values where possible. Where potential impacts are unavoidable, the residual impact has been identified and evidence that there are opportunities within the region to offset the residual impact is provided.

The residual impact of the Project has been identified as 17.3 ha of plains wanderer secondary habitat. The assessment of offset availability within the region identified 179,583 ha of potential habitat across 8471 number of lots.

It is considered that the implementation of biodiversity offsets guided by current recovery and conservation objectives as identified in this report, will contribute to achieving a positive biodiversity outcome for the plains wanderer.

1.0 Introduction

1.1 Scope of assessment

The aim of this preliminary offset strategy was to document the residual impacts of the Deniliquin Ethanol Plant (the Project) on the plains wanderer (*Pedionomus torquatus*) and outline the Project's commitments to ensuring a positive biodiversity outcome for the species. In meeting this aim, the objectives of the preliminary offset strategy were to:

- Present a full description of the action proposed.
- Determine the legislative framework that underpins the Project.
- Present the Project's avoidance and mitigation strategies.
- Identify any residual impacts on the plains wanderer following the implementation of avoidance and mitigation strategies.
- Outline the Project's approach to the provision of offsets.
- Undertake a preliminary assessment into the availability of offset areas in the region.
- Demonstrate commitment to comply with NSW Biodiversity Offset Principles.

This strategy will immediately inform the approach to the detailed design of the works, and ultimately inform the preparation of a detail biodiversity strategy or plan that will achieve a long-term conservation gain through:

- providing an offset that is underpinned by sound ecological principles
- improving biodiversity over time through enhancing habitats within the offset site
- removing any threats to ecological values (such as inappropriate management activities, and/or pest plant and animal infestations)
- providing offsets that are quantifiable, enduring, and secure.

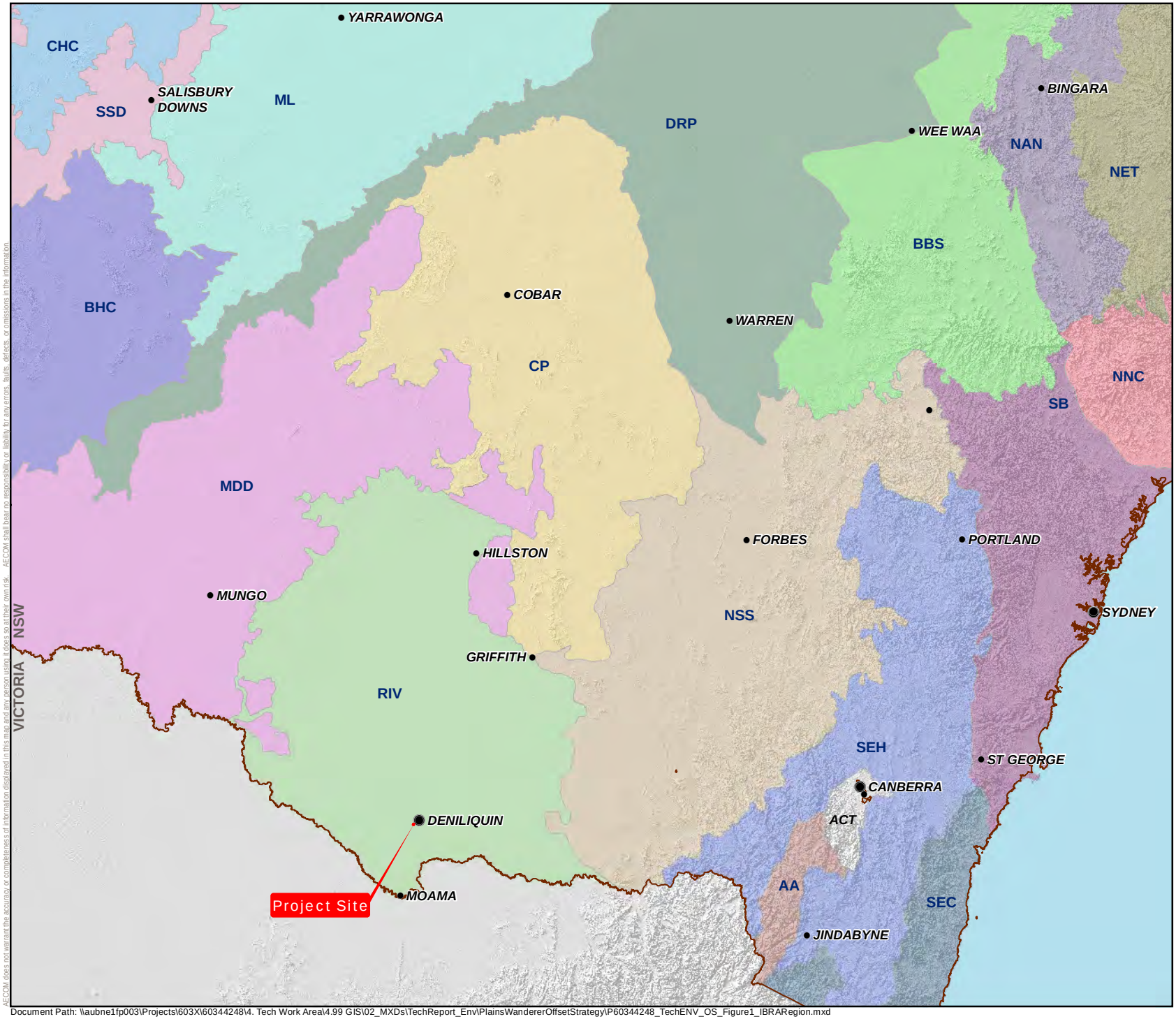
This strategy presents the maximum potential residual impact to plains wanderer habitat that may result from the construction of the Project. The strategy also provides the framework for achieving required offsets including a preliminary analysis of suitable offset availability in the region.

1.2 Project area

The Project is located in the Murray region of south western New South Wales (NSW). The Project Site is approximately 5.5 kilometres (km) south west of the township of Deniliquin. The Project Site is located on approximately 120 hectares (ha) of land over lots 234, 272 and 273 of DP 756325, Deniliquin-Barham Road.

The Project Site is located within the central portion of the Riverina Interim Biogeographical Regionalisation for Australia (IBRA) Region (Thackway and Cresswell V. 8.0) in south west New South Wales (NSW), within the Murray Fans Subregion (Figure 1). This bioregion is dominated by river channels, floodplains, backplains, swamps, lakes and lunettes that are all of Quaternary age.

The Murray Valley Regional and National Park system is the closest protected area to Deniliquin (Figure 2), extending from the Deniliquin townsite, 6 km to the east of the Project Site, south and east along the Edward and Murray Rivers, and joining up with the Barmah National Park, over the border in Victoria.



Plains Wanderer Offset Strategy

FIGURE 1
Interim Biogeographical Regionalisation for Australia (IBRA) Region

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 50 100 150
Kilometres

LEGEND

- Cities / Towns (selection)
- Project Site
- State Boundary

Riverina Interim Biogeographical Regionalisation for Australia (IBRA) Region

- AA, Australian Alps
- BBS, South Brigalow
- BHC, Broken Hill Complex
- CHC, Channel Country
- CP, Cobar Peneplain
- DRP, Darling Riverine Plains
- MDD, Murray-Darling Depression
- ML, Mulga Lands
- NAN, Nandewar
- NET, New England Tableland
- NNC, NSW North Coast
- NSS, NSW SouthWestern Slopes
- RIV, Riverina
- SB, Sydney Basin
- SEC, South East Corner
- SEH, South Eastern Highlands
- SSD, Simpson-Strzelecki Dunefields

Data Sources:
1. Roads, Railway, Parks, Drainage, Suburbs: @ Street Pro, 2011
2. Base Map Layer: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3. NSW Interim Biogeographic Regionalisation of Australia (IBRA), Version 4.1 @ Office of Environment and Heritage (OEH) 2012-11-21

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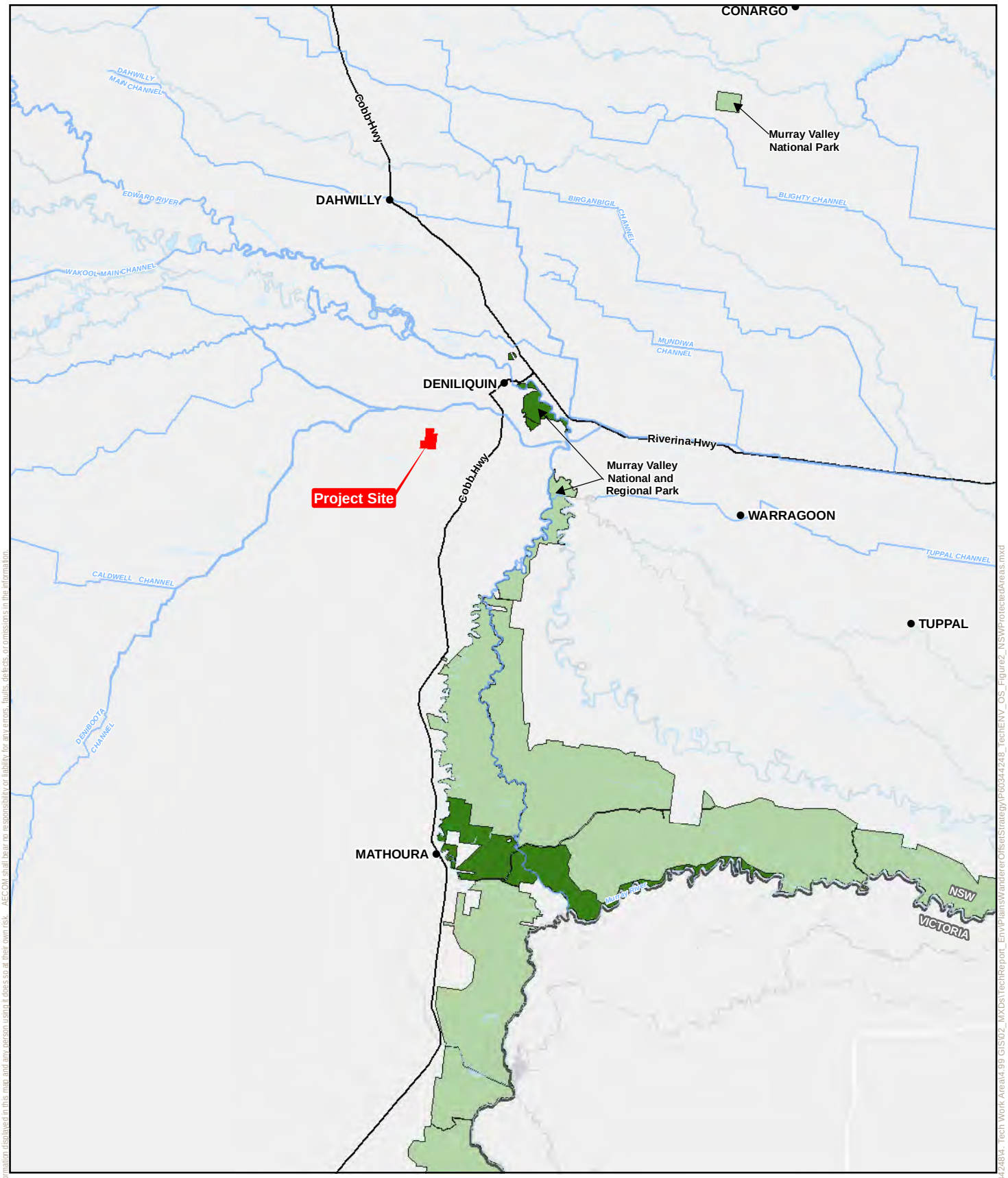
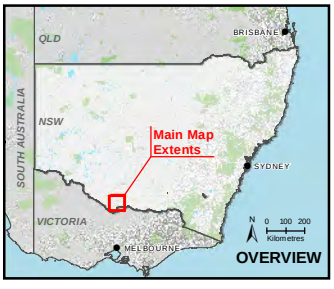
Plains Wanderer Offset Strategy

NSW Protected Areas





LEGEND

- Locality
- Major River / Watercourse
- Minor Watercourse
- Highway; Freeway
- Project Site
- State Boundary

NSW Protected Areas

- Regional Park
- National Park
- Nature Reserve

Data Sources:
1. Roads, Railway, Parks, Drainage, Suburbs: @ Street Pro, 2011
2. Base Map Layer: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3. Parks and Reserves: An area of land, the boundaries of which have been determined by the Governor by proclamation in the Government Gazette, which has been reserved for various protection purposes defined in instruments administered by Department of Environment and Climate Change (Parks & Wildlife Division).

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DATUM GDA 1994, PROJECTION MGA ZONE 55

N 0 2.5 5 7.5
Kilometres

FIGURE 2

A4

1.3 Project description

An Environmental Impact Statement (EIS) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of Dongmun Greentec Pty Ltd (the Proponent), for a State Significant Development (SSD) application for the construction and operation of an ethanol production facility at Deniliquin, NSW (the Project). The Proponent is seeking approval for the development of an ethanol plant capable of producing 115 mega litres (ML) annually including several grain storage silos, a wastewater treatment facility and a workshop area.

Approval for the Project is being sought under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). AECOM has prepared an EIS pursuant to the requirements of the EP&A Act and the Environmental Planning and Assessment Regulation 2000. The EIS was prepared in accordance with the requirements of the Director General's Requirement (DGRs) issued on 23 December 2013 by the Department of Planning and Infrastructure, now the Department of Planning and Environment (DP&E), under the EP&A Act.

The Project will have a capacity of producing 115 ML of ethanol per annum and will include several grain storage silos, a wastewater treatment facility and a workshop area. The Project will operate 24 hours per day, seven days a week for 330 day per year with a scheduled shut down period.

The Project will process approximately 300,000 tonnes (t) of locally grown grain of wheat per annum. Utilising the carbohydrate in the wheat, the primary output from the production is fuel graded ethanol, which will be sold to the major petroleum companies as additive to regular ULP to produce E10, or exported. The additional saleable co-products of the ethanol production process will be a dried distiller grain with solubles (DDGS), syrup and liquid fertiliser. These will be sold as high nutrient agricultural protein meal and agricultural fertiliser.

The Project will generate approximately 350 jobs during construction and up to 50 permanent jobs during the operation and ongoing management of the Project. The following key infrastructure/process sets has been included within the Project's conceptual design:

- Closed system grain milling.
- Liquefaction of grain flour.
- Fermentation.
- Distillation and dehydration.
- Centrifuge and drying of dried distiller's grain.
- A boiler to remove odours generated by the production process.
- An anaerobic digestion area to treat liquid compost by-product.
- A site office, control room and maintenance room.
- A storage area and silos for input grain.
- A storage area for dried distillers grain output.
- A storage area for solid waste from anaerobic digestion.
- An on-site ethanol storage area.
- A staff car parking area.
- Onsite bio-retention basin.

CNG will be piped to the site via a proposed Elgas facility located between the Project Site and the airport (to the east). The plant will be constructed on site. All materials will be transported to the site via the existing road and rail network. Products will be distributed using existing rail and road networks, 70 percent by rail and 30 percent by road.

1.4 Limitations

This offset strategy is considered a high level document, and has been prepared to inform (not to replace) a future and more detailed Biodiversity Offset Plan. Given the strategic nature of the document, the following limitations apply:

- The location and suitability of offset sites are indicative only, further work is required to investigate the viability of potential offset sites.
- This strategy focuses the potential impacts of the Project, the ecological characteristics that are required to be present in a suitable offset site, and an overview of potential management actions that might be required to achieve favourable ecological outcomes- these are a guide only, and are likely to change depending on the final offset site/sites chosen.
- Future offset sites will be selected in close consultation with OEH.

2.0 Legislative framework

2.1 NSW Biodiversity Offsets Policy for Major Projects

The NSW Biodiversity Offsets Policy for Major Projects clarifies, standardises and improves biodiversity offsetting for major project approvals (OEH, 2014). The policy applies to state significant development and state significant infrastructure under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The policy aims to strike an effective balance between the needs of proponents, communities and the environment through the following objectives:

- providing clear, efficient and certain guidance for stakeholders;
- improving outcomes for the environment and communities; and
- providing a practical and achievable offset scheme for proponents.

The NSW Biodiversity Offsets Policy for Major Projects is underpinned by six overarching principles, including:

1. Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.
2. Offset requirements should be based on a reliable and transparent assessment of losses and gains.
3. Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.
4. Offsets must be additional to other legal requirements.
5. Offsets must be enduring, enforceable and auditable.
6. Supplementary measures can be used in lieu of offsets.

Section 6 demonstrates how the Project will comply with each of the overarching principles.

2.1.1 Framework for biodiversity assessment

The Framework for Biodiversity Assessment (FBA) underpins the Biodiversity Offsets Policy for Major Projects. It contains the assessment methodology that is adopted by the policy to quantify and describe the impact assessment requirements and offset guidance that applies to Major Projects.

The FBA sets out:

- requirements for a reliable and transparent assessment of biodiversity values on land in order to:
  - identify the biodiversity values subject to a proposed major development;
  - determine the impacts of Major Projects on biodiversity as part of an application for approval to undertake the Major Project under NSW planning legislation; and
  - quantify and describe the biodiversity offsets required for the unavoidable impacts of Major Projects on biodiversity values.
- types of conservation measures that are available to offset the unavoidable impacts of Major Projects, and how they may be used by a proponent to prepare a biodiversity offset strategy as part of an application for approval to undertake the Major Project.

The FBA must be used by a proponent to assess all biodiversity values on the development site for a Major Project. Where a proponent is proposing to establish an offset site as part of the BOS for the Major Project, the

Biobanking Assessment Methodology (BBAM) must be used to assess the biodiversity values of the offset site and to identify the number and type of biodiversity credits that may be created on the offset site.

3.0 Avoidance and mitigation of impacts

Mitigation measures of potential impacts have been developed as part of the EIS assessment. These measures are presented below as well as specific mitigation for the Plains wanderer. Using a hierarchal mitigation process, potential impacts must be avoided in the first instance by using prevention and then reduced using mitigation measures where avoidance is not achievable. Environmental offsets are then used to address any residual impacts. The proposed measures for managing potential impacts on the Project Site are detailed below.

3.1 Avoidance

The design of the Deniliquin Ethanol Plant has been modified substantially to reduce the Project Footprint from 68 ha to 25.6 ha. This modification was implemented in an effort to reduce the extent of vegetation clearing within plains wanderer habitat. The reconfiguration of the Project Site has relocated infrastructure into a consolidated area in the north of the Project Site away from the recognised plains wanderer secondary habitat found in the south of the site.

3.2 Mitigation

3.2.1 General ecology mitigation measures

The following mitigation measures will be implemented to reduce the potential impact on biodiversity values:

- The clearing of vegetation shall be managed through a vegetation management plan.
- Weed hygiene procedures to be followed during the construction phase, with particular emphasis on limiting the spread or movement of the noxious weed species African boxthorn and Bathurst burr.
- African boxthorn and Bathurst burr will be removed from the construction footprint pre-construction.
- Continued weed hygiene and monitoring procedures will be followed throughout the life of the Project, and documented in a weed management plan.
- An ecologist will supervise felling of hollow bearing trees and translocate animals to approved sites.
- Native vegetation clearance will be staged, so as to allow animals recourse to move away.
- Trees will be felled outside the main bird-nesting season, i.e. in winter months.
- Landscaping will use endemic native species where possible.
- Implementation of appropriate speed limits and fencing to minimise fauna mortality.

3.2.2 Plains wanderer mitigation measures

The general mitigation measures outlined above will assist in reducing potential impacts on the plains wanderer habitat. The following specific mitigation measures will also be implemented to minimise the potential impacts to plains wanderer:

- A plains wanderer species management plan will be developed prior to any works being undertaken. The species management plan will identify mitigation and monitoring procedures throughout the life of the Project.
- A pre-clearance survey for plains wanderer and plains wanderer breeding places will be undertaken prior to any clearing activities. The species management plan will identify procedures to be followed should breeding places be identified.
- The clearing extent within plains wanderer habitat will be clearly delineated to ensure no over-clearing occurs.
- Staff training toolboxes will be delivered to all staff associated with the clearing and management of plains wanderer habitat.
- Permanent lighting will be directed away from adjacent plains wanderer habitat.

- Efforts to minimise noise will be undertaken where possible (i.e. mufflers on machinery).

4.0 Residual impacts

The implementation of avoidance and mitigation measures will reduce the extent of potential impacts on plains wanderer habitat, and minimise ongoing potential impacts associated with the construction and operation of the Project. Despite this a residual impact to 17.3 ha of secondary plains wanderer habitat remains, as depicted in Figure 3.

To mitigate the residual impact, biodiversity offsets are proposed. The approach to the provision of offsets is discussed below (Section 5). Furthermore, a preliminary analysis of plains wanderer offset availability in the region has been undertaken (Section 6).

5.0 Approach to the provision of offsets

This preliminary offset strategy provides an estimate of the maximum potential residual disturbance to plains wanderer habitat likely to occur from the Project. As outlined above in Section 3, the Proponent is committed to reducing potential impacts on biodiversity values including the plains wanderer habitat through avoidance and mitigation measures, with offsets employed as a secondary measure to ameliorate residual impacts.

A range of options exist for the delivery of biodiversity offsets including:

- Land based offsets (offsite or onsite): secure additional plains wanderer habitat through a suitable legal instrument, ensuring the land is managed for conservation.
- Retirement of BioBanking credits: purchase an appropriate number of BioBanking threatened species credits under the NSW BioBanking scheme.
- Compensatory measure: investment into plains wanderer scientific research or education programs.

Given the above, the following approval and offset delivery pathway for the implementation of an offset delivery plan and the delivery of suitable Project offsets is proposed in the following steps:

- Assess biodiversity impacts and determine the biodiversity offset requirements as per the FBA guidelines and BioBanking Assessment Methodology – offset delivery mechanism to be identified. Residual impacts have been calculated as part of the EIS, however habitat condition and offset requirement reports are required prior to the determination of a suitable offset site.
- Identify offset site and prepare offset delivery plan – suitable offset areas which meet the offset requirements of the Project will be identified. The preferred offset mechanisms and offset site management measures will also be detailed.
- Delivery of offsets – Offset areas are to be delivered following regulatory approval of the offset delivery plan. Monitoring of the offset site will begin during this stage.

5.1 Assessment of impacts and biodiversity offset requirements

Depending on the offset pathway selected, a detailed assessment of the biodiversity impacts may be required within the Project area to determine the quantum of offset required for the Project. At a minimum, a review of the field surveys undertaken as part of the EIS would be required.

Should the retirement of Biobanking Credits be selected, an accredited Biobanking Assessor would need to be engaged to undertake a Biobanking assessment of the disturbance footprint. The availability of the appropriate number and class of biodiversity credits required would also be investigated.

5.2 Offset site identification and offset delivery plan

Should a land based offset be selected, potential offset sites that meet the specified criteria will need to be identified. This is achieved through spatial analysis using an existing data sources such as vegetation mapping, museum records, connectivity and land tenure.

Following identification of a potential offset site(s), a condition and habitat assessment would be required to confirm the presence of suitable values and determine habitat condition. This assessment would be undertaken by suitably qualified ecologists and the report prepared would be included in the offset delivery plan.

An offset delivery plan will be prepared regardless of the offset mechanism selected. The delivery plan will include (but not be limited to) the following key steps:

- Outline the final offset mechanism to be used for the Project;
- Identify the proposed offset site(s), their locations and contribution towards offset requirements;
- Detail the results of ground truthing surveys of the ecological values within the proposed offset site(s);
- Identify offset requirements that will be secured through an offset transfer or offset payment; and
- Identify any indirect offset proposals.

Where direct offsets are proposed, a risk assessment of future land use will be completed. This will go towards ensuring that any direct offset proposed by the Project is not subject to future non-compatible land uses.

Consultation will be conducted with State agencies during the development of an offset delivery plan to ensure all offset issues are identified and discussed before the package is finalised.

5.3 Delivery of offsets

The delivery of an offset is defined for the Project as entering in agreements to establish an offset with the relevant landholder or organisation.

Following approval of the offset delivery plan, the measures and mechanisms identified will be secured. This includes legally securing the offset sites and the preparation of appropriate offset site specific management plans. Where offsets are to be secured through brokers and offset payments, contracts are to be in place (and payments made) to satisfy these offsets requirements. Finally, all funding for indirect offsets are to be in-place with the appropriate institution or department.

Offset site specific management plans will be prepared where required to outline ongoing management actions required at each area, such as (not limited to):

- Management of grazing;
- Weed suppression and control;
- Pest control;
- Management of fire;
- Fencing to restrict informal access; and
- Monitoring requirements against performance criteria.

These offset site specific management plans will also include details such as the duration of active management, reporting, monitoring and measures to achieve condition improvement requirements. Annual reporting may be required to be undertaken to assess the progress of the offset area against biodiversity objectives.

Offsets selected will be managed to deliver a net benefit, particularly in regards to an improvement in condition and context of the protected offset area.

Key elements of management that can deliver improvement are:

- Active weed management;
- Fire management;
- Rotation and control of grazing pressure;
- Maintenance of connectivity to other vegetation/offset/protected areas and application of consistent and complimentary management measures across a larger area focused on conservation; and
- Control of pest animals that have the potential to destroy habitat and displace or prey on native fauna.

6.0 Offset availability

An estimation of the offset availability within the immediate region of the Project Site was undertaken and is presented below.

6.1 Offset availability identification methodology

To determine the offset availability within the immediate region, a desktop study using GIS was undertaken. The desktop study reviewed current literature for habitat preferences and incorporated existing mapping undertaken by Roberts and Roberts (2001). The desktop assessment targeted areas of land which met the following criteria: Primary or secondary habitat is mapped by Roberts and Roberts (2001) and is not contained within protected estates (i.e. national park).

6.2 Limitations of the desktop assessment

The desktop assessment has a number of limitations including:

- All desktop identified areas require ground truthing of environmental values;
- Desktop limited to study area of Roberts and Roberts (2001), potential habitat may occur outside these areas;
- Potential conflicts may exist between land use areas;
- Identified areas may been modified where native grasslands are mapped;
- Further site specific assessments are required to determine the suitability of the offset and the size of the offset required; and
- Identified potential offset areas will need to be acquired from landholders.

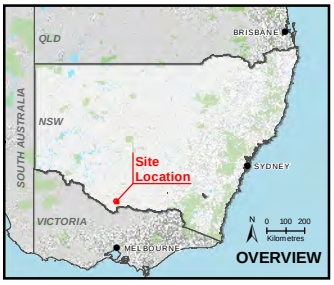
6.3 Offset availability for the plains wanderer

The results of the desktop assessment identified 179,583 ha of potential habitat across 8471 number of lots. The breakdown of potential habitat in terms of primary and secondary habitat in the Riverina region, as mapped by Roberts and Roberts (2001), is outlined in Table 1. Figure 4 depicts an indicative area of potential habitat within the Conargo and Murray LGA, and does not depict the full extent of potential habitat within the region.

Table 1 Potential primary and secondary habitat area within the Riverina region

Habitat type	Total area mapped	Number of lots
Primary Habitat	65, 335 ha	3,322
Secondary Habitat	114, 248 ha	5,149

Potential Plains Wanderer Habitat within the Project Site



LEGEND

- Potential Plains Wanderer Habitat
- Cadastral Boundaries
- Project Site
- Project Footprint

Data Sources:
1.Imagery: © 2015 DigitalGlobe © 2015 GeoEye Earthstar Geographics SIO © 2015 Microsoft Corporation
2. Roads, Railway, Drainage, Suburbs, Parks, Localities: @ Street Pro, 2011
3. Key Map Base Layer: ESRI Online
4. Site Boundary: based on CAD Drawingd prepared by DONGMUN I.R.S. Co. Ltd.
5. Environmental Data: AECOM, 2015

AECOM
www.aecom.com

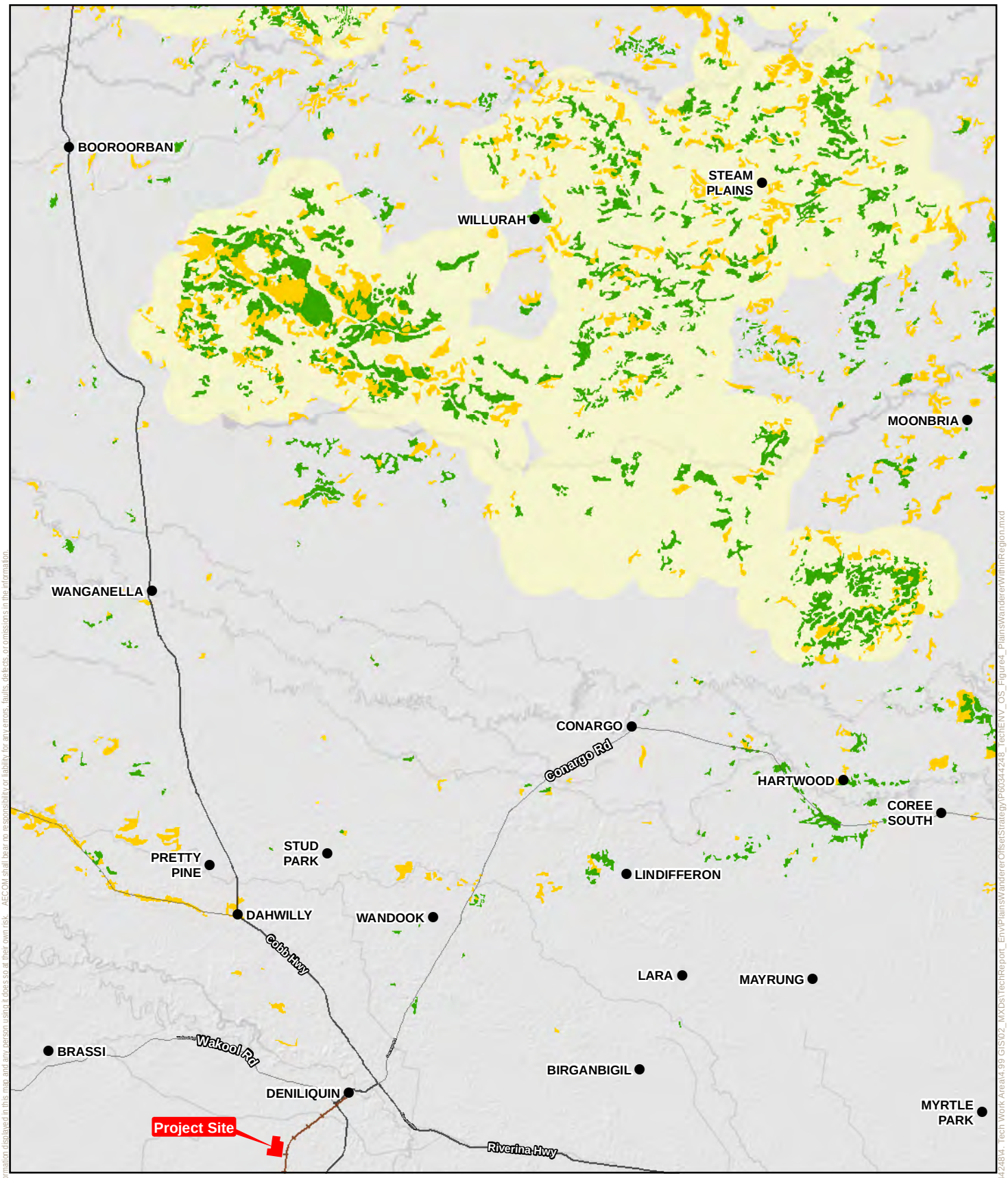
DATUM GDA 1994, PROJECTION MGA ZONE 55

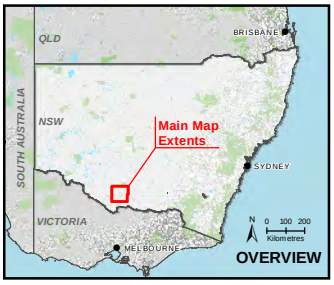
N 0 50 100 150
Metres

FIGURE 3

A4

Plains wanderer habitat within the Region





LEGEND

- Railway
- Freeway; Highway
- Main Road
- Project Site
- Plains Wanderer Primary Habitat
- Plains Wanderer Secondary Habitat
- Plains Wanderer Core Area

Data Sources:
1. Roads, Railway, Parks, Drainage, Suburbs: @ Street Pro, 2011
2. Canvas/World_Light_Gray_Base: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3. Plains Wanderer Primary Habitat, Secondary Habitat and Core Area @ Office of Environment and Heritage (OEH), 2011
Map derived from Roberts, I. & Roberts, J. (March 2001). Plains wanderer (Pedionomus torquatus) Habitat Mapping - Including Woody Vegetation and other Landscape Features. Riverina Plains - NSW NPWS.

AECOM
www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 55

N 0 2.5 5 7.5 Kilometres

FIGURE 4

A4

7.0 Compliance with offset principles

7.1 NSW offset principles for major projects (state significant development)

The NSW Biodiversity Offset Policy, 2014 requires proponent to demonstrate how the Project achieves the overarching principles of the policy. A response to each principle is detailed below.

1) Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.

Following ground-truthing of plains wanderer habitat within the Project Site, the design of the Deniliquin Ethanol Plant has been modified substantially to reduce the Project Footprint from 68 ha to 25.6 ha. The revised Project Footprint co-locates potential impacts from Project infrastructure with existing disturbances such as modified dam and adjacent agricultural practices. This modification was implemented in an effort to reduce the extent of vegetation clearing within plains wanderer habitat.

A reduction in the Project Footprint leaves a residual impact on potential plains wanderer habitat of 17.3 ha (Section 4.0). To minimise the potential impacts of this 17.3 ha, general mitigation for the Project and specific mitigation measures have been developed (Section 3.2).

2) Offset requirements should be based on a reliable and transparent assessment of losses and gains.

The FBA methodology provides a transparent and repeatable methodology for assessing impacts on biodiversity through a modified credit calculator, similar to the existing credit calculator used under BioBanking. The Project is committed to provide an offset that adequately meets the quantum of the offset requirements under the FBA and NSW Biodiversity Offset Policy, 2014.

3) Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.

Any direct offset will meet, as a minimum, the quality of the habitat at the impact site. If a proposed offset site has a lower habitat quality than that of the impact site, the offset will be managed and resourced over a defined period of time so that its habitat quality is improved to meet the quality of habitat originally impacted.

4) Offsets must be additional to other legal requirements.

This Offset Strategy is being prepared to address concerns regarding the determination of offsets for the Project. This Offset Strategy is not being used concurrently to satisfy another assessment or approval under other relevant legislation.

The proponent will not source land that is currently zoned for conservation.

5) Offsets must be enduring, enforceable and auditable.

Offsets will only be chosen if they are suitable for ongoing management for conservation through an appropriate legal instrument. Additionally, offsets will be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes. Details of monitoring and auditing will be included in the Biodiversity Offset Plan.

6) Supplementary measures can be used in lieu of offsets.

Supplementary measures, such as research and education programs may be used in lieu of offsets in situations where land based offsetting is not feasible or practical. The supplementary measure proposed must be relevant to the biodiversity value being impacted.

The proponent will, as a first priority, seek to achieve all required offsets directly, that is, the objective is for direct offsets to form 100 per cent of the offset requirement. Deviation from the 90 per cent direct offset requirement may be considered if it can be demonstrated that a greater benefit to the environment is likely to be achieved through increasing the proportion of other compensatory measures in an offsets package. This would be determined following consultation with OEH.

8.0 Conclusion

This offset strategy outlines the residual impacts of the Project following the avoidance of and mitigation of potential impacts (Section 4). It was identified that a residual impact of 17.3 ha of plains wanderer secondary habitat will result from the clearing of native grassland for Project infrastructure (Section 4). The Project is committed to achieving a positive biodiversity outcome, with the implementation of offsets identified as the appropriate management measure (Section 5).

A preliminary desktop assessment of the potential availability of suitable offset values within the region has been undertaken (Section 6). The results of this assessment have indicated that the plains wanderer secondary habitat presently found on the Project Site has analogous areas with values that could serve as offsets within the region. The suitability of identified primary and secondary habitat will require field verification to confirm their ecological condition and suitability as offsets for the specific habitat requirements of the plains wanderer.

The implementation of biodiversity offsets guided by current recovery and conservation objectives as identified in this report, will contribute to achieving a positive biodiversity outcome for the plains wanderer.

9.0 References

Roberts, I. and Roberts, J., 2001 Plains wanderer (Pedionomus torquatus) Habitat Mapping Including Woody Vegetation and Other Landscape Features, Riverina Plains, New South Wales. Unpublished report to New South Wales National Parks and Wildlife Service.

Plains Wanderer EPBC Act Significant Impact Assessment

Deniliquin Ethanol Plant EIS

Plains Wanderer EPBC Act Significant Impact Assessment

Deniliquin Ethanol Plant EIS

Client: Dongman Greentec Pty. Ltd

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Quality Information

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Date	02-Oct-2015
Prepared by	David Gatfield
Reviewed by	Dan Simmons

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	18-Aug-2015	Draft Issue	Dan Simmons Principal Ecologist	
0	28-Aug-2015	Issued for Adequacy	Dan Simmons Principal Ecologist	
1	02-Oct-2015	Final	James MacDermott Practice Leader - Approvals	

Table of Contents

1.0 Species profile

Common Name: Plains wanderer

Scientific Name: *Pedionomus torquatus*

1.1 Status

EPBC Status: Critically Endangered

TSC Act Status: Endangered

The plains wanderer is a small, quail-like bird that measures 15-19 cm in length and has a mass of 40-95 grams when fully grown (Marchant and Higgins, 1993 in TSSC, 2015). Adult birds exhibit different plumage between sexes. The females are distinguishable by their rufous breastband and white-spotted black collar, while males are plainer in plumage with light brown colouration above, covered in brown rosettes, and fawn to white colouration below, covered in blackish crescents (Pizzey and Knight, 1997 in TSSC, 2015). Both sexes have a cream-coloured iris, a cream to pale yellow bill and cream to pale yellow legs and feet, though females are again more brightly coloured (Marchant and Higgins, 1993 in TSSC, 2015).

1.2 Species distribution

The plains wanderer has been recorded across scattered sites within west-central Queensland, southern New South Wales, north-central Victoria and eastern South Australia (DoE, 2015; Garnett *et al.* 2010). Core habitat for the species is the western Riverina region of south-western New South Wales, with the majority of recent records occurring within this region (DoE, 2015).

Within the western Riverina core habitat areas, the distribution of the plains wanderer is scattered, with the findings of an aerial photo interpretation mapping project (conducted by the former NSW NPWS) identifying approximately 2.3% of the mapping area as primary habitat suitable for the plains wanderer all year round (OEH, 2015). A further 4.3% of the mapping area comprised denser, secondary habitat that may be periodically occupied, particularly during drought or extended periods of heavy grazing when primary habitat areas can become too sparse.

The primary reason cited for the decline in the numbers and distribution of plains wanderers in all eastern States has been the conversion of native grasslands to dense introduced pasture or croplands. If native grasslands are not overgrazed or cultivated then plains wanderers are largely sedentary, though there is some recent evidence to suggest that birds may not remain sedentary during prolonged drought conditions (OEH, 2015).

1.3 Abundance

Garnett *et al.* (2011) estimated the total number of mature individuals of plains wanderers to be 2000. However, since publication of this estimate, a 95% decline has been recorded in the species' Victorian stronghold of the Patho Plains (Baker-Gabb, 2014 in TSSC, 2015), and a 84% decline recorded in the NSW Riverina region (Wilson *et al.*, 2014 in TSSC, 2015). A submission by the OEH estimated the total population size of plains wanderers to be approximately 250 birds (or less) in the core part of its range, and noted that no significant populations have been identified outside of the core range of the species (OEH, 2015 in TSSC, 2015). It is estimated that the total number of mature individuals of plains wanderer may now be less than 1000 (Baker-Gabb, 2015 in TSSC, 2015).

1.4 Habitat and ecology

The plains wanderer is known to inhabit semi-arid, lowland native grasslands that typically occur on hard red-brown soils (DoE, 2015). The grassland habitat structure appears to play a more important role than plant species composition with preferred habitat typically comprising 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses (OEH, 2015). Typically grassland habitat of the plains wanderer is less than 5 cm high, but vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10-20 cm apart (OEH, 2015). During prolonged drought, the denudation of preferred habitats may force birds into marginal denser and taller grassland habitats that become temporarily suitable (OEH, 2015).

The plains wanderer is capable of breeding in their first year, breeding in solitary pairs (Baker-Gabb *et al.*, 1990 in TSSC, 2015). The nest is a hollow or 'scrape' that is scratched into the ground and lined with grass (Harrington *et al.*, 1988, in TSSC, 2015). The nests are placed amongst native grasses and herbs, or sometimes amongst crops (Harrington *et al.*, 1988, in TSSC, 2015). Clutch-size is usually four eggs, but can range from two to five (Bennett, 1983, in TSSC, 2015). The young are primarily attended by the male, and perhaps sometimes by the female, becoming independent at about two months of age.

1.4.1 Potential habitat extent within the Project Site

Within the Project Site, 101 ha of potential plains wanderer habitat (native tussock grassland on orange-brown clay loam plains) was recorded. Detailed grassland surveys within the habitat noted recent disturbances including clearing, grazing, irrigation and the cultivation of wheat. As a result, the recorded grassland diversity was low and exotic species were interspersed throughout. Preferred habitat for the plains wanderer typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Tussock grassland within the Project Site was noted to support 19% bare ground, 21 % litter and 60 % herbs, forbs and grasses. Comparison of field results with habitat criteria outlined in the plains wanderer habitat management guide (Parker and Oliver, 2006) result in the categorisation of habitat as between ‘slightly too dense’ to ‘much too dense’. It is recognised that appropriate management of this habitat could be undertaken to reduce the density of grass and litter down to ‘ideal’ levels.

Given the recorded structure of the potential habitat and habitat mapping criteria developed by Roberts and Roberts (2001), it is considered that this grassland is ‘secondary’ habitat for the species. Whilst secondary habitat is sub-optimal in comparison to primary habitat, it is known to be utilised by the plains wanderer during periods of drought or overgrazing when primary habitat is unsuitable.

1.5 Key threats

Key threatening processes to the plains wanderer identified in the recovery plan include:

- Habitat loss due to cultivation of native grassland, causing fragmentation of habitats and subsequent isolation of populations.
- Overgrazing of native grasslands by domestic livestock and rabbits (Oryctolagus cuniculus), particularly during drought conditions, can result in the temporary displacement of the species from areas of preferred habitat on a local or regional scale, and an increase in the rate of mortality (DoE, 2015).
- Predation by foxes and feral cats has been identified as a potential threat, particularly around cultivated land, where greater numbers of mice might help to sustain larger predator populations.

1.6 Recovery plans

A draft recovery plan has been prepared for the species (Baker-Gabb 2002). Furthermore, primary conservation objectives and recommended conservation and management actions have been developed within the EPBC conservation advice (2015) for the species.

The following recovery actions have been recommended in the draft national recovery plan (Baker-Gabb 2002):

- Improve knowledge on the distribution and abundance of the species by undertaking surveys, population monitoring and habitat mapping in all four states in which the plains wanderer is known to occur.
- Determine areas of critical habitat in Queensland, Victoria and South Australia (critical sites, termed 'Core Areas', have already been established in NSW) and implement actions to ensure the conservation of the species in these areas.
- Maintain and enhance the quality of habitat by providing information to land-owners, providing input on clearing applications for important sites, monitoring sites with important habitat, and identifying and managing areas of critical habitat.
- Establish new reserves and private refuge areas through the acquisition of land or properties of high conservation value and liaise with, and provide incentives to, landowners to encourage the implementation of favourable management protocols.
- Undertake surveys to establish benchmarks for population size and breeding success, and implement monitoring at selected sites to track population trends. In conjunction with monitoring, tests should be

undertaken to determine and monitor the impact of locust-spraying operations on plains wanderer populations.

- Undertake a Population Viability Analysis for the species throughout its entire range.
- Increase community awareness by engaging volunteers in the recovery effort, and by providing annual reports on the status of the recovery effort to participants, the general public and media.
- Ensure the continued operation of the recovery team and management of the recovery effort.

The primary conservation objectives listed in TSSC (2015) include:

- Reverse the long-term trend of population decline and increase numbers to a level where there is a viable, wild breeding population of plains wanderers, even in poor breeding years
- Maintain key plains wanderer habitat in a condition that maximises survival and reproductive success, and provides refugia during periods of extreme environmental fluctuation.

2.0 General potential impacts from the Project

The main construction activities involved with the development of the Project will be site clearance, earthworks and facilities construction. The construction phase is expected to take 14 to 16 months. The operation phase of the Project will involve the day to day running of the Project. The Project will need to operate 24 hours a day, seven days a week with a scheduled four week annual shutdown to allow for plant maintenance.

Potential impacts from the construction and operation of the Project on biodiversity values and thus the plains wanderer include:

- Loss of habitat
- Mortality during clearing
- Noise, light and dust.

2.1 Loss of habitat

During this phase, the predominant impacts on flora and fauna will be the direct impacts associated with site clearance and the removal of native vegetation. With regards to the plains wanderer, 17.3 ha of potential secondary habitat will be removed during the clearing process.

2.2 Mortality during clearing

Encounters between fauna and site traffic and machinery may potentially occur throughout all phases of the Project, with heightened risk of mortality occurring particularly during the clearance of vegetation. The clearing of vegetation generally has a greater impact on ground dwelling fauna and arboreal mammals. Fauna spotter personnel will be required during clearing to minimise this potential impact. Pre-clearance surveys for plains wanderer individuals or breeding places will ensure the risk of mortality to this species is mitigated.

2.3 Noise, light and dust

The potential impacts on biodiversity values during all phases include indirect disturbance from noise, light and vibration. Fauna will generally move away from noise and light sources as these may be perceived as a threat. Acclimatisation by some species is likely to occur over the medium to long term.

3.0 Mitigation measures

Mitigation measures of potential impacts have been developed as part of the EIS assessment. These measures are presented below as well as specific mitigation for the plains wanderer. Using a hierarchal mitigation process, potential impacts must be avoided in the first instance by using prevention and then reduced using mitigation measures where avoidance is not achievable. Environmental offsets are then used to address any residual impacts. The proposed measures for managing potential impacts on the Project Site are detailed below.

3.1 Avoidance

The design of the Deniliquin Ethanol Plant has been modified substantially to reduce the Project Footprint from 68 ha to 25.6 ha. This modification was implemented in an effort to reduce the extent of vegetation clearing within plains wanderer habitat. The reconfiguration of the Project Site has relocated infrastructure into a consolidated area in the north of the Project Site.

3.2 Mitigation

3.2.1 General mitigation measures

The following mitigation measures will be implemented to reduce the potential impact on biodiversity values:

- The clearing of vegetation shall be managed through a vegetation management plan.
- Weed hygiene procedures to be followed during the construction phase, with particular emphasis on limiting the spread or movement of the noxious weed species African boxthorn and Bathurst burr.
- African boxthorn and Bathurst burr will be removed from the construction footprint pre-construction.
- Continued weed hygiene and monitoring procedures will be followed throughout the life of the Project, and documented in a weed management plan.
- An ecologist will supervise felling of hollow bearing trees and translocate animals to approved sites.
- Native vegetation clearance will be staged, so as to allow animals recourse to move away.
- Trees will be felled outside the main bird-nesting season, i.e. in winter months.
- Landscaping will use endemic native species where possible.
- Implementation of appropriate speed limits and fencing to minimise fauna mortality.

3.2.2 Plains wanderer mitigation measures

The general mitigation measures outlined above will assist in reducing potential impacts on the plains wanderer habitat. The following specific mitigation measures will also be implemented to minimise the potential impacts to plains wanderer:

- A plains wanderer species management plan will be developed prior to any works being undertaken. The species management plan will identify mitigation and monitoring procedures throughout the life of the Project.
- A preclearance survey for plains wanderer and plains wanderer breeding places will be undertaken prior to any clearing activities. The species management plan will identify procedures to be followed should breeding places be identified.
- The clearing extent within plains wanderer habitat will be clearly delineated to ensure no over-clearing occurs.
- Staff training toolboxes will be delivered to all staff associated with the clearing and management of plains wanderer habitat.
- Permanent lighting will be directed away from adjacent plains wanderer habitat.
- Efforts to minimise noise will be undertaken where possible (i.e. mufflers on machinery).

3.3 Offsetting

The proponent is committed to maintaining positive biodiversity outcomes through implementing plains wandered habitat offsets for residual impacts. The proposed offset will be undertaken with consideration to, and in accordance with, the:

- Biodiversity Offsets Policy for Major Projects
- Framework for Biodiversity Assessment
- NSW Biodiversity Banking and Offsets Scheme

- EPBC Act Environment Offsets Policy, 2012.

Offsets for the plains wanderer will be guided by current recovery and conservation objectives, and expert advice. The proposed offset for the plains wanderer will target primary and secondary habitat types, with preference given to habitat within recognised core habitat areas (Roberts and Roberts, 2001).

4.0 EPBC Act significant impact assessment

The potential impact on threatened species has been assessed against the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance'. The nine significant impact criteria and response are detailed below.

1) Lead to a long-term decrease in the size of a population

A 'population of a 'critically endangered species' is defined under the EPBC Act as an occurrence of the species in:

- A geographically distinct regional population, or collection of local populations, or
- A population, or collection of local populations, that occurs within a particular bioregion.

As identified in Section 1.1.3, the total population for the plains wanderer was estimated at a total number of mature individuals to be 2000 (low). However, this estimate is now out of date as a 95% decline has been recorded in the species' Victorian stronghold of the Patho Plains (Baker-Gabb, 2014 in TSSC, 2015), and a 84% decline recorded in the NSW Riverina region (Wilson *et al.*, 2014 in TSSC, 2015), since this time.

A submission by OEH estimated the total population size of the plains wanderer to be ≤ 250 birds in the core part of its range, measured as approximately 200 birds in NSW and < 50 birds in Victoria, and noted that no significant populations have been identified outside of the core range of the species (OEH, 2012).

For the purpose of this assessment the population in question is determined to be the NSW Riverina regional population situated within the mapped core habitat area to the north of the Project Site (Roberts and Roberts, 2001).

Given the sedentary nature of the species, the removal of 17.3 ha of potential secondary habitat within the Project Site is not considered likely to significantly contribute to the long term decrease of the species population within the core extent of its range (approximately 45 km north of the Project Site.

2) Reduce the area of occupancy of the species

The potential impact on 17.3 ha of potential secondary habitat may reduce the extent of habitat available to the species in the immediate locality of the Project Site. However, the extent of habitat loss as a proportion of habitat mapped within the Riverina core habitat areas is relatively small at 0.01%.

Potential exists for a reduction in the area of occupancy for potential plains wanderer within the immediate locality of the Project Site. However given the location of the Project Site being outside core habitat zones (Roberts and Roberts, 2001) the potential impact of the Project is unlikely to significantly reduce the occupancy of the Riverina population. The implementation of environmental offsets for plains wandered habitat will also minimise the potential impact of a reduced occupancy for the species.

3) Fragment an existing population into two or more populations

The Project is unlikely to significantly increase the fragmentation of habitat for the population within the region, with the site already having been subjected to fragmented local connectivity, being surrounded by irrigation and cropping on the northern and western boundaries. Dispersal of the species is unlikely to be significantly interrupted and it is considered unlikely that the Project will fragment one population in two more populations.

4) Adversely affect habitat critical to the survival of a species

The potential habitat within the Project Site is considered secondary habitat for the species. Whilst secondary habitat is sub-optimal in comparison to primary habitat, it is known to be utilised by the plains wanderer during periods of drought or overgrazing when primary habitat is unsuitable. Given the distance from the species core habitat (Roberts and Roberts, 2001), the potential habitat within the Project area is not considered critical to the survival of the species.

5) Disrupt the breeding cycle of a population

The greatest disruption to the breeding cycle of the plains wanderer is periods of drought which can exacerbate the impacts of overgrazing (DoE, 2015). Breeding success during these periods has been recorded as low with potentially no breeding occurring (DoE, 2015).

Given the above, and that the Project is outside the known Riverina core habitat areas, the clearance of 17.3 ha of potential plains wanderer secondary habitat within the Project area is considered unlikely to disrupt the breeding cycle of the Riverina population.

6) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The potential impact to plains wanderer secondary habitat within the Project Site as a result of clearing activities for surface infrastructure is 17.3 ha. The nearest record of the plains wanderer is located 2.5 km to the east of the Project Site, suggesting the species has a presence in the adjacent environs to the Project Site, although this is not considered core habitat to the Riverina regional population. The potential impact to secondary habitat within the Project area may reduce the species resilience of the local population only, during dryer years when primary habitat is unsuitable.

Given that the Project is outside the known Riverina core habitat area for the species, the clearance of 17.3 ha of potential plains wanderer secondary habitat within the Project Site (approximately 0.01% of the extent of mapped habitat for the Regional population), is considered unlikely to disrupt the breeding cycle, modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Further to this the proponent is committed to maintaining positive biodiversity outcomes for the Project through implementing plains wanderer habitat offsets.

Proposed offsets will be in accordance with the NSW biobanking offsets and EPBC biodiversity policy methodology (if required) and will be guided by current recovery and conservation objectives.

7) Result in invasive species that are harmful to a critically Endangered or Endangered species becoming established in the Endangered or critically Endangered species' habitat

A pest and weed management plan will be prepared and implemented throughout the construction and life of the Project. Species specific management will be undertaken for identified key weed species at risk of spread through Project activities. As such it is considered unlikely that Project activities will result in the introduction of invasive species that are harmful or will become established in the Endangered or Critically Endangered species' habitat.

8) Introduce disease that may cause the species to decline

Disease has not been identified as a key threating process to the species. The environmental management plan for the Project will detail pest and weed measures to be undertaken throughout the life of the Project to prevent the introduction and spread of disease. It is considered unlikely that the Project activities will result in the introduction disease that may cause the species to decline.

9) Interfere with the recovery of the species.

A draft recovery plan has been prepared for the species (NSW NPWS, 2002). Furthermore, primary conservation objectives and recommended conservation and management actions have been developed within the EPBC conservation advice (TSSC, 2015) for the species.

Recovery objectives as per NSW NPWS (2002) include:

- Establishing an effective Recovery Team to administer and organise the recovery effort.
- Maintaining the extent and enhancing the quality of plains wanderer habitat.
- Locating and protecting plains wanderer habitat in areas not yet surveyed.
- Securing a key area(s) of native grassland biodiversity through the purchase of one or more large reserves of at least 20,000 ha, and containing not less than 5,000 ha of habitat suitable for plains wanderers.
- Halving the decline in plains wanderers in NSW due to overgrazing during droughts, and increasing numbers in 10,000 ha of habitat by enhanced management.
- Assessing the relative impact of different management regimes and controlling threatening processes.

The proponent is committed to maintaining positive biodiversity outcomes through implementing plains wanderer habitat offsets. Proposed offsets will be in accordance with the NSW biobanking offsets methodology and will be guided by current recovery and conservation objectives. The implementation of biodiversity offsets will ensure the extent of plains wanderer habitat in the Riverina region is maintained and enhanced. Given this, the Project is considered in keeping with recovery objectives and thus unlikely to interfere with the recovery of the species. Given this, it is not considered likely that the Project activities will interfere with the recovery of the species.

5.0 Conclusion

The Project has the potential to impact on 17.3 ha of secondary plains wanderer habitat through vegetation clearing activities. The EPBC Act significant impact assessment determined the following:

- The removal of secondary habitat from the Project Site is unlikely to significantly contribute to the decline of the species within its core range (45 km north of the site), or Lead to a long-term decrease in the size of the Riverina population.
- The area of occupancy is unlikely to be significantly reduced within areas of core habitat to the north. Potential exists for a reduction in the area of occupancy for plains wanderer within the immediate region of the Project Site.
- The removal of 17.3 ha of secondary habitat is unlikely to significantly increase fragmentation of habitat within the region. Furthermore, it is considered unlikely that the Project will exacerbate current threats from predation.
- Given the distance from the species core habitat, the potential secondary habitat within the Project area is not considered critical to the survival of the species. Furthermore, the clearance of 17.3 ha of potential plains wanderer secondary habitat within the Project area is considered unlikely to disrupt the breeding cycle of the Riverina population.
- The application of mitigation measures including environmental offsets guided by current recovery and conservation objectives, will contribute to achieving a positive biodiversity outcome.

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Appendix L

Surface Water and Groundwater Technical Report

Deniliquin Ethanol Plant EIS

Technical Report - Water

Deniliquin Ethanol Plant EIS

Technical Report - Water

Client: Dongmun Greentec Pty. Ltd.

ABN: 11 158 522 000

Prepared by

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Quality Information

Document Deniliquin Ethanol Plant EIS

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Date 02-Oct-2015

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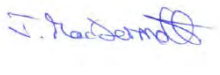
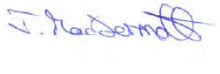
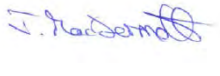
Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	28-May-2015	Draft for Internal Review	James MacDermott Practice Lead – Approvals	
B	02-Jun-2015	Final to Support EIS	James MacDermott Practice Lead – Approvals	
1	07-Aug-2015	Draft Final Report	James MacDermott Practice Lead – Approvals	
2	02-Oct-2015	Draft Final Report for Adequacy	James MacDermott Practice Lead-Approvals	

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Executive Summary

Dongmun Greentec Pty Ltd. is seeking approval for the development of an Ethanol Production Plant with the capacity to produce 115 ML of ethanol per annum at Deniliquin, New South Wales (NSW). The proposed development is deemed a 'State Significant Development' under the provision of Clause 8 of the State Environmental Planning Policy (State and Regional Development) 2011, and as such requires assessment under the provisions of Part 4 Division 4.1 of the Environmental Planning and Assessment Act 1979.

The objective of this report is to identify potential water-related issues arising from the proposed development, and where required, to outline mitigation strategies to be implemented to minimise the identified issues. The scope of the report was developed to meet the issued Director-General's Environmental Assessment Requirements (DGR's).

As demonstrated throughout this report, the proposed development is not expected to have significant impacts on the surrounding environment or communities from water resource, wastewater, surface water or groundwater perspectives, beyond those issues that can be adequately mitigated against. Where appropriate, specific mitigation strategies were identified.

1.0 Introduction

1.1 Background

Dongmun Greentec Pty Ltd. is seeking approval for the development of an Ethanol Production Plant with the capacity to produce 115 ML of ethanol per annum at Deniliquin, New South Wales (NSW) (hereafter referred to as 'the Project'). Under the provision of Clause 8 of the State Environmental Planning Policy (State and Regional Development) 2011 the proposed development, with an estimated cost of $90 million is deemed a 'State Significant Development'.

State Significant Developments require assessment under the provisions of Part 4 Division 4.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act). In accordance with Section 89D of the EP&A Act, the consent authority is the Minister for Planning.

An Environmental Impact Statement (EIS) is required in support of the development proposal. The EIS is required to consider the Project objectives and the requirements of the Director General (now Secretary) of the NSW Department of Planning and Infrastructure (DoPI) (now the Department of Planning and Environment) and other relevant agencies.

An application for Director-General's Environmental Assessment Requirements (DGRs) for the proposed development was submitted, and a decision was issued on 23-December-2013. A copy of the DGRs is attached as Appendix A.

A number of key areas were identified that need to be assessed in detail, including 'soil and water' and 'wastewater'. This report addresses potential surface water and groundwater impacts, including wastewater.

1.2 Proponent

Dongmun IRS Co. Ltd was established in 1996 in Korea. The company specialises in the construction and installation of anaerobic fermentation facilities. To obtain approval and operate the proposed ethanol plant in Deniliquin, Dongmun IRS has established Dongmun Greentec Pty. Ltd. in Australia (hereafter referred to as 'Dongmun').

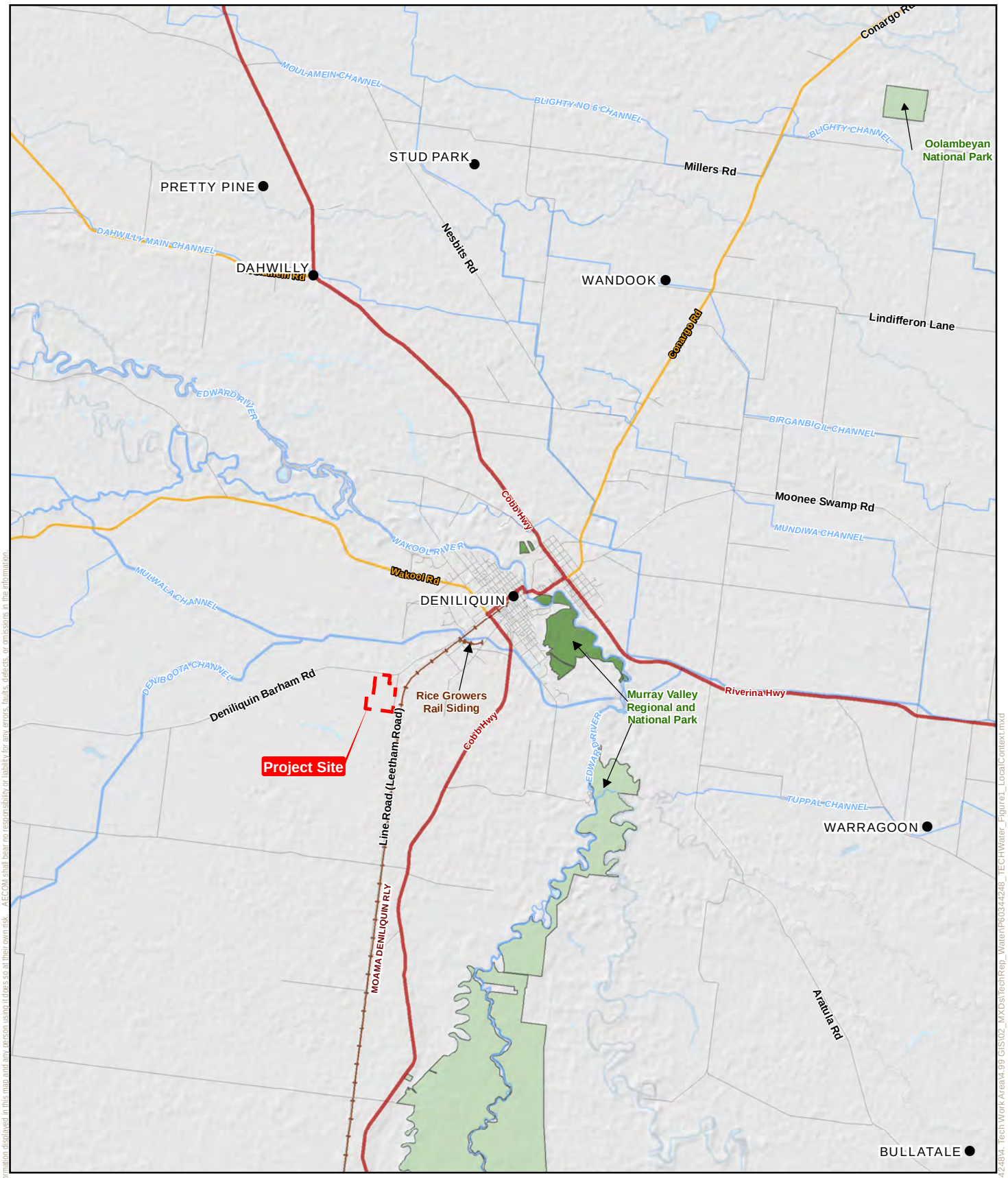
1.3 The Project Site

The Project Site is located approximately 5.5 km southwest of the town of Deniliquin. The area within the site boundary is approximately 120 ha in size; however, the Project Footprint is about 25.6 ha. Please refer to Figure 1 for a location map.

1.4 Report Objectives

The main objective of this report is to identify potential impacts of the proposed development on water resources (surface water and groundwater) in accordance with the issued DGRs. This report addresses the identified issues, their potential impacts and the mitigation measures that would be adopted to minimise these impacts. Section 2.0 provides a summary of the DGRs, and where these are addressed in this report.

Local Context



LEGEND

- Locality
- Freeway; Highway
- Main Road
- Other Roads
- Railway
- Major River / Watercourse
- Minor Watercourse
- Project Site

NSW Protected Areas

- Regional Park
- National Park
- Nature Reserve

Data Sources:
1. Roads, Railway, Parks, Drainage, Suburbs: @ Street Pro, 2011
2. Base Map Layer: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3. Parks and Reserves: An area of land, the boundaries of which have been determined by the Governor by proclamation in the Government Gazette, which has been reserved for various protection purposes defined in instruments administered by Department of Environment and Climate Change (Parks & Wildlife Division).

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FIGURE 1

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2.0 Scope of assessment

Table 1 presents the scope of this assessment in accordance with the issued DGRs.

Table 1 Scope of Assessment

DGRs Requirement	Scope Item	Chapter Reference
A detailed Water balance is required	Source of water, access and required license	7.1 & 8.1
	Construction water requirement	7.2.1
	Operational water requirements for the life of the Project including variation in water usage	7.2.2 & 7.3
	Potable water requirement	7.3
	Water management plan	7.2 & 8.1
	Minimising water usage	8.1
Clear and detailed description of the wastewater treatment system	The process	7.4
	Key pollutants and concentrations with regard to water guidelines	7.4
	Water pollution control and effluent management plan with regard to guidelines	8.1.4
	Flood assessment	7.5.1
Surface water	Stormwater assessment and management plan	7.5
	Construction erosion and sediment management control	7.5
	Potential impact of the development on surface water	7.5
	Develop a Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Model to assess the effectiveness of the proposed treatment devices in reducing pollutant loads	7.5.4.2
Groundwater	Assess the potential for groundwater impacts associated with the development and the on-site water storage compounds, including the impacts on Groundwater Dependent Ecosystems (GDEs), and potentially affected groundwater users	7.6
	Assess potential impacts on adjacent licensed groundwater users riparian ecosystems and GDEs. The requirements of relevant State policies including the Aquifer Interference Policy and objects and principles of the *Water Management Act 2000* need to be addressed in addition the provisions of the WSP covering the potentially affected water sources	7.6
	Suitability of soil for water storage	6.3.2
	Assess any potential impacts due to intercepting groundwater, including predicted dewatering volumes, zone of drawdown and associated impact, water quality and disposal methods	7.6.2, & 8.3.2
	Outline methods to prevent seepage and contamination of stockpiles and/or dumps to access groundwater	8.3.3
	Update the baseline groundwater conditions	6.5
	Undertake an impact assessment of construction and operation of the wastewater management system with specific regard to	8.3

DGRs Requirement	Scope Item	Chapter Reference
	groundwater quality, and quantity management	
	Assess the impact of groundwater extraction for the construction and ongoing water use at the ethanol plant	Not Applicable
	Outline mitigation, management or monitoring measures that are to be implemented to protect groundwater resources	Not applicable
Mitigation Measure & Management	Mitigation and monitoring for both groundwater and surface water	7.4.3 & 8.1.4

3.0 Legislation and policy

3.1 Relevant Legislation

Environmental Planning and Assessment Act 1979 (EP&A Act)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the framework for Environmental Planning in NSW. Proposals with potential environmental impacts need to provide a detailed assessment of likely impacts of the Project before an approval decision can be made.

Under the provision of Clause 8 of the *State Environmental Planning Policy (State and Regional Development) 2011*, the proposed development is declared to be a State Significant Development (see Section 3.2 below).

The proposed development therefore needs to be assessed under the provisions of Part 4 Division 4.1 of the EP&A Act. The consent authority is the Minister of Planning in accordance with Section 89D of the Act.

NSW Protection of the Environment Operations Act 1997

The objects of this Act are:

a) to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development

b) to provide increased opportunities for public involvement and participation in environment protection

c) to ensure that the community has access to relevant and meaningful information about pollution

d) to reduce risks to human health and prevent the degradation of the environment by the use of mechanisms that promote the following:

   1) pollution prevention and cleaner production

   2) the reduction to harmless levels of the discharge of substances likely to cause harm to the environment

   3) the elimination of harmful wastes

   4) the reduction in the use of materials and the re-use, recovery or recycling of materials

   5) the making of progressive environmental improvements, including the reduction of pollution at source

   6) the monitoring and reporting of environmental quality on a regular basis

e) to rationalise, simplify and strengthen the regulatory framework for environment protection

f) to improve the efficiency of administration of the environment protection legislation and

g) to assist in the achievement of the objectives of the Waste Avoidance and Resource Recovery Act 2001.

This Act regulates pollution and polluting activities. The Act does not apply at the planning and assessment stage of the Project, but will apply following the commencement of the proposed works. The proposed ethanol plant would require an Environmental Protection Licence as it would be defined as ‘agricultural processing’ under Clause 2 of Schedule 1 of the Act. Clause 120-Prohibition of Pollution of Waters and Clause 142A –Pollution of Land will apply. Additionally, the Duty to Notify under Part 5.7 will apply to pollution events which occur during construction and operation.

Water Management Act 2000

Surface water and groundwater in NSW is managed by the NSW Office of Water (NOW) under the *Water Act 1912* and the *Water Management Act 2000*. The Water Management Act is gradually replacing the planning and management frameworks in the Water Act although some provisions of the Water Act remain in operation. The Water Management Act regulates water use for rivers and aquifers where water sharing plans have commenced, while the Water Act continues to operate in the remaining areas of the State.

The objects of the Water Management Act are:

a) to apply the principles of ecologically sustainable development

b) to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality

c) to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including:

   1) benefits to the environment

   2) benefits to urban communities, agriculture, fisheries, industry and recreation

   3) benefits to culture and heritage and

   4) benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water

d) to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources

e) to provide for the orderly, efficient and equitable sharing of water from water sources

f) to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna

g) to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users

h) to encourage best practice in the management and use of water.

The Project area is located in the Murray Unregulated and Alluvial Water Sharing Plan (WSP) area that commenced on 30-January-2012.

The Project Site is not located within Environmentally Sensitive Land, and a Controlled Action Permit is therefore not required.

Local Government Act 1993 (New South Wales)

Under Section 68 of this Act approval is required to install, construct or alter an on-site sewage management system, to draw water from a Council water supply, to carry out water supply work, to carry out stormwater drainage work or to connect a private drain or sewer with a public drain or sewer under the control of a Council. This approval is required to ensure building standards are abided by and minimum health and safety standards are met.

3.2 NSW State policies and plans

State Environmental Planning Policy (State and Regional Development) 2011

The aims of this Policy are:

a) to identify development that is State significant development

b) to identify development that is State significant infrastructure and critical State significant infrastructure

c) to confer functions on joint regional planning panels to determine development applications.

The proposed development is declared to be State significant development, in accordance with Clause 8 and item 3(b) of Schedule 1 of this SEPP, given the proposed development is an ethanol plant with a capital investment of more than $30 million.

The Aquifer Interference Policy 2012

The Aquifer Interference Policy 2012 explains the process of administering water policy under the Water Management Act 2000. The Aquifer Interference Policy (2012) outlines minimal impact considerations that must be met as a result of the Project. There is no groundwater abstraction proposed as part of the proposed development and the project will not change groundwater flow or groundwater levels. Therefore this policy is not relevant to this project.

The NSW State Groundwater Policy 1997

The NSW State Groundwater Policy (Framework Document) was adopted in 1997 and aims to manage the State's groundwater resources to sustain their environmental, social and economic uses. The policy has three component parts:

- The NSW Groundwater Quality Protection Policy, adopted in December 1998.
- The NSW State Groundwater Dependent Ecosystems Policy, adopted in 2002.
- The NSW Groundwater Quantity Management Policy.

There is no groundwater interaction proposed as part of the proposed development and the project will not change groundwater quality, flow or groundwater levels. Therefore this policy is not relevant to this project.

NSW Flood Prone Land Policy

The primary objective of the NSW Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, using 'ecologically positive' methods where positive. The proposed development is not located within flood prone land.

Murray Unregulated and Alluvial Water Sharing Plan

The Project area is located in the Murray Unregulated and Alluvial Water Sharing Plan (WSP) area that commenced on 30-January-2012.

Murray-Darling Basin Plan

The Murray-Darling Basin Plan includes a Water Quality and Salinity Management Plan. The plan:

a) identifies the key causes of water quality degradation in the Murray–Darling Basin

b) includes water quality and salinity objectives and targets for the Basin's water resources.

The Water Quality and Salinity Management Plan aims to maintain appropriate water quality (including salinity levels), for environmental, social, cultural and economic activity in the Basin. Water quality objectives for the proposed development will be in line with the Murray-Darling Basin Plan requirements.

Water Sharing Plan for the Lower Murray Shallow Groundwater Source

The Project area is located in the Lower Murray Shallow Groundwater Source Water Sharing Plan area but this plan is not applicable for the proposed development as no abstraction of groundwater is proposed as part of the Project.

Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers Water Source

The Project area is located in this Water Sharing Plan area but this plan is not applicable for the proposed development.

3.3 Deniliquin Council policies and plans

Deniliquin Local Environmental Plan 2013

The Project Site is comprised of three lots (Lot 234, Lot 272 and Lot 273 on DP756325). Land use zoning for the Project Site is as follows:

- Lot 234: SP2 Infrastructure (Sewerage Systems)
- Lot 272: SP2 Infrastructure (Sewerage Systems)
- Lot 273: RU1 Primary Production.

Under the provision of Deniliquin Local Environmental Plan 2013, Lot 273 (the southern portion of the Project Site) is zoned RU1 Primary Production Land use zone. The objective of the zone is:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area

- to minimise the fragmentation and alienation of resource lands
- to minimise conflict land uses within this zone and land uses with adjoining zones
- to allow development of non-agricultural land uses which are compatible with the character of the zone
- to ensure that development in the area does not unreasonably increase the demand for public services or public facilities.

The proposed development is defined as an agricultural produce industry, which is a type of rural industry as defined in the Dictionary of the Deniliquin Local Environmental Plan 2013.

Rural industries are permitted with consent within the RU1 zone in accordance with the provisions of clause 2.3 Zone Objectives and Land Use Table. Rural industries are listed in item 3 '*permitted with consent*'.

However, it is noted that consent under the LEP is not required for State Significant Development.

Deniliquin Council Stormwater Drainage Asset Management Plan

One of the opportunities for demand management as identified in the Deniliquin Council Stormwater Drainage Asset Management Plan is to 'ensure large-scale new developments include stormwater detention in order to not increase the demand on the network'. A conceptual Stormwater Management Plan was developed as part of this study, in line with Deniliquin Council's Stormwater Drainage Asset Management Plan.

3.4 Other guidelines

Managing Urban Stormwater: Soils and Construction (Landcom 2004)

The Managing Urban Stormwater: Soils and Construction guidelines, if implemented correctly, help mitigate the impacts of land disturbance activities on soils, landforms and receiving waters by focussing on erosion and sediment control.

Managing Urban Stormwater: Treatment Techniques (DECC 1997)

The Managing Urban Stormwater: Treatment Techniques document provides guidance to stormwater planners and designers on the selection and conceptual design of a range of structural stormwater quality management practices.

Managing Urban Stormwater: Source Control (DECC 1998)

The Managing Urban Stormwater: Source Control document provides guidance to local government, State government agencies, developers as well as community and business groups on a range of source control techniques that can be adopted to minimise impacts on the stormwater environment.

Managing Urban Stormwater: Environmental Targets (consultation draft) (DECC 2007)

The Managing Urban Stormwater: Environmental Targets document outlines recommended environmental targets for stormwater management that councils and other stormwater managers can adopt.

Australian/New Zealand Standard; On-site domestic wastewater treatment units (AS/NZS 1546.1:2008)

The objective of this Standard is to specify performance requirements and performance criteria for septic tanks, to specify technical means of compliance and to provide test specifications that will enable septic tanks to be manufactured to comply with the performance requirements and performance criteria.

Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting (ANZECC)

The guidelines form the central technical reference of the National Water Quality Management Strategy, which the Federal and all State and territory governments have adopted for managing water quality with a framework for conserving ambient water quality in our rivers, lakes, estuaries and marine waters.

National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ) 2000

This document updates the Australian water quality guidelines for fresh and marine waters released in 1992 (ANZECC 1992).

Specifically, this document:

- outlines the important principles, objectives and philosophical basis underpinning the development and application of the guidelines
- outlines the management framework recommended for applying the water quality guidelines to the natural and semi-natural marine and fresh water resources in Australia and New Zealand
- provides a summary of the water quality guidelines proposed to protect and manage the environmental values supported by the water resources
- provides advice on designing and implementing water quality monitoring and assessment programs
- was revised using data, relevant literature, and other information available to at least 1996.

Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC) 2006

The aim of this booklet is to explain the principles behind the ANZECC guidelines. It is designed for technical practitioners applying the ANZECC guidelines in New South Wales.

4.0 Methodology

The assessment was based on a desktop assessment of the existing environment and proposed development. Referenced information includes:

- information provided by Dongmun
- DGRs dated 23-December-2013
- publicly available information from relevant agencies
- requests for information lodged with Deniliquin Council
- outcomes from a meeting with the Department of Planning and Environment (DP&E) on 1-May-2015
- outcomes from an AECOM workshop with Dongmun on 7-May-2015
- feedback on a draft water technical report (2 June 2015) in correspondence from the DP&E (30 June 2015), including comments from the Environment Protection Authority and the Department of Primary Industries Office of Water
- outcomes of a meeting with the DP&E on 8 July.

No fieldwork, surveying or consultation with stakeholders was undertaken to prepare this technical report.

Alternative water supply options were considered including:

Barham ERS Pond, owned by Deniliquin Council with capacity of 175 ML (Figure 4). It is adjacent to the Project Site along Braham Road. The main ERS storage pond is located at Warbreccan Farm to the north of the Project Site. Overflow from this main pond is pumped to the Barham ERS Pond. Rights to the treated water in these two storage ponds are owned by Warbreccan Farm.

Water could be purchased from Murray Irrigation Supply through an existing irrigation channel within 600 m of the Project Site, at a cost of approximately $900/ML. However, water would not be available during the period May to July each year due to channel maintenance.

The feasibility of using these sources was discounted following careful consideration of potential environmental and operational impacts.

4.1 Water balance model

The following methodology was used to develop the water balance model:

- Review of available information provided by Dongmun including water usage, water storage, production and operation schedule, water sources and required licenses.
- Assessment of adequacy and security of water source to provide the required water during construction and operation.
- Development of a detailed water balance model including water requirements for construction, ethanol plant operation and general usage considering variation for the life cycle of the Project.
- Review of on-site wastewater treatment system including the process, capacity and input/output water quality.
- Review of water management plan including water sources and contingency plan, potential impact on water resources, recycling on-site, water usage efficiency and minimising water requirements.
- Review of wastewater disposal strategy.
- Development of mitigation and management measures to address potential surface water impacts during the construction and operation phases.

4.2 Surface water

The following methodology was followed to complete the surface water assessment:

- Review of details on the construction of the proposed ethanol plant, particularly in relation to flood risk and stormwater management.
- Review of information from Deniliquin Council regarding historic flood risk and drainage, topographical data, Deniliquin Effluent Reuse Scheme, existing services, etc.
- Review of relevant water policy and legislation.
- Review of publicly available relevant and applicable information.
- Description of the local hydrology.
- Prepare a stormwater assessment and develop a conceptual Stormwater Management Plan, based on the Project layout and local hydrology.
- Prepare an Erosion and Sediment Control Plan for the proposed development.
- Review and assess the potential impacts to surface water during the construction and operation phases.
- Develop mitigation and management measures to address potential surface water impacts during construction and operation phases.
- Develop a MUSIC model to assess the effectiveness of the proposed treatment devices to meet pollutant reduction targets

4.3 Groundwater

The following methodology was followed to complete the groundwater assessment:

- Review of details on the construction of the proposed ethanol plant, in particular areas to be excavated/ developed beneath the ground surface.
- Review of data from the Bureau of Meteorology (BoM) groundwater database to identify registered groundwater users.
- Identification of any high priority GDEs listed within the Schedule based on the Water Sharing Plans of NSW Office of Water.
- Identification of any high priority wetlands through a search of the Commonwealth Department of Environment protected matters database.
- Review of relevant water policy and legislation.
- Review of the local geology and hydrogeology.
- Review and assessment of potential impacts to groundwater during the construction and operational phases.
- Development of mitigation and management measures to address potential groundwater impacts during the construction and operational phases.

5.0 Description of project

5.1 Proposed development and project overview

5.1.1 Introduction

The objective of the proposed development is to construct an ethanol plant with the capacity to produce 115 ML of fuel-grade ethanol per annum. Figure 1 shows the location of the proposed development.

The Project involves the following general works before operation:

- Construction of workshops.
- Construction of the ethanol plant infrastructure including required infrastructure for the process and utility areas.
- Construction of a wastewater treatment plant including anaerobic and aerobic treatment processes and a 2ML on-site aerated water treatment basin (concrete lined).
- Construction of associated office, control rooms and maintenance room.
- Construction of storage area and silos for input grain.
- Construction of on-site ethanol storage.
- Construction of staff car parking area.
- Construction of stormwater bioretention and flood detention basin.
- Internal road network.

5.1.2 Design and footprint

The proposed Project Site layout of the development is provided in Appendix B. The Project footprint is about 25.6 ha. Reference to the site plan indicates a proposed impermeable surface of approximately 20.22 ha, consisting of roof, pavement and hardstand areas. The ratio of paved area and dams to unpaved area is therefore approximated at 20.22 ha to 120 ha (about seventeen percent (17 %)).

Runoff from roof and some hardstand areas would be collected into rainwater tanks and a shallow concrete-lined underground holding facility for reuse. Runoff from remaining hardstand areas is proposed to drain into an on-site bioretention and flood detention basin through vegetated swales.

It should be noted though that this report is presented for the approval process in the knowledge that some future modifications to the Project, such as hardstand coverage, may be required in the subsequent detailed design and construction phases and before the Project is commissioned.

5.1.3 Operation and staff

The plant would operate 24 hours per day, seven days a week. It would be shut down for one month each year in December for general maintenance.

The plant workforce would have up to approximately 50 full-time staff. There would be eight administration staff work during standard working hours. The plant would operate three shifts per day and the shifts would be 7 am to 3 pm, 3 pm to 11 pm and 11 pm to 7 am. Each shift would employ eight technical staff.

Existing electricity and telecommunication networks are available for the Project Site. Potable water supply is discussed as part of the water balance model in Section 7.3.

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5.1.4 Ethanol production process

Ethanol manufacturing involves the conversion of wheat to ethanol by a cooking, fermentation and distillation process. Throughout this process, storage of ethanol and various wastewater by-products would be required. Wastewater from the process would contain elevated concentrations of Biological Oxygen Demand (BOD) and suspended solids. Further details on the wastewater quality and the treated effluent are provided in Section 7.1.5.

5.2 Water

Water is required for construction and operation of the proposed development. Ethanol plants require a significant volume of water for operation. The proposed development with a production capacity of 115 ML of ethanol per year would require 34 ML/y water during construction and 871.2 ML/y water during operation for ethanol production. About 52% of the required water during operation would be recycled through an on-site wastewater treatment system and reused in the ethanol production process. Therefore, 3.65 ML of water is required to produce 1 ML of ethanol.

In addition to operation requirements, water is also needed for workplace requirements and landscape management. The Project would operate all year with the exception of December when it would be shut down for general maintenance. This is the only measurable variation in water requirements in a year. The plant operates in a relatively closed system and changes to water requirements across seasons and years is relatively small.

A water balance model including water sources, requirements and variation was developed, as presented in Section 7.2 .

6.0 Existing environment

6.1 Land use

The Project Site is located approximately 5.5 km southwest of Deniliquin.

The current dominant land use in the Study locality is agriculture, including cropping and grazing. Most remnant vegetation within the area has previously been cleared for agricultural development. Significant irrigation channels have also been developed in the area to support agricultural development.

The land uses surrounding the Project Site include:

- Deniliquin aerodrome, approximately 2.7 km east of the Project Site
- the Deniliquin railway line, approximately 300 m east of the Project Site
- Cobb Highway, approximately 3.5 km east of the Project Site
- an industrial precinct including rice mill, approximately 2 km northeast of the Project Site.

6.2 Climate

The Project Site is located within the Riverina Bioregion. The dominant climate of this region is dry, semi-arid, characterised by hot summers and cool winters. The mean annual temperature is between 15 and 18°C.

There are two meteorological stations close to the Project Site. The one with the longest record (1858 to 2014) was selected and long term rainfall data was extracted from the BoM Climate Database. The mean annual rainfall for this station over a 156 year record is ~404 mm. Table 2 and Figure 2 show the long term average monthly rainfall for this station.

Table 2 Long Term Mean Monthly Rainfall (mm) at Rainfall Gauge Deniliquin (Wilkinson St)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean rainfall (mm)	28	28.2	32.1	30.3	38	39.9	34.8	36.4	37.7	39.1	30	29.6

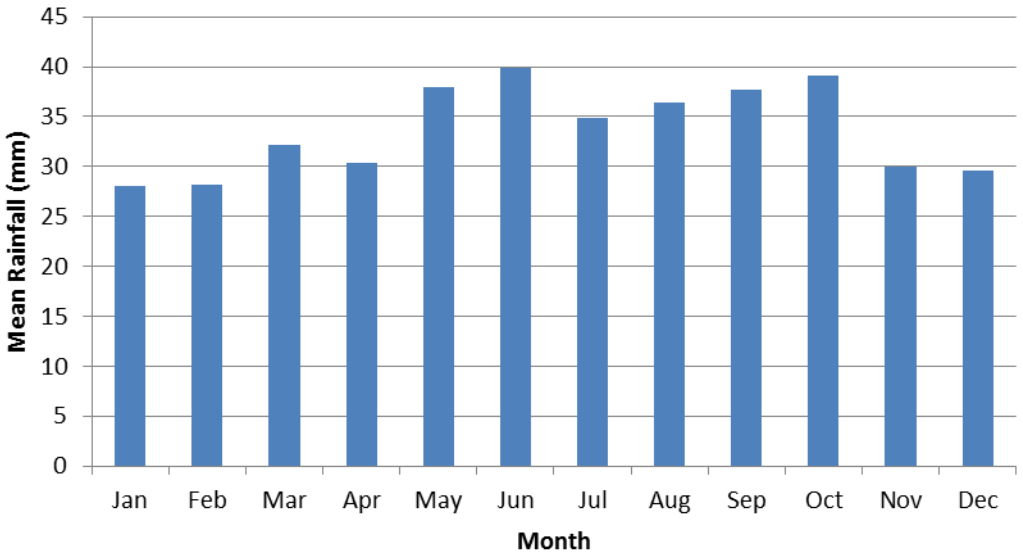


Figure 2 Long Term Mean Monthly Rainfall (mm) at Deniliquin (Wilkinson St)

6.3 Topography and soil

6.3.1 Topography

LiDAR (Light Detection and Ranging) data for the Project Site and surrounding area was obtained from Deniliquin Council, and presented in Figure 3. The Project Site is relatively flat and falls generally from south to north, from a high of ~96.5 m AHD in the south-western corner to a low of ~94.0 m AHD in the north-eastern corner.

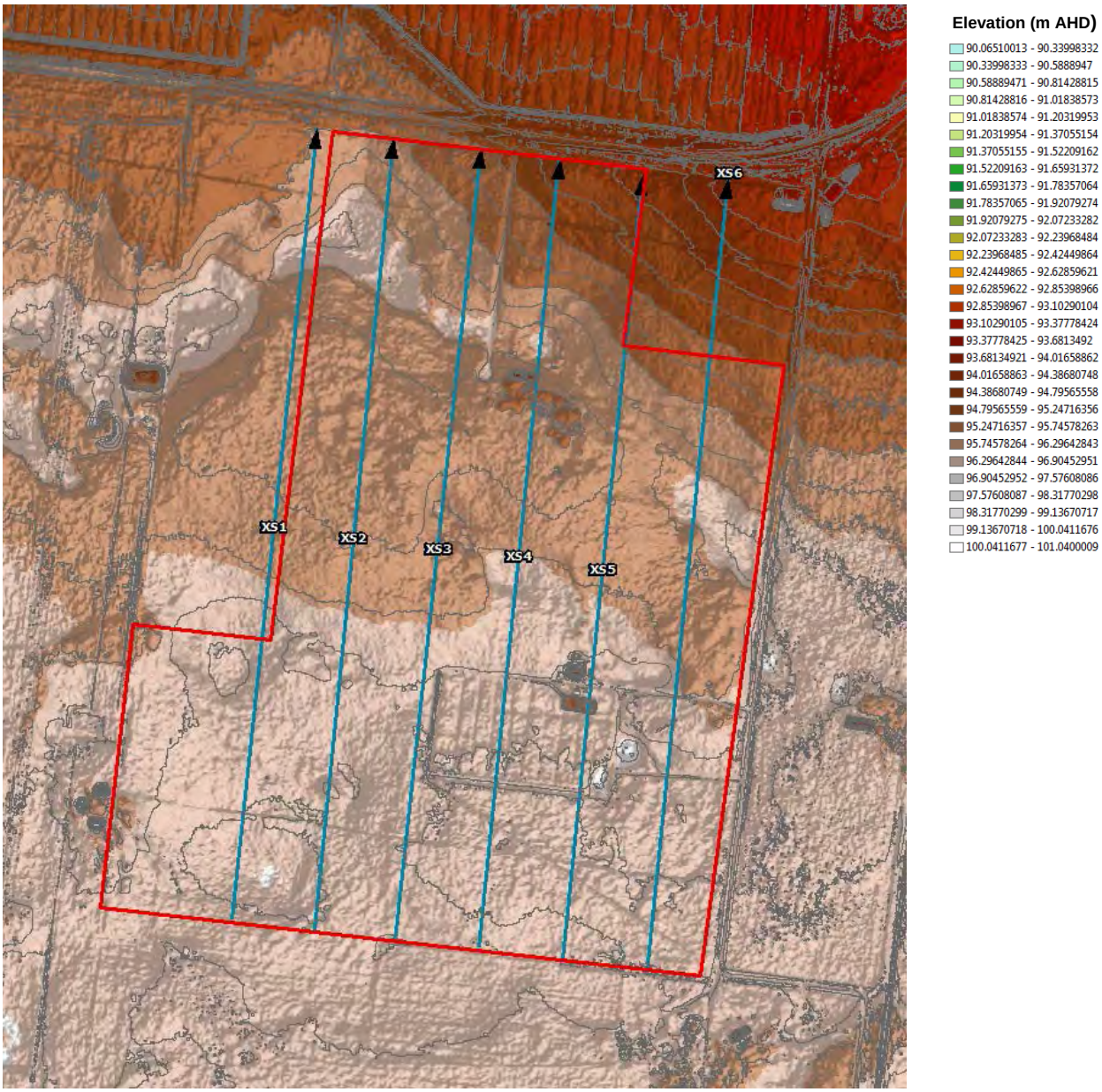


Figure 3 Local Topography Based on LiDAR Data

Cross sections were developed to illustrate the Project Site topography, and are provided in Plate 1 to Plate 6. These cross sections demonstrate the following:

- A low ridge (approximately 0.3 - 0.5 m high), runs in a south-east north-west direction in the northern half of the Project Site, creating a localised watershed. Most of the Project Footprint area is located on the northern side of this ridgeline.
- The ridgeline creates a local depression to the south, which will capture and hold surface water runoff.

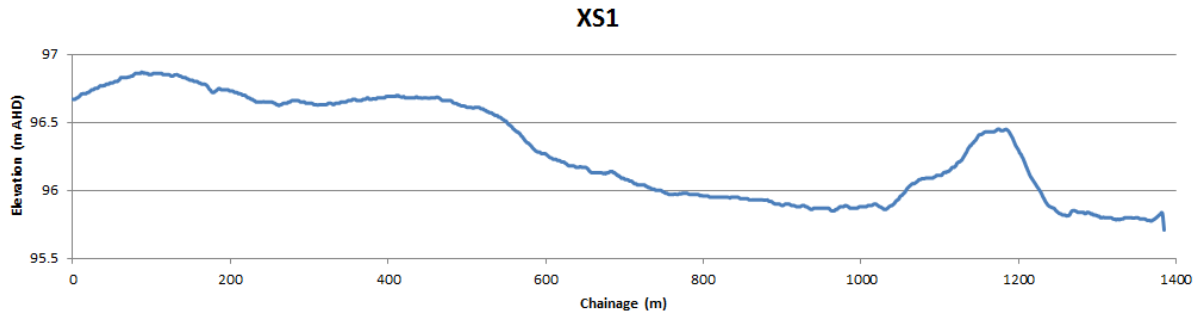


Plate 1 Cross Section 1

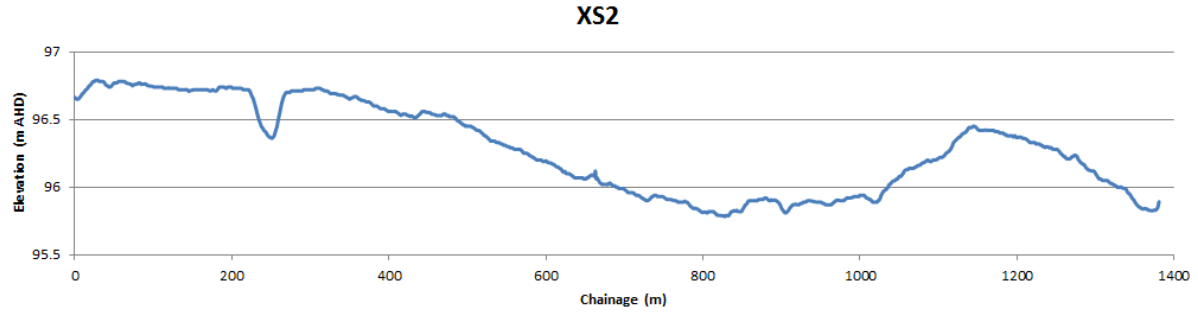


Plate 2 Cross Section 2

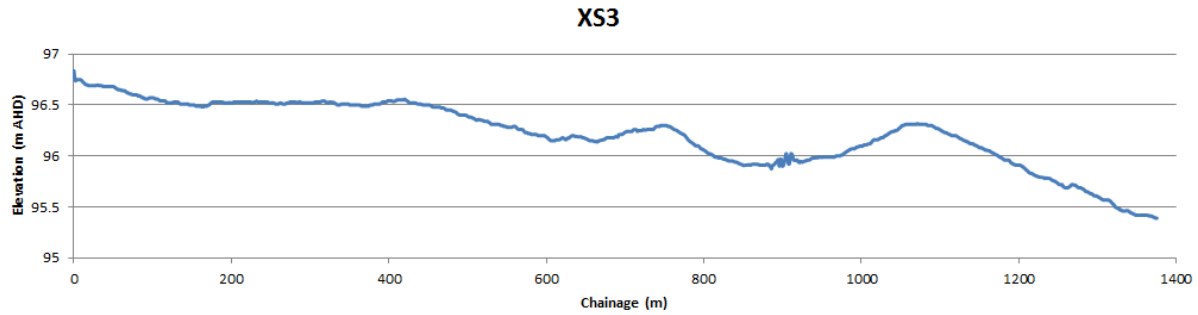


Plate 3 Cross Section 3

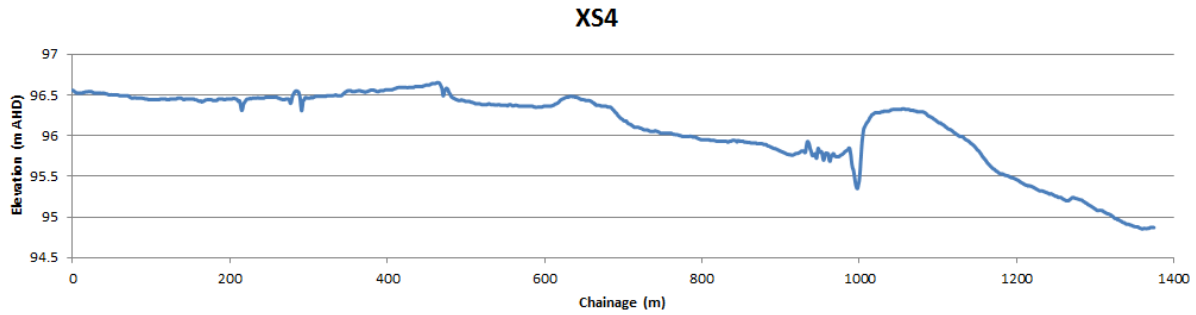


Plate 4 Cross Section 4

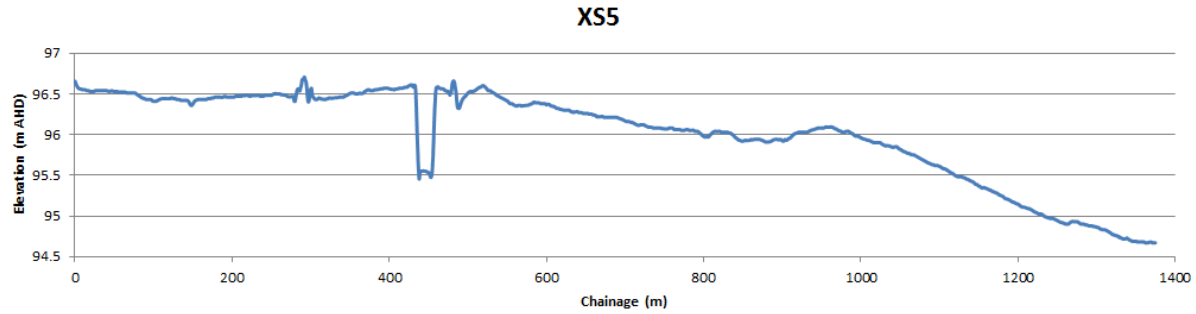


Plate 5 Cross Section 5

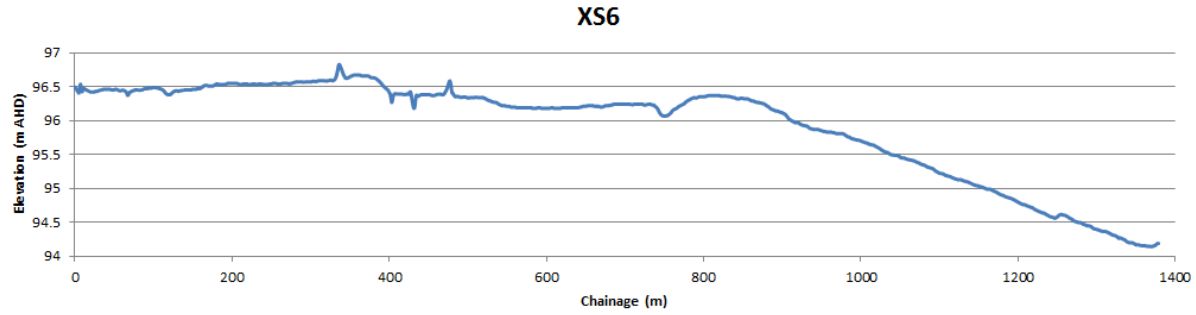


Plate 6 Cross Section 6

6.3.2 Soil

Saline heavy grey and brown clays form the main soil types of the Study area. Other soil types in the area are red-brown and grey clays and calcareous sand (Ken & Jenni Bates Pty Ltd, 2009). The native soils of the Shepparton Formation are silty and sandy and unsuitable for water storage. As such all water storages on site will be concrete-lined.

6.4 Surface water

6.4.1 The Murray-Darling Basin

The Project is located in the Murray Darling basin, one of the largest and most important catchments in Australia. The River Murray rises near Mount Kosciuszko and flows 2,530 km to the Southern Ocean; its mouth is near Goolwa in South Australia. The central section of the River Murray (between Yarrawonga in the east to the confluence of the Darling River and the River Murray at Wentworth), includes the Edward River as one of its tributaries. The Edward River flows through Deniliquin, and is located approximately 6 km north of the Project Site.

The central River Murray supports a diverse range of natural environments (wetlands, rivers, floodplains, river red gum forests, black box and grey box woodlands) that are refuges and breeding sites for many endangered species. Ramsar-listed sites along this section of the River Murray include Kerang Wetlands and Gunbower Forest in Victoria, and the New South Wales Central Murray state forests: Millewa, Werai and Koondrook (Murray-Darling Basin Authority Website, accessed 26-May-2015).

6.4.2 Regional flood risk

No significant waterways or waterbodies are located within the Study area. The nearest major waterway, the Edward River, lies approximately 6 km north of the Project Site. There is no historic or anecdotal evidence suggesting that the Project Site is at flood risk, as confirmed with Deniliquin Council (Julie Rogers, Deniliquin Council, pers. comm.). A detailed flood study of the Edward River was carried out for Deniliquin Council during 2014 (WMA Water, 2014), which concluded that the Project Site is located outside the 0.5% AEP (or 1 in 500 year ARI) Edward River flood line.

6.4.3 Local hydrology

As demonstrated in Figure 3 any surface runoff north of the low ridge on the Project footprint currently drains to the north-eastern corner of the Project Site, and into the shared table drain located within the road reserve on Barham Road. A small percentage of runoff from less than five percent (5%) of the Project footprint area currently drains towards the north-western corner of the Project Site, and into the same Barham Road table drain.

Runoff generated from the catchment area south of the low ridge will accumulate and pond within the existing localised depression storage. In extreme rainfall events, the depression storage might overtop the low ridge and continue as overland flow in a northerly direction, towards the Barham Road table drain.

There are no major springs, wetlands or swamps within the Project Site. Wetlands within a 10 km radius of the Project Site are described in Section 6.5.5.

According to Deniliquin Council there are no existing drainage issues on the Project Site; however, '*a significant rain event can result in localised flooding at the intersection of Barham Road and Leetham Road*' (Julie Rogers, Deniliquin Council, pers. comm.). It is also understood that there is an existing 450 mm culvert across Barham Road, located on the Deniliquin side of the intersection of Barham Road and Leetham Road (Mark Dalzell, Deniliquin Council, pers. comm.).

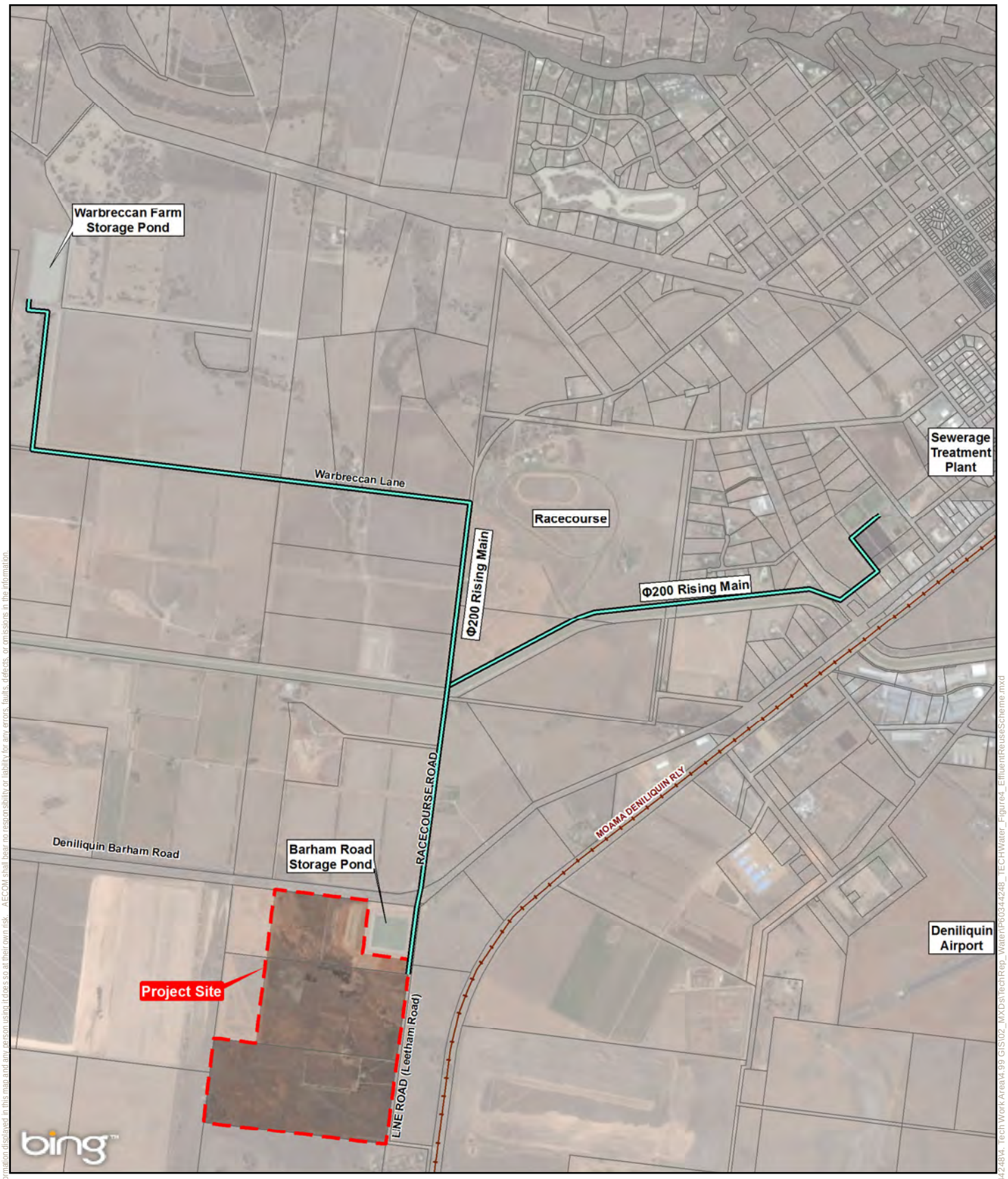
6.4.4 Existing water bodies

An Effluent Reuse Storage (ERS) Pond, approximately 175 ML in size, is located adjacent to the Project Site, to the north-east, which is maintained by Deniliquin Council. This pond, locally known as 'Barham ERS Pond' is part of Deniliquin Council's Effluent Reuse Scheme, which in turn is a part of Council's Sewage Treatment Plant.

Barham ERS Pond acts as overflow storage during times of wet weather with the main storage being located on Warbreccan Farm. Figure 4 shows the extent of the Effluent Reuse Scheme. Deniliquin Council has a contractual agreement with the owners of Warbreccan Farm regarding the ownership and use of the effluent. Under this agreement, Deniliquin Council is obliged to sell all the effluent produced by the STP to the owners for the next 30 years.

A small stormwater detention basin is located between Barham ERS Pond and Barham Road, which currently collects runoff from the western area of the Project Site (Mark Dalzell, Deniliquin Council, pers. comm.). This basin is a Deniliquin Council asset.

Deniliquin Council Effluent Reuse Scheme Extent



LEGEND

- Railway
- Pipeline
- Cadastral Boundaries
- Project Site

Data Sources:
1.Imagery: © 2015 DigitalGlobe © 2015 GeoEye Earthstar Geographics SIO © 2015 Microsoft Corporation
2. Roads, Railway, Drainage, Suburbs, Parks, Localities: @ Street Pro, 2011
3. Key Map Base Layer: ESRI Online
4. Site Layout: based on CAD Drawingd prepared by DONGMUN I.R.S. Co. Ltd.
5. Utilities @ Deniliquin Council, pers. comm., 13-May-2015

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N 0 150 300 450
Metres

FIGURE 4

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6.5 Groundwater

6.5.1 Geology

Reference to the geology of the Murray Basin (Brown and Stephenson, 1991) indicated the Project Site is located on the Riverine Plain within the Murray Basin. The Project Site is underlain by Quaternary-aged unconsolidated to poorly consolidated clay, silt and silty clay with intercalated lenses of fine to coarse grained sand and gravel of the Shepparton Formation. The thickness of the Shepparton Formation is variable but in some parts of Deniliquin bores have reached depths in excess of 100 m.

West of the Project Site alluvial sediments associated with the Edward River form a thin veneer over the Shepparton Formation. These unconsolidated silts, sand silty clays and gravel of the Coonambidgal Formation are poorly sorted and are found within the confines of local floodplains associated with the Edward River.

The Shepparton Formation is underlain by the Calivil Formation. The Calivil Formation underlies most of the Riverine Plain and consists of coarse to granular quartz and conglomerate within a white sandy and silty clay matrix. Across parts of the Riverine Plain, the Calivil Formation forms deep leads or palaeo-channels that are concealed by the Shepparton Formation. These buried palaeo-channels are incised 30 to 60 m into the underlying Renmark Formation and tend to follow similar alignments to the modern drainage systems. The Renmark Group is an extensive blanket of sediments that is the basal unit of the Murray Basin. It consists of sand and gravel layers up to 40m thick inter-bedded with clay layers and lignite. Most clay and silt beds are carbonaceous, with abundant plant remnants, and appear peaty brown in colour.

6.5.2 Hydrogeology

Groundwater is present within the alluvial sediments, Shepparton, Calivil and Renmark Formations and form aquifers. Groundwater within the Shepparton aquifer is typically contained within an upper and lower zone that is separated by discontinuous clay layers that are partially confined. Groundwater flow within the Shepparton Formation aquifer is in a westerly/south-westerly direction, however, variations in the thickness of the Shepparton Formation, and the absence of the aquifer over bedrock ridges result in local-scale variability to the overall direction of groundwater flow. Groundwater quality is variable and tends to increase in salinity with depth ranging from 900 to 4,000 mg/L Total Dissolved Solids (TDS). Where extensive irrigation occurs, groundwater mounds can form resulting in water logging and land salinization. The Shepparton aquifer is recharged locally by rainfall and runoff.

The Calivil is separated from the Shepparton Formation by a basal clay that is not always present. Groundwater within the Calivil aquifer can form a valuable groundwater supply if palaeo-channels are intersected. Historically, groundwater flow within the Calivil aquifer has been interpreted to be in a general south westerly/westerly direction. Variations in the thickness of the Calivil Formation and the absence of Calivil Formation deposits (due to bedrock highs) have localised effects on groundwater flow.

Sand layers in the Renmark Group formation generally constitute important aquifers where low salinity groundwater is available. Some sand layers in this formation show favourable aquifer properties and provide high yields. However, in some areas the poorly sorted nature of sands and gravel reduces the transmissivity of these aquifers (NSW Office of Water, 2011a).

6.5.3 Groundwater flow

The Project Site is located topographically within a relatively flat riverine landscape. Consequently groundwater flow within the Shepparton aquifer is expected to be westward towards the Edward River under low hydraulic gradients.

Groundwater is expected to discharge into the alluvial sediments of the Coonambidgal Formation and ultimately into Edward River. Due to the flat hydraulic gradients base flow may emerge as springs or waterlogged areas as the local water table meets the ground surface.

Irrigation wells intersecting the Renmark Group in the Deniliquin area typically provide bore yields between 1 to 15 ML/day (Jeff Shand, pers. comm.) depending on aquifer properties, borehole diameter and pump selection.

6.5.4 Groundwater quality

The Renmark Group aquifer forms a valuable groundwater resource and the majority of irrigation water in the area is pumped from this aquifer sometimes from depths in excess of 100 m. Groundwater quality is variable in the Deniliquin area but is generally suitable for stock and industrial purposes with salinity concentrations in the order of 1,000 mg/L TDS.

Principle 1 of the NSW State Groundwater Protection Policy states that the most sensitive identified beneficial use (or environmental value) is to be maintained. NSW Office of Water characterises the beneficial use of groundwater in the Water Sharing Plan for the Murray Unregulated and Alluvial Water Sources (2012) based on salinity as agricultural. This includes beneficial use for livestock and irrigation but not drinking water due to high salinity.

6.5.5 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are flora and fauna communities that depend on groundwater for survival. A GDE may either be entirely dependent on groundwater for survival or it may use groundwater opportunistically or for a supplementary source of water (Hatton and Evans, 1998). GDEs are most likely to occur in low lying areas with shallow groundwater close to the surface. The NSW State Groundwater Dependent Ecosystems Policy (DLWC, 2002) outlines four GDE types in NSW including:

- terrestrial vegetation
- base flows in streams
- aquifer and cave ecosystems
- wetlands.

Reference to Schedule 4 of the Water Sharing Plan for the Murray Unregulated and Alluvial Water Sources (accessed 12-May-2015) indicates there are no high priority GDEs within the Schedule.

A review of the Commonwealth Department of Environment protected matters search tool indicates the nearest wetlands are about 6.5 km to the north-east within the Deniliquin State Forest associated with the Edward River and Tarangle Creek located at the edge of Deniliquin (extracted 13-May-2015). There are also wetlands to the south east approximately 7.7 km from the Project Site within the Tuppal National Park associated with the Edward River and Bullatale Creek. These wetlands are classified as nationally important. There are no Ramsar wetlands within a 10 km radius of the Project Site.

There are no major springs, wetlands or swamps within the Project Site and there is no extensive alluvium deposits mapped on the Project Site that could support GDEs. The nearest wetlands and groundwater dependent ecosystems at Edwards River are more than 6 km to the east and are considered to be at a sufficient distance to not be impacted by the Project.

6.5.6 Regional groundwater use

The Project Site is located in Groundwater Management Area 016, the Lower Murray Alluvium (GWMA 016) which is administered by the NSW Office of Water. GWMA 016 is highly utilised for irrigation, industrial, farming, domestic and recreational supply as well as town water. At the time of the 2010 GWMA 016 Groundwater Status Report, there were 378 production or ‘high yield’ licensed groundwater wells in GWMA016, all of which are fitted with usage meters. Of licensed groundwater wells in the region, irrigation in GWMA 016 accounts for over ninety five percent (95%) of all groundwater use (NOW 2011a).

A search of registered groundwater wells within a 1km radius of the Project Site boundary was undertaken and the results are presented in Appendix C. The aquifer intersected was interpreted based on the depth of the bore and limited lithological data. It is noted that the potential exists for unregistered groundwater wells to be present in the local area that have not been identified by the search. The search identified five registered groundwater bores and their details are summarised in Table 3.

Table 3 Off-Site Registered Groundwater Use

Registered Bore	Depth (m)	Purpose	Standing water level*	Interpreted aquifer
GW500926	114	Domestic stock	23.2	Renmark
GW501494	21	Monitoring^	12.41	Shepparton
GW501661	21	Monitoring^	11.23	Shepparton
GW501662	17	Monitoring^	15.26	Shepparton
GW504037	39	Domestic stock	16.0	Shepparton

*Note: *metres below ground level ^purpose in database is not provided*

Review of the bore data indicates that groundwater is poorly utilised in the vicinity of the Project Site. Only two bores are registered for the purpose of water supply intersecting the Shepparton aquifer (GW504037) and Renmark Group aquifer (GW500926). The purpose of the three remaining wells is unknown, however there is continual groundwater level monitoring data for these wells since the 1970's (GW501494 and GW501662) and 1990's (GW501661) suggesting these are monitoring wells. The water table within the Shepparton Formation is relatively deep ranging from 10 to 14 metres below the ground surface, fluctuating in response to seasonal and climatic changes.

7.0 Water requirements, water resources and wastewater

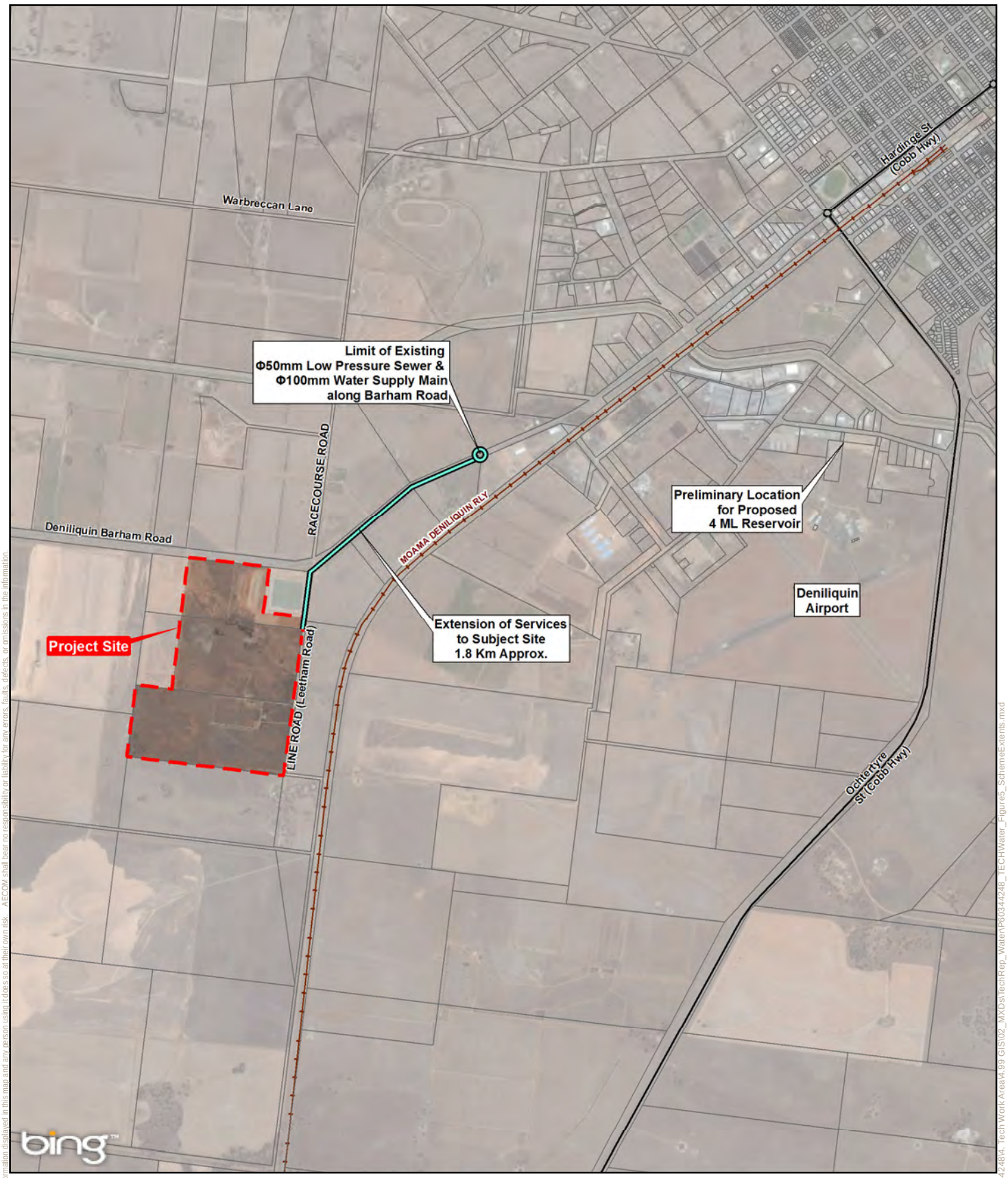
Water is required for construction and operation of the proposed development. Ethanol plants need a significant volume of good quality water for operation. The following sections provide a review of available water sources and water requirements for the Project.

7.1 Available water resources

A number of potentially available water sources for the Project were considered as discussed earlier in Section 4.0. Recycled process water and town water (i.e. potable water) were selected as the Project water sources, in consultation with Deniliquin Council.

Dongmun has agreed with Deniliquin Council that up to 1.3 ML/day of town water could be provided for the proposed development via an extension of the main trunk along Barham Road as part of the industrial development scheme for the area. Currently there is no capacity in the reticulation system to provide this demand to the Project Site. Deniliquin Council is planning to construct a 4 ML reservoir in an industrial area in 2016. On completion, the reservoir could be used to transfer water to the proposed ethanol plant via a pump station and trunk main. Figure 5 shows Deniliquin Council's plan for developing this area, including the construction of the 4 ML reservoir.

Deniliquin Council Development of Lots 234, 272 DP756325 Scheme Extents



LEGEND

- Railway
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- Cadastral Boundaries
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FIGURE 5

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Deniliquin Council allocates approximately 5,500 ML/y of its own water for use by the town. However, current usage is around the 3,000 ML/y. The peak day use in summer has been up to 17 ML/day while Council has the capacity to provide 25 ML/day (Mark Dalzell, Deniliquin Council, pers. Comm). Deniliquin Council therefore has sufficient capacity for future growth in town, as well as growth in industrial usage. Council's ability to provide water to service abattoirs, when operating at full capacity, had been discussed as part of Deniliquin Council's Integrated Water Catchment Management Plan (IWCM), which considered a range of climate conditions and growth strategies.

This plan doesn't include the proposed Ethanol Plant, and a review of the IWCM and Drought Management Plan (DMP) is therefore required to incorporate the Project's water demand (Mark Dalzell, Deniliquin Council, pers. Comm).

Potable water, supplied by Deniliquin Council, along with the on-site recycled water from the wastewater treatment system would supply water to the proposed ethanol plant. These water sources would be highly reliable and adequate for project water requirements. The water quality of these sources is acceptable for ethanol production. Further details are presented in Section 7.2.1 and 7.4.

There is a very small likelihood for the on-site wastewater treatment system to fail. This would cause a water deficit for ethanol production, and in such an unlikely event, the ethanol plant would be shut down.

7.2 Water requirements

7.2.1 Construction water requirements

Water requirements during construction, including potable drinking water for the predicted workforce, are estimated at approximately 34 ML/y. This will be supplied by Deniliquin Council via an extension of the main trunk along Barham Road.

7.2.2 Operational water requirements

Water is a primary input to the ethanol production process, and is therefore crucial for operation of the proposed development. The dominant use of water is in the ethanol production process, which requires approximately 2,640 kL/day. A small supply of water would also be used for landscaping and workplace supply (toilets, drinking water, etc.). This water would be supplied from rainwater (refer to Section 7.5).

Potential impacts of the operational water requirements and supply are as follows:

- Subject to obtaining formal approval, Deniliquin Council potable water would be a reliable water supply. By using a Council water supply, there is no potential impact on surface water and groundwater quality.
- There is a low probability that Deniliquin Council might be unable to meet the required potable water demand during significant dry periods. Based on information provided by Deniliquin Council, the Project would become part of the overall Council water supply network, to be managed in line with Deniliquin Council's existing Drought Management Strategy.

7.3 Water balance model

Identified water sources for the proposed development are:

- Council potable water supply with the capacity to provide up to 1,272 kL/day.
- On-site wastewater treatment system with the capacity to provide 1,368 kL/day of treated water (discussed further in Section 7.4).

A consolidated water balance model bringing together all sources was developed for this assessment. To develop an integrated water budget plan for the proposed ethanol plant, the following water related issues were identified and assessed:

- Water demand for operation of various process operations.
- Losses from different parts of the plant.
- Water runoff and all outputs from the plant.
- Total input needed to meet the above requirements.

- Available water sources.
- The amount of water that can be supplied with high security from each of the identified water sources.

Lot 273 of the Project is zoned RU1 Primary Production and under Deniliquin Council's current Water and Sewer Limits Policy, Council does not service properties in this zone. Properties in the RU1 zone must source potable water from a separate source than the town supply system, which for Deniliquin is predominantly a rainwater tank.

Rainwater tanks would be used as the water source for general usage. This would meet the requirements of the RU1 zone and minimises the use of the town water supply by the development. Captured roof runoff would be used as drinking water. Runoff from some hardstand areas would be captured in a shallow concrete-lined underground holding tank. This water would be used for minor on-site landscape irrigation. Refer to Section 8.2.4 which sets out the proposed rainwater harvesting techniques.

In the unlikely event of rainwater not being sufficient to meet drinking water requirements, the deficit can be supplied via Deniliquin Council's town water supply.

The proposed ethanol plant operates in a relatively closed system. Therefore, seasonal and annual climate variations do not affect the water requirements. The only variation would be the month that the plant is closed for general maintenance in December. There would be no water requirement for general maintenance. Required water for general usage during maintenance would be small and can be provided via Deniliquin Council potable water supply or rainwater tanks.

The plant would operate at full capacity from day one of operation. Water requirements during start-up are expected to be 148 ML. This significant volume of water is needed to fill all the tanks, pipes and the cooling tower. Such a volume cannot be provided from the proposed project water supplies without accumulating the water on the Project Site over some months. A commissioning period of three months is proposed prior to plant commencing operation.

Based on the developed water balance, there is no water deficit for the Project during the operational phase. Potential impacts related to different water supplies including security, adequacy, quality and their potential impacts are discussed in the following sections.

Figure 6 shows the operational water balance model including; water inputs, required water for different processes, losses, reused water and outputs.

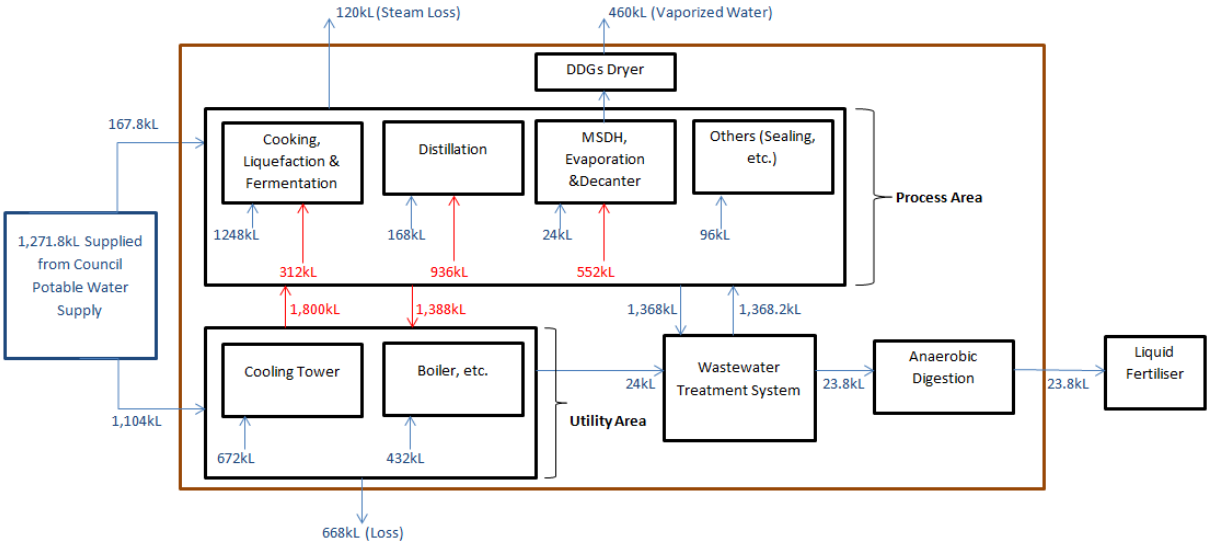

Figure 6 Daily Operational Water Balance

Note: Red numbers are the volumes of water supplied in the form of steam

Table 4 shows the overall water balance in the ethanol plant disregarding how the water is consumed in different sections. Table 5 provides details of water usage, losses and outputs in the process and utility areas.

Table 4 Operational Water Balance (Daily and Annual)

Input	Annual Quantity (ML/y)	Daily Quantity (kL/day)	Destination
Council potable water supply	419.7	1,271.8	To the process and utility area
Recycled water from on-site wastewater treatment system	451.5	1,368.2	To the process area
Total	**871.2**	**2,640.0**	
Output	**Annual Quantity (ML/y)**	**Daily Quantity (kL/day)**	**Destination**
Steam loss from process area	39.6	120.0	
Vaporized water loss in DDGs dryer	151.8	460.0	
Steam loss in cooling tower	220.4	668.0	
Liquid fertiliser	7.9	23.8	Sold as fertiliser
Recycled water from wastewater treatment	451.5	1,368.2	Use as input in the system (to be reused in process)
Total	**871.2**	**2,640.0**	

DDGs: Distiller Dried Grains

Table 5 Water Balance in the Process and Utility Area (Daily and Annual)

Process Area						
Input	**Water (ML/y)**	**Water (kL/day)**	**Water use in form of Steam (ML/y)**	**Water Use in form of Steam (kL/day)**	**Total (ML/y)**	**Total (kL/day)**
Council Potable water supply	55.37	167.79	-	-	55.37	167.79
Recycled water from on-site wastewater treatment system	451.51	1,368.21	-	-	451.51	1,368.21
Steam from boiler		-	594.00	1,800.00	594.00	1,800.00
Total	**506.88**	**1,536.00**	**594.00**	**1,800.00**	**1,100.88**	**3,336.00**
Usage	**Water (ML/y)**	**Water (kL/day)**	**Water use in form of Steam (ML/y)**	**Water Use in form of Steam (kL/day)**	**Total (ML/y)**	**Total (kL/day)**
Usage in cooking process	-	-	102.96	312.00	102.96	312.00
Usage in liquefaction process	403.92	1,224.00	-	-	403.92	1,224.00
Usage in fermentation process	7.92	24.00	-	-	7.92	24.00
Usage in distillation process	55.44	168.00	308.88	936.00	364.32	1,104.00
Usage in evaporation process	7.92	24.00	182.16	552.00	190.08	576.00
Usage in other (sealing, etc.)	31.68	96.00	-	-	31.68	96.00
Total	**506.88**	**1,536.00**	**594.00**	**1,800.00**	**1,100.88**	**3,336.00**
Utility Area						
Input	**Water (ML/y)**	**Water (kL/day)**	**Water use in form of Steam (ML/y)**	**Water Use in form of Steam (kL/day)**	**Total (ML/y)**	**Total (kL/day)**
Council Potable Water supply	364.32	1,104.00	-	-	364.32	1,104.00
Total	**364.32**	**1,104.00**	**-**	**-**	**364.32**	**1,104.00**
Usage	**Water (ML/y)**	**Water (KL/day)**	**Water use in form of Steam (ML/y)**	**Water Use in form of Steam (kL/day)**	**Total (ML/y)**	**Total (kL/day)**
Cooling tower	221.76	672.00	-	-	221.76	672.00
Boiler etc.	142.56	432.00	-	-	142.56	432.00
Total	**364.32**	**1,104.00**	**-**	**-**	**364.32**	**1,104.00**

Note: Red numbers are the volumes of water supplied in the form of steam

7.4 Wastewater

Ethanol production plants typically produce wastewater with high levels of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Suspended Solids (SS), Total Dissolved Solids (TDS) as well as colour impurities and odour. The key pollutant of ethanol production would be organic waste.

7.4.1 Wastewater generation

Wastewater generated from two sources is discharged to the on-site wastewater treatment system. These sources are described below:

- Approximately 1,345 kL/day of wastewater generated within the process area and DDGs would be condensed in the condenser (with design of 1,400 kL/day capacity) and would be pumped to the wastewater treatment system.
- Approximately 47 kL of wastewater generated within the cooling tower and general cleaning of process and utility areas would be discharged to the wastewater treatment system.

The proposed wastewater treatment system is expected to generate a low volume of effluent as the majority (98% or 1,368 kL) of wastewater generated will be recycled as process water (refer to Table 6, point G).

The remaining 2% (23.8 kL) is in the form of organic waste (sludge) that ends up as a liquid fertiliser.

7.4.2 Wastewater treatment process

The wastewater treatment process comprises a sealed anaerobic digester that breaks down the organic compounds into methane which is returned as fuel for the boilers with excess methane flared. The next step is an anoxic basin where further anaerobic treatment such as denitrification occurs. The next treatment step is aerobic digesters where the sludge form the anaerobic treatment steps will be digested. This process step is then followed by a membrane bioreactor which is the combination of a membrane process like microfiltration or ultrafiltration with a suspended growth bioreactor.

Membrane bioreactor processes are widely used for municipal and industrial wastewater treatment applications and can produce effluent of high quality. The membrane bioreactor process produces two separate streams, treated effluent and sludge. The treated effluent will be directed to an intermediate basin where it will be filtered (via activated carbon) for reuse as process water.

Figure 7 illustrates the inputs and outputs of the wastewater treatment system and shows how the water is treated in the system. Flow rate and water quality at the labelled points in Figure 7 are presented in Table 6.

Table 6 Wastewater Treatment Inputs and Outputs

Point	Flow Rate (kL/day)	pH	BOD (mg/l)	COD (mg/l)	SS (mg/L)	N (mg/L)	P (mg/L)	TDS (mg/L)
Input								
A	47.00	6~8	1,500	2,500	100	10	4	
B	1,345.00	4~5	2,500	3,500	200	40	10	
Total	**1,392.00**	**4~5**	**2,500**	**3,500**	**313**	**39**	**8**	**1,990**
Water flow in the system								
C	1,392.00	6-8	2,250		275			
D	1,392.00	6-8	560	875	240	29	6	
E	1,372.00	6-8	15	20	3	7	3	
F	1,368.21	6-8	10	15	2	6	2	
H	3.79	6-8	10	15	3	6	2	760
J (Sludge)	3.79	6-8	25,000	35,000	16,000	10,000	600	2,400
K	20.00	6-8	15	20	3	7	3	
L (Sludge)	20.00	6-8	25,000	35,000	16,000	10,000	600	2,400
Output								
G (Treated recycled water)	1,368.21	6-8	10	15	2	6	2	
M Liquid fertiliser)	23.79		21,026	29,460	14,410	8,414	506	2,200
Total	**1,392.00**							

Further information regarding the on-site wastewater treatment plant, specifically in relation to the process and the individual treatment stages, is provided in Appendix D.

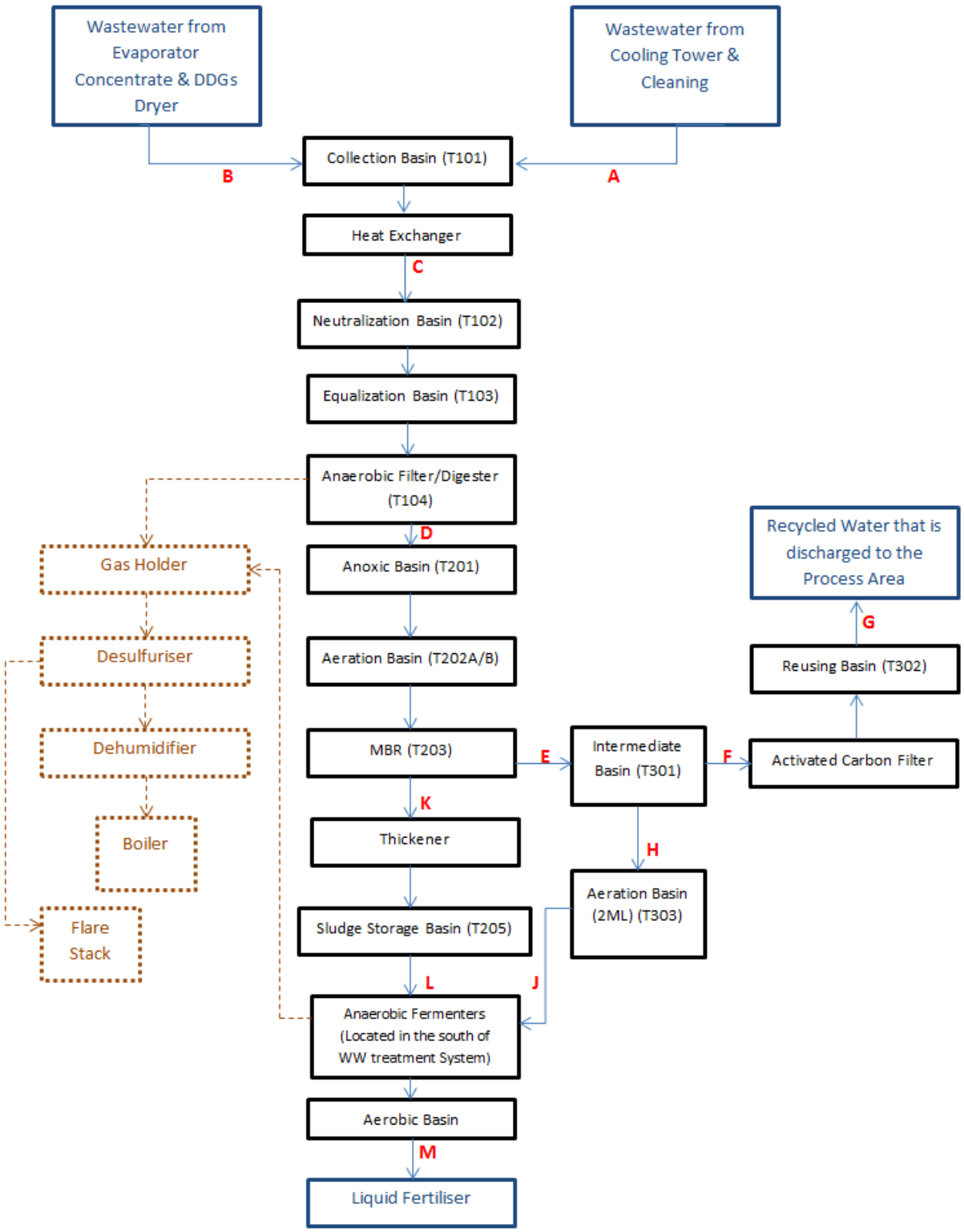

Figure 7 Wastewater Treatment System

(TAG number of each infrastructure/step on the system layout have been provided in parenthesis (refer to Appendix D). Input, output and water quality of labelled points are presented in Table 6.

The amount of Oxygen required for the Aeration Basin (T-303) with capacity of 2 ML would be 0.1 kg-O2/hr. The water aerator can supply 15.4 kg-O2/hr to the basin that would be more than the required Oxygen.

7.4.3 Wastewater treatment performance

The expected wastewater treatment performance is illustrated in Figure 7. The anticipated quality of the treated wastewater is likely to improve, in particular a reduction in BOD and COD concentration as a result of aeration in the aeration basin.

Wastewater generated from ethanol production would be discharged to the on-site wastewater treatment system. The proposed wastewater treatment system maximises recycling and provides good quality water for use in ethanol production.

The wastewater treatment system is critical for the proposed development and its failure would have a significant impact on ethanol production.. As such a double system will be installed for some key treatment components and the volume supplied by each system would exceed the required volume to ensure a reliable supply of recycled water to the ethanol production process.

All water generated in the wastewater treatment system would be beneficial and safe for reusing in ethanol production. Potential impacts related to the on-site wastewater treatment system would be as follows:

- Spillage and leakage from water and wastewater storage and treatment. The potential for leakage from tanks that store treated water is considered negligible owing to mitigation measures to be employed. The main risk would be related to the collection tank that stores wastewater generated in the process area and DDGs and storage of liquid fertiliser. Mitigation measures in this regard are discussed in Section 8.1.4.
- There would be a small likelihood that the wastewater treatment system operates inefficiently. This would result in production of poor quality water that may not meet the requirements for reuse in the system. The risk is minor and could be minimised by monitoring the quality of treated water.
- There is a risk of leakage and spillage of the stored by-products that are produced in the wastewater treatment process. Mitigation measures are discussed in 8.1.4.

Sewage generated from the site workforce has the potential to contaminate surface water and groundwater. To mitigate this risk, Dongmun is seeking approval to dispose of the effluent via Council's sewerage system extension (refer to Figure 5). Should Deniliquin Council be unable to provide a connection to the Council's sewerage system, Dongmun would use an off-line septic system. In such an event an 'Application for Local Activity' under Section 68 of the Local Government Act 1993 will be lodged with Deniliquin Council to seek approval to install a septic tank.

7.5 Surface water

Potential impacts to surface water as a result of construction and operation would be associated with flooding, stormwater quality and possible changes to the drainage regime. Potential surface water impacts are discussed below and mitigation measures to eliminate or manage potential impacts are discussed in Section 8.0.

7.5.1 Flooding impacts

The Project Site is not located within a classified flood risk area, and as such the development is highly unlikely to exacerbate flood risk elsewhere. Deniliquin Council has confirmed that '*the land has not been identified within the flood planning area in the Edward River at Deniliquin Flood Study'* (Julie Rogers, Deniliquin Council, pers. comm.).

As demonstrated in Figure 3, there is little to no risk of overland flow emanating from areas off-site to affect the Project Site during extreme rainfall events. Runoff generated on the area to the south of the Project footprint is captured within the localised depression storage.

7.5.2 Stormwater quantity impacts during construction

Construction of the ethanol plant is unlikely to have any measurable impact on the stormwater drainage regime external to the Project Site. As part of the construction management, the contractor would be required to protect existing drainage infrastructure from damage, and prepare and implement a Stormwater Management Plan. This will form part of the Construction Environmental Management Plan (CEMP).

7.5.3 Stormwater quality impacts during construction

Initial construction activities, including topsoil stripping and earthworks, would disturb soils at the Project Site and increase potential erosion and sediment risks. As part of the construction management, the contractor would be required to protect existing drainage infrastructure from damage and establish a detailed Erosion and Sediment Control Plan to ensure runoff from the Project Site, does not mobilise and transport sediment, or cause scour. This will form part of the CEMP.

The Project Site has a very shallow grade, and flow velocities are expected to be low, which significantly reduces the erosion potential for the Project. Oil, lubricants and other liquids used during construction could be released to stormwater runoff; although this would be addressed through the development and implementation of a Materials Storage and Handling Plan for the construction phase. As a result, construction of the works is unlikely to have any measurable impact on water quality in the Murray-Darling basin.

7.5.4 Stormwater impacts during operation

The impervious areas within the Project Footprint would be increased significantly as a result of the proposed development. The majority of proposed impervious areas would consist of internal roads, car parks and roof areas. A Conceptual Stormwater Management Plan has been prepared for the Project Site, as shown in Appendix F. The following sections provide details of the Conceptual Stormwater Management Plan.

7.5.4.1 Stormwater quantity impacts during operation

Any increase in impervious areas is likely to increase runoff as areas available for infiltration would be reduced. Left unmitigated an increase in runoff could lead to a larger peak flow being discharged from the Project Site along with a change in the timing of the peak, which could potentially cause drainage issues elsewhere. There will be three stormwater categories generated by the development, being:

- Category 1: Rainwater runoff from roofed areas, which has the lowest pollutant concentrations and is suitable for reuse or discharge without further treatment.
- Category 2: Runoff from hardstand areas (e.g. car park areas and internal road pavement), which may contain some trace pollutants, and requires treatment prior to discharge.
- Category 3: Runoff from landscaped areas, some of which would infiltrate, with excess water running off as overland flow.

7.5.4.2 Stormwater quality impacts during operation

Erosion and sedimentation is not expected to occur as a result of operation of the ethanol plant, as the active operational areas would be paved, effectively stabilising the surface. Areas surrounding the plant would be landscaped or turfed to prevent erosion of the topsoil. Consequently, the potential impacts of erosion and sedimentation from the Project are negligible.

The increase in impervious surfaces associated with the Project has the potential to impact on surface water quality. Surface runoff washes off pollutants that build up on hard surfaces such as road pavements. Runoff would typically contain pollutants such as nutrients, chemicals and heavy metals as a result of spills of materials on the roads or hardstand areas, or from atmospheric deposition, vehicle leaks, operational wear and road wear. These pollutants could be discharged to the receiving environment with the stormwater runoff, and could contribute to impaired ecosystem health or biodiversity impacts in the Edward River.

Should stormwater runoff come into contact with some of the process materials, such as grain, dry distiller's grain or other stored materials, the stormwater may be contaminated with organic matter or other pollutants (e.g. oil residue). To address this, it is proposed to store all feed material and by-products in covered areas to prevent stormwater contact.

7.5.5 Conceptual Stormwater Management Plan

A Conceptual Stormwater Management strategy has been prepared for the Project Site, as shown in Appendix F. The Project Site would be engineered in such a way that a variety of containment techniques would capture runoff, and direct it to the appropriate water storages and/or discharge points. Final discharge points will replicate existing and surface water will not be diverted across local watersheds.

The proposed stormwater solution for the Project Site during operation is to capture and convey Category 2 and 3 surface runoff via a system of vegetated swales. The use of vegetated swales to convey surface runoff is a proven method of controlling runoff while increasing infiltration rates.

The Conceptual Stormwater Management Plan also outlines the proposed stormwater quality treatment strategy which incorporates the following treatment devices:

- rainwater tanks within each of the proposed building blocks
- vegetated swales
- a bioretention basin

The Conceptual Stormwater Management Plan demonstrates three catchment areas on the Project Site, of which two cover the Project Footprint:

- Catchment A which includes rainwater harvesting measures. This catchment would discharge via vegetated swales into a proposed bioretention and flood detention basin. Runoff generated from hardstand areas would be collected by a pit-and-pipe system, and directed into the vegetated swale. Runoff generated from the roofs of the workshops and office building is to be captured in rainwater harvesting tanks.
- Catchment B which includes rainwater harvesting measures. This catchment would discharge via vegetated swales into a proposed bioretention and flood detention basin. Runoff generated from hardstand areas would be collected by a pit-and-pipe system, and directed into the vegetated swale. Runoff generated from the hardstand area that supports the ethanol storage tanks will be collected in a shallow concrete-lined underground holding tank, for the primary use of minor on-site landscape irrigation.
- Catchment C which falls away from the Project Site in a south-eastern direction and ponds in the existing localised depression storage. This catchment will be left undisturbed, and so requires no mitigation.

To assess whether the proposed Stormwater Management Plan is adequate to mitigate stormwater quality impacts, the proposed treatment systems were conceptually designed and modelled using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) modelling platform. Section 7.5.6 presents details of the developed MUSIC model.

7.5.6 MUSIC Modelling

The MUSIC Model, version 6.1, has been used to assess the effect of the Conceptual Stormwater Management Plan on water quality. This software was developed by the Cooperative Research Centre for Catchment Hydrology (now eWater CRC) as a decision support system for the design of stormwater treatment devices, and is now considered the standard method for determining compliance with water quality targets within the stormwater industry.

7.5.6.1 Pollutant reduction targets

Stormwater pollution control targets set out in the draft document Managing Urban Stormwater: Environmental Targets (DECC, Consultation Draft, 2007) are applicable to the operations phase of the Project.

The NSW Office of Environment and Heritage recommends the following load reduction targets as the minimum requirements for developments to minimise impacts on the environmental values of water.

- 85% reduction in fine sediment (TSS)
- 45% reduction in Total Nitrogen
- 65% reduction in Total Phosphorus

7.5.6.2 Methodology

Modelling was done to size and test the effectiveness of proposed stormwater treatment devices to demonstrate compliance with identified pollutant reduction targets. Following steps were taken:

1) Relevant MUSIC modelling and Water Sensitive Urban Design (WSUD) guidelines for the Project area were identified.
2) The most suitable meteorological station was determined and rainfall and evaporation data was obtained from eWater website.
3) Project catchments were defined based on their land use and surface types in accordance with the guidelines.
4) Sources of stormwater runoff in each catchment were identified and defined in accordance with the guidelines

5) Proposed treatment devices were defined in accordance with the guidelines and were conceptually sized through iteration process in such a way to meet the reduction targets

7.5.6.3 Model setup

Modelling was based on the contributing catchment areas and change in size of the proposed treatment devices. In the absence of specific MUSIC modelling guideline for Deniliquin, Draft NSW MUSIC Modelling Guidelines prepared for Sydney Metropolitan Catchment Management Authority (2010) was adopted for this study. This guideline is acceptable by the Council (based on the conversation made with Mark Dalzell, Deniliquin Council). Additional guidelines and documents referred during the study are outlined below:

- MUSIC Modelling Guidelines prepared by Water by Design (2010),
- WSUD Engineering Procedures prepared by Melbourne Water (2005) and
- Australian Runoff Quality –A guide to WSUD design prepared by Engineers Australia (2006)

The rainfall assessed was Deniliquin Airport for the period 2003 to 2008 inclusive, 6 minute time step data, as the most suitable station based on Pluviograph Rainfall Data Toolkit available on the eWater website.

Properties of two contributing catchments, Catchment A and B, covering the Project Footprint were defined using Sydney Metropolitan Catchment Management Authority (2010). Figure 8 shows how the model was setup for each catchment and Table 7 presents catchments properties used in the model.

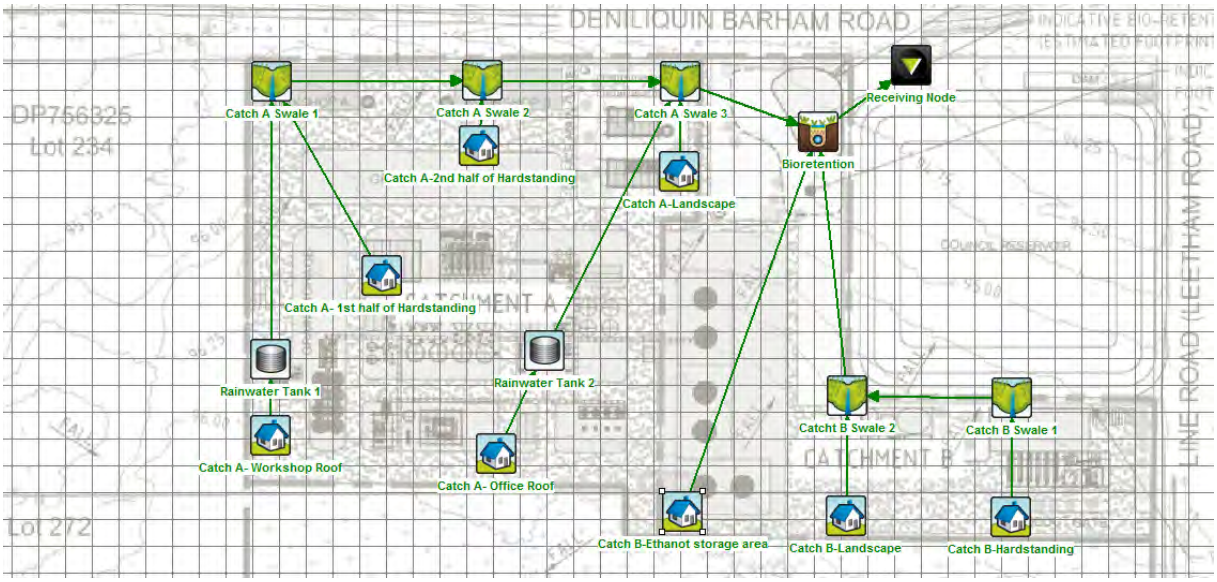

Figure 8 Developed model in MUSIC for catchment A and catchment B

Table 7 Contributing catchments' properties

Surface Types	Area (ha)	Adopted parameters for MUSIC modelling	Effective Impervious Area (EIA) factor (1)	Rainfall Threshold (RT) Value
Catchment A				
Roofs	1.0	Roofs	1.0 * Total Catchment	0.3 mm
Hardstanding and Paved area	13.4	Sealed Roads	1.0 * Total Catchment	1.5 mm
Landscape	1.0	Residential	0.5 * Total Catchment (2)	1.0 mm
Catchment B				
Hardstanding	3.0	Roofs	1.0 * Total Catchment	0.3 mm
Hardstanding +Paved area	3.9	Sealed Roads	1.0 * Total Catchment	1.5 mm
Landscape	3.3	Residential	0.5 * Total Catchment (2)	1.0 mm

(1) EIA factor was defined using Approach 2 of the Sydney Metropolitan Catchment Management Authority (2010) because contributing area of each source node is less than 10 ha

(2) The most conservative factor was chosen for the landscape as EIA factor assuming that the landscape area will be paved landscape

The dominant soil type of the project site is Clay Loam. Since the effective impervious areas of these two catchments are more 5%, typical soil properties and storage values was used in the model (Sydney Metropolitan Catchment Management Authority, 2010) and presented in Table 8. Base flow and Storm flow concentration parameters were also obtained from Sydney Metropolitan Catchment Management Authority (2010) and presented in Table 9.

Table 8 Selected soil properties for a Clay Loam soil type obtained from Sydney Metropolitan Catchment Management Authority (2010)

Properties	Value
Root zone (m)	0.50
Soil Storage Capacity	199.00
Field Capacity	99.00
Initial Storage (%)	25.00
a	180.00
b	3.00
DRR (%)	25.00
DBR (%)	25.00
Initial Depth (m)	10.00
DSR (%)	0.00

Table 9 Base Flow and Storm Flow concentration parameters for NSW (Sydney Metropolitan Catchment Management Authority, 2010)

Concentration (mg/L-log$_{10}$)						
	TSS		**TP**		**TN**	
	Mean	std.dev	Mean	std.dev	Mean	std.dev
Base Flow						
Roofs	n/a	n/a	n/a	n/a	n/a	n/a
Sealed Roads	1.20	0.17	-0.85	0.19	0.11	0.12
Residential	1.20	0.17	-0.85	0.19	0.11	0.12
Storm Flow						
Roofs	1.30	0.32	-0.89	0.25	0.30	0.19
Sealed Roads	2.43	0.32	-0.30	0.25	0.34	0.19
Residential	2.15	0.32	-0.60	0.25	0.30	0.19

Rainwater Tanks

Two rainwater tanks were located close to the workshops and lumped together as Tank 1 and two rainwater tanks were located close to the office buildings and lumped together as Tank 2 (refer to Figure 8). In rural areas, it is common for the entire roof area to drain to rainwater tanks position above the ground (Sydney Metropolitan Catchment Management Authority, 2010). So 100% of roof areas were assumed to drain to the tanks. This assumption was confirmed with the Council (Mark Dalzell, Deniliquin Council, pers. comm.).

To estimate the required tank volume, following steps were taken:

1. Office water demands were estimated using values suggested in the Sydney Metropolitan Catchment Management Authority (2010). Daily internal use for a rural dwelling reliant solely on rainwater tanks with 4 occupants is suggested as 0.58 kL/day for toilet, hot water, kitchen and other usage.
2. Total water demands were estimated as 5.2 kL/day based on the maximum number of employee per day (36ppl).
3. Estimated maximum demand was multiplied by 5 (to give 5 days storage) in accordance with the Water by Design (2010).
4. Sydney Metropolitan Catchment Management Authority (2010) suggests adopting maximum 80% of the physical rainwater tank volume for modelling. The rest 20% will give enough storage for temporary detention, sediment storage zone and top up volume. Therefore, total required tank volume was estimated as 33 kL.

Finally, four tanks with total capacity of 35 kL were selected. Low and high flow bypasses and overflow pipe diameters were chosen in accordance with the Sydney Metropolitan Catchment Management Authority (2010). Surface area of each tank was estimated using typical water tank properties obtained from Bushmantanks Website. High flow bypass was estimated using rainfall intensity of 100 mm/hr using simple rational rainfall method (Sydney Metropolitan Catchment Management Authority, 2010). Figure 9 shows the tank parameters used in the model

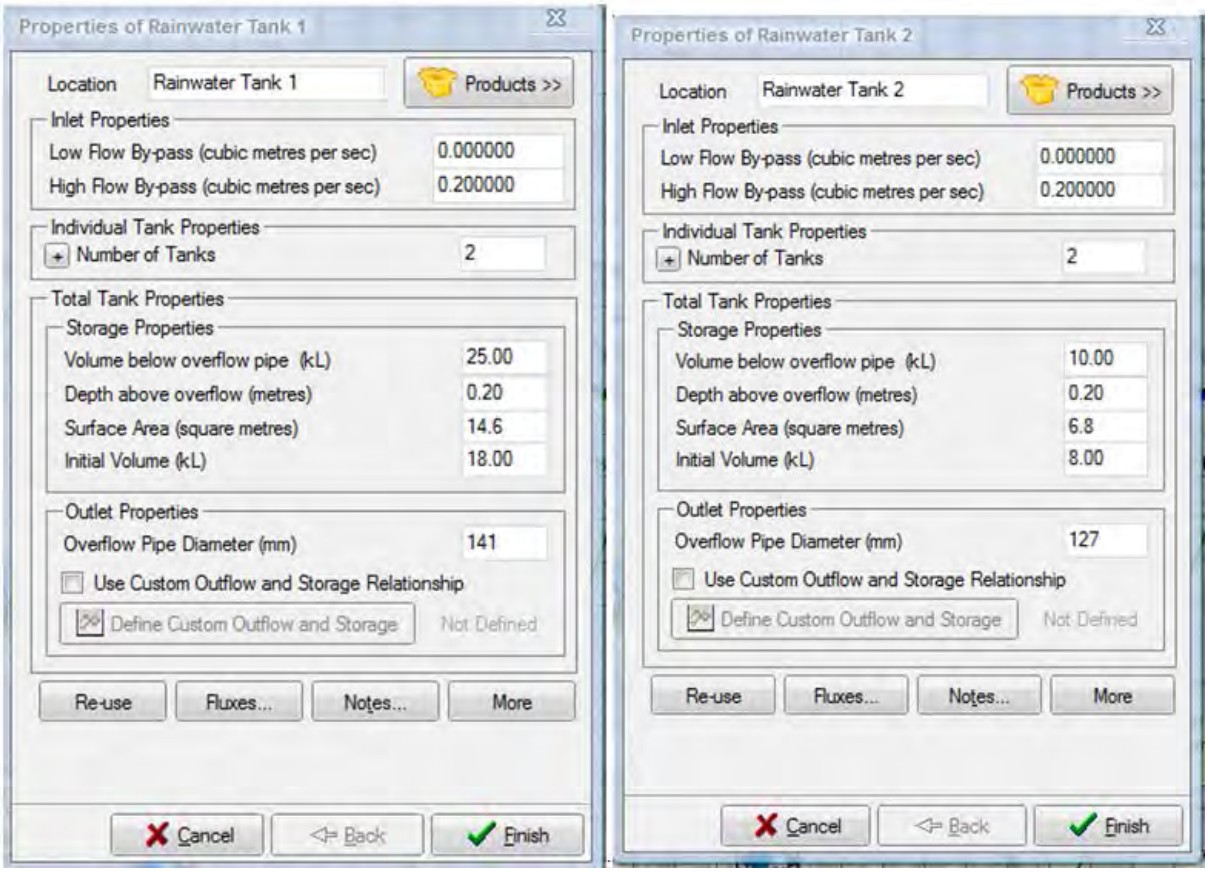

Figure 9 Rainwater tanks parameters used in the model

There is a proposed shallow underground detention tank to capture runoff from the ethanol product storage area in Catchment B. There is no specific guideline on how to define concrete shallow detention tank in MUSIC. Water by Design (2010) states that “MUSIC is not an appropriate tool for modelling the effectiveness of tanks for peak-flow mitigation or for on-site detention volume assessment”. The main purpose of the proposed underground shallow detention tank is to mitigate peak flows and to store water for on-site landscape irrigation. Since it will not have significant impact on water quality treatment, it was not modelled at this stage.

Swale

Deniliquin Council doesn’t have specific standards for swale and bioretention design (based on conversation made with Mark Dalzell, Deniliquin Council). Therefore, NSW and other available guidelines were used for the purpose of this study.

Due to the long swale in catchment A and because the effective impervious area of this catchment is large, three swales with series arrangement were considered for this catchment. Runoff generated from hardstanding and landscape areas would be collected by a pit-and-pipe system, and directed into the vegetated swales. Table 10 shows guidelines recommendations for defining swale parameters and Figure 10 and Figure 11 show selected Swale parameters in the model.

Table 10 Consideration taken in selecting swale parameters in the model

parameter	recommended by guidelines
Length (m)	Based on the Project site layout[1]
Bed slope (%)	Should be between 1 to 4%. Because the project site is flat and to give enough treatment time, slope of 1% was selected[1]
Base width (m)	Should be less than 2.5 m[2]
Batter Slope	Should be less than 1:4[3]
Depth (m)	Should be between 0.15 to 0.3. Swale depth closer to 0.3 m is preferred where it is possible[1]
Manning number	Should between 0.15 to 0.3 for flow condition where depth of flow is below the height of the vegetation[2]
Vegetation height (m)	Average height of suitable plants in Deniliquin was obtained from Melbourne Water (2005). Some suitable species for NSW will be Kindy Weed, Tall Sedge, Knobu Club-rush, Juncys amabilis and Common Tussock Grass. For the purposes of this submission, these species will suffice. The species list would be refined at the next stage of design. [4]
Seepage (mm/hr)	Should be set as 0[1]

1 Sydney Metropolitan Catchment Management Authority guidelines (2010)

2 Engineers Australia (2006)

3 Water by Design (2010)

4 Melbourne Water (2005), Table A.1

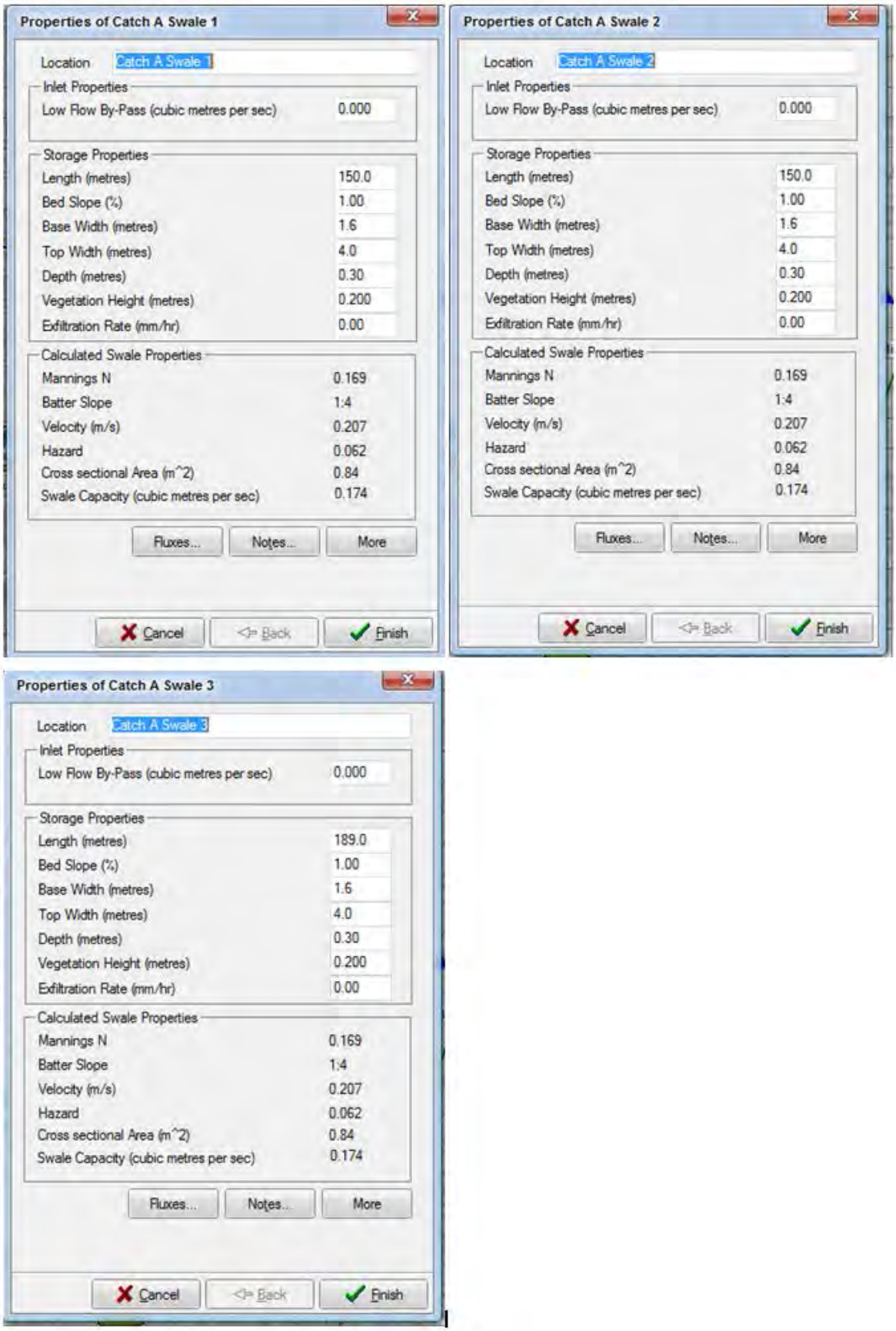

Figure 10 Catchment A swales parameters used in the model

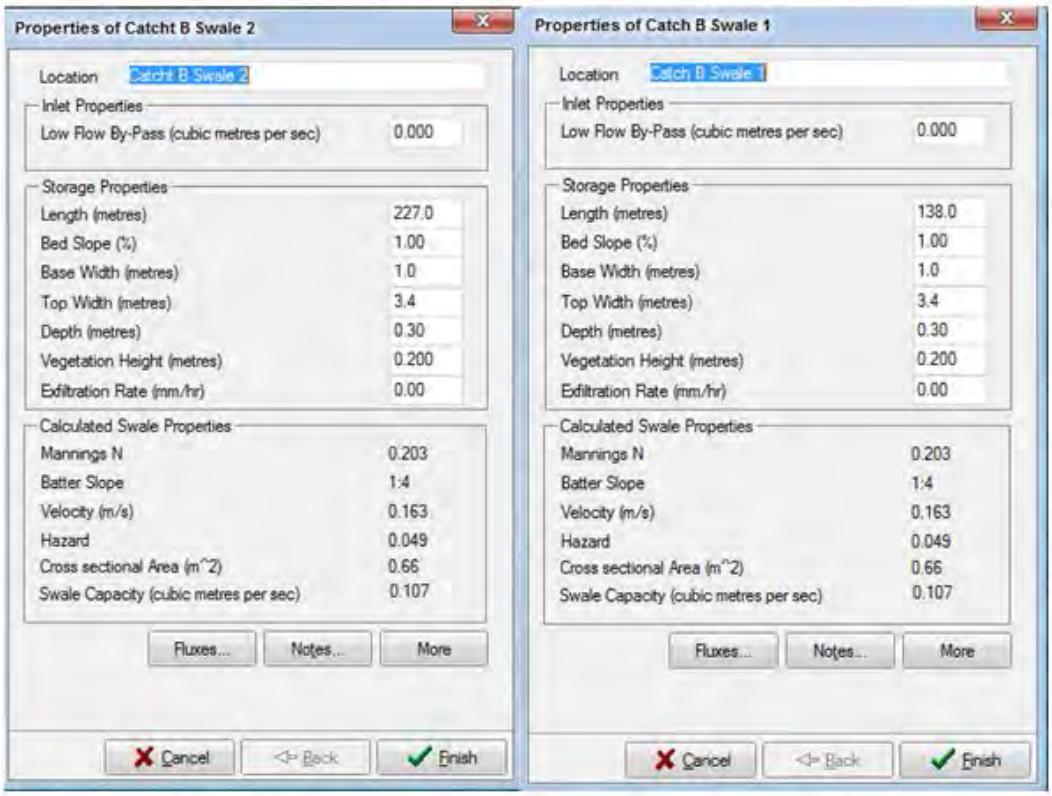

Figure 11 Catchment B swale parameters used in the model

Based on the Engineers Australia (2006), a maximum flow velocity less than 0.5 m/s for the one-year ARI event and a maximum velocity of 1.0 m/s for the 100-year event should be considered in swale design. Design rainfalls for Deniliquin obtained from BOM website. A simple rational rainfall method was used to estimate peak flows and maximum velocity. Calculated maximum velocities were in the mentioned range. For the purposes of this submission, this preliminary calculation will suffice but final size of treatment devices would be refined at the next stage of design.

Bioretention System

The Project footprint required for bioretention systems in Deniliquin to meet the treatment targets is typically about 2% of the contributing catchment. This number was used as the start point and final surface area was estimated through an iteration process to achieve the required pollution reduction. The bioretention system was modelled using defined parameters in accordance with the guidelines (refer to Table 11). The final footprint can be confirmed during detailed design.

Table 11 Bioretention parameters used in the model

Parameter	recommended by guidelines	Adopted in the model
Surface area (m^2) and Filter Area (m^2)	Started as 2% of the contributing catchment and defined through an iteration process. The filter area should not be greater than 70% of the surface area. [1] & 2	3000 & 2100 respectively
Filter depth (m)	Should be between 0.4 and 1.0 m [1]	0.3
Saturated hydraulic conductivity (mm/hr)	For a typical Loamy Sand filter, with an effective particle diameter of 0.45mm, saturated hydraulic conductivity is 200 mm/hr.[1]	200
Overflow weir width (m)	Starting point can be set as surface area divided by 10. [1]	300
Unlined Filter Media Perimeter (m)	As rule-of-thumb, four times the square root of the surface area can be used [1]	220
TN content	Less than 800 [1]	700
Orthophosphate	Less than 55 [1]	50
High flow By-pass (m^3/s	Should be adopted as 50% of the 1-year ARI peak flow. Rational rainfall coefficient of 0.9 was used. [1]	0.35
Extended detention	Should be between 0.15 and 0.3 [1]	0.2

1 Sydney Metropolitan Catchment Management Authority guidelines (2010)
2 Melbourne Water (2005)

7.5.6.4 Model results

Model results are summarised in Table 12. Required pollutant reduction was also provided for comparison. Based on the results, the proposed treatment devices will be sufficient to reduce pollutant loads to meet the required reduction targets. The developed MUSIC model will be refined when final stormwater treatment system design is confirmed.

Table 12 MUSIC model results

	Sources	Residual Loads	% Reduction	Required reduction target	Was the target met?
Total Suspended Solids (kg/yr)	18900	1710	91	85	Yes
Total Phosphorus (kg/yr)	32.5	8.52	73.8	65	Yes
Total Nitrogen (kg/yr)	143	66.6	53.3	45	Yes

7.5.6.5 Design considerations

Runoff that is discharged to bioretention systems must be pre-treated to remove coarse sediments, prior to the runoff reaching the bioretention filter media surface. Swales are proposed along the perimeter of the site for the purposes of collecting runoff from the drainage system, and conveying this to the flood detention and bioretention systems. Swales are an efficient device for coarse sediment removal and would provide suitable pre-treatment. Total Suspended Solid (TSS) reduction was the limiting factor for determining swale and bioretention dimension. To achieve the required reduction in TSS, a larger surface area of the bioretention was used to that required to treat the other parameters to achieve their target quality (as per Table 12).

Future detailed design of the stormwater management solutions would be undertaken in such a way that ensures peak discharge is not increased by the development. Based on the proposed design and standard operating measures, the runoff from the Project Site is highly unlikely to have a measurable impact on water quality in the Murray-Darling Basin.

7.5.6.6 Conclusion and recommendation

Model results demonstrate that the proposed stormwater quality improvement devices will improve the overall water quality indicators during the post-development phase, compared to the untreated developed site, with the reductions generally exceeding the required percentage reductions. The water quality targets appropriate for the project are the application of the DECC, Consultation Draft (2007) treatment targets to the increase in pollutant loads that would result as a result of the project.

The proposed treatment devices with estimated size will be sufficient treatment to ensure compliance with these treatment targets.

7.6 Groundwater impacts

Construction and operational activities have the potential to impact groundwater levels as a result of changes to groundwater flow patterns, recharge and discharge characteristics of the Project Site. Potential groundwater impacts are discussed below, and mitigation measures to eliminate or manage potential risks are discussed in Section 8.0.

7.6.1 Reduced groundwater recharge impacts

The planned construction activities pose a low potential to cause changes to groundwater flow patterns that could impact groundwater levels and recharge characteristics. The Project Site boundary covers an area of approximately 120 ha of pasture, of which approximately 25.6 ha is proposed to form the Project footprint. Approximately 20.22 ha of the Project Footprint is proposed to be covered with roofs, hardstand areas and paved road and parking areas. Runoff from most roofs would be collected into rainwater tanks for drinking water, whilst runoff from a large area of hardstand will be collected in a shallow concrete-lined underground holding tank for reuse. Most of the 20.22 ha of hardstand is proposed to drain into an on-site bioretention and flood detention basin. The nett reduction in available recharge area (by approximately 17%) is not considered significant given the Project Site is in a rural area.

The risks during the construction phase would be that during the construction of access roads, buildings, water storage and plant and areas for stockpiling of construction materials, groundwater recharge could be altered, but would be minimal and temporary.

7.6.2 Construction drawdown impacts

Groundwater drawdown due to construction is unlikely to occur since the highest water table measured within the local aquifer is 10 metres below the ground surface. Excavations to enable construction of foundations, is unlikely to extend to depths beyond 10 metres deep and consequently dewatering is unlikely to be required. Indeed, the deepest excavations are not expected to exceed 5m in depth below the existing ground surface. It is considered there would be no impacts related to construction dewatering.

7.6.3 Water quality impacts during construction

The potential for construction activities to adversely impact groundwater quality arise from fuel and chemical spills; petrol, diesel, hydraulic fluids and lubricants contaminating groundwater; or if a leak or accident occurs. Spills as a result of accidents can occur during construction activities, refuelling operations or from storage areas. Stockpiling of construction materials may also introduce pollutants to the Project area. Currently there is no site-specific groundwater quality or groundwater level data.

7.6.4 Water quality impacts during operation

Water, waste water and by-products are to be stored on-site within sealed or concrete lined areas. The use of impermeable materials in the construction of these storages should avoid the potential for leakage and infiltration to groundwater.

8.0 Mitigation measures

8.1 Water requirements, water resources and wastewater

8.1.1 Available water resources

The proposed ethanol plant requires a considerable amount of water as input to the process; however, wastewater generated by the process would be treated on site and reused to reduce raw water requirements. Water supply sources for the Project would be secured by obtaining all necessary licenses and other commercial agreements to use Council water supply.

8.1.2 Construction water requirements

Council water supply would be used as water supply during construction.

8.1.3 Operational water requirements

There is no mitigation measure relating to the quality of water supplied via Council potable water system, as it is expected to be of sufficient quality.

The proposed development benefits from an on-site wastewater treatment system which supplies approximately fifty two percent (52%) of the required water, however the plant still needs approximately 419.7ML/y of Deniliquin Council-supplied potable water to sustain operations. To reduce the potable demand further, mitigation measures include:

- Increasing water usage efficiency in the system by minimising the water loss in the system. One of the major losses is in the cooling tower. The proposed development would collect blow-down water for reuse on-site which improves the efficiency of the system. Mitigation measures may include:
    - to install all valves properly to make sure that there is no leakage and to monitor water consumption
    - to replace the current open loop cooling tower system with a closed loop system. This would significantly reduce water loss in the cooling tower
    - to monitor the quality of the feed water and blow-down water conductivity to maintain higher average conductivity, thus reducing total bow-down.
- The proposed development would use rainwater tanks for potable water supply to reduce the demand for potable water.

While it is proposed to recycle water from the on-site wastewater treatment plant, there is a small likelihood that water may not be available at times due to plant failure. To mitigate this, a double system will be installed and the volume supplied by each system will be bigger than the required volume.

8.1.4 Wastewater and on-site wastewater treatment system

The proposed plant benefits from an on-site wastewater treatment system that recycles approximately ninety eight percent (98%) of the generated wastewater from ethanol production. Mitigation measures to reduce the risk of contamination from generated wastewater and the wastewater treatment system are described below:

- Water, waste water and by-products are to be stored on-site within sealed or concrete lined areas. The use of impermeable materials in the construction of these storages should avoid the potential for leakage and infiltration to groundwater.
- All organic waste, which is the key pollutant of the wastewater, would be pumped to anaerobic andaAerobic digestion and would be used as liquid fertiliser. Liquid fertiliser will be stored in a tank with capacity of 100 kL which is enough for four days storage of produced liquid fertiliser. No organic waste would be pumped or released. There is a risk of contamination of surface and groundwater due to loss of containment of materials generated, used and stored in the anaerobic digester and fertilizer batching facility. Mitigation measures would be as follows:
    - Construction of the storage in accordance with Australian codes (such as Fertilizer Australia – Fertilizer Handling Code of Practice (December 2014) and Australian Fertiliser Services Association Code of Practice (August 2008)), standards and legislative requirements and follow the storage and handling procedures outlined in the CEMP. The construction management plan would document the nature of these dangerous goods in detail.

- Spill management equipment available in all areas where materials or goods are stored. All materials and goods will be stored in appropriate containers in designated areas, with bunding provided to contain any accidental spills and designed in accordance with the Australian Standards (such as AS1940 - 1993 for the Storage of Flammable and combustible liquids and AS 4452 - 1997 for the Storage and Handling of Toxic Substances).
- Clearly and correctly label all storage containers so the contents are easily identifiable.
- Provision of spill kits on site and inclusion of protocols and the training of staff, on the handling of chemicals and materials particularly spillage management.

- Sewage generated by on site facilities (i.e. toilets and kitchen) would be disposed to Council's sewerage system via an extension provided by Deniliquin Council. Should a sewer connection not be available, an off-line septic system would be developed. This would be designed to comply with AS/NZA 1546.1:2008 On-site Domestic Wastewater Treatment Units – Septic Tanks standard.

Variations in the performance of biological treatment systems are typically attributed to variable process water streams. In this case, the influent concentrations are expected to be largely consistent in nature given that the wastewater source is largely cleaning water from various ethanol production processes. Notwithstanding this, mitigation measures are included that will ensure the treated wastewater stream consistently meets the required criteria. These include the following:

- Real-time monitoring of various parameters in the anaerobic and aerobic digesters such as methane, oxygen and temperature which will provide an indication of treatment performance issues.
- Online monitoring of various effluent parameters, including (but not limited to) DO, TSS, ORP, ammonia, nitrate/nitrite analysers. Real time monitoring of these parameters at key process units (i.e. in the intermediate basin) will ensure that all effluent directed towards the aerated lagoon will be of sufficient quality. In the event of an exceedance of any parameter, the effluent can be recycled back in the wastewater treatment system for additional treatment.
- Regular cleaning of the Membrane bioreactor membranes to prevent fouling. This may include membrane backwashing or chemical cleaning. The frequency of these backwashing events will be determined during operation.

8.2 Surface water

8.2.1 Flooding

The Project Site is not located within a flood risk area, and as such no flood risk impacts are expected as a result of the proposed development. No mitigation or management measures are proposed for flooding.

Minor surface runoff currently being conveyed from a small catchment area to the west of the Project Site to the on-site localised depression, will be captured in the proposed bioretention and flood detention basin (refer to Section 8.2.3).

8.2.2 Stormwater impacts during construction

A conceptual Erosion and Sediment Control Plan showing the proposed preliminary erosion and sedimentation controls to be used during the construction phase of the Project is included in Appendix E, and is in accordance with Soils and Construction: Managing Urban Stormwater 2004.

Following detailed design an updated Erosion and Sediment Control Plan will be prepared and implemented by the contractor as part of the CEMP, prior to construction commencing, a Materials Storage and Handling Plan would also be implemented during construction for the on-site storage of potential pollutants, such as oil, to avoid accidental spillage into the receiving environment.

Temporary stormwater management measures would be installed during the construction process, to avoid any stormwater impacts to the Project Site, or elsewhere as a result of vegetation stripping and/or earthworks. The permanent vegetated swales will be established first, which will also fulfil a sediment and erosion control function during construction.

The contractor would be required to prepare and implement a detailed construction Stormwater Management Plan, as part of the CEMP. Civil works would be staged to minimise disruption to the local drainage regime.

With the above mitigation, the Project is considered to have a negligible impact on stormwater discharge during construction.

8.2.3 Stormwater impacts during operation

With the mitigation proposed in the following section, the Project is considered to have a negligible impact on stormwater discharge during operation of the ethanol plant.

At the detailed design stage, an updated MUSIC (Model for Urban Stormwater Improvement Conceptualisation) model will be developed to demonstrate water quality compliance. In addition to currently proposed water treatment features (e.g. vegetated swales and bioretention and flood detention basin) structural treatment devices, such as oil separators, may also be required. These will be confirmed during detailed design stage.

8.2.4 Rainwater harvesting

Lot 273 of the Project Site is currently zoned as RU1 Primary Production and under Deniliquin Council's current Water and Sewer Limits Policy, Council does not service properties in this zone (note: Deniliquin Council is currently reviewing this policy and it is understood that by June/July 2015 Council would adopt a new policy that would allow services being executed to these areas with the approval of the General Manager (Mark Dalzell, Deniliquin Council pers. comm.). Therefore, properties in the RU1 zone must source potable water from a separate source than the town supply system, which for Deniliquin is predominantly a rainwater tank.

It is proposed to harvest Category 1 and Category 2 stormwater runoff as follows:

- Category 1: Runoff from roofed areas in Catchment A would be captured in above-ground rainwater tanks, which would be used as the main potable water source.
- Category 2: Runoff from the ethanol storage hardstand area in Catchment B would be captured in a shallow underground concrete lined holding tank, primarily for use in minor on-site landscape irrigation. Water would be treated through a proprietary treatment device prior to storage to remove trace particulates and contaminating materials.

Appendix F shows the proposed locations of the rainwater tanks and underground holding tank, the number and size of which have been estimated in 7.5.6.1 and will be further detailed during subsequent design phases. All rainwater harvesting collection infrastructure and storages will be designed to include appropriate and safe overflow management provisions during extreme rainfall events.

8.2.5 Proposed swale, bioretention and flood detention basin

Final bioretention and flood detention basin will be designed in accordance with Water Sensitive Urban Design (WSUD) principles during the detailed design stage. It will be a 'dry' basin with the bioretention treatment facility included within a wider flood detention facility, as shown on the Concept Stormwater Management Plan in Appendix F. The flood detention facility will be sized to ensure that peak discharges from the site are not increased beyond that of the pre-developed environment for nominally the critical 1, 10 and 100 year ARI storm events. Preliminary calculations suggest that flood storage of around 6,000 m^3 will be required.

The proposed conceptual treatment devices were modelled using MUSIC software. The results demonstrate that the proposed stormwater quality improvement devices will improve the overall water quality indicators during the post-development phase, compared to the developed site without treatment, with the reductions meeting or exceeding the required percentage reductions. Based on the model results, the project is considered to have negligible impact on stormwater quantity and quality during operation.

8.2.6 Maintenance of stormwater drainage features

If not maintained properly, there is a residual flood risk associated with blocked or damaged stormwater infrastructure such as culverts and drains. The proposed mitigation measure is to ensure that a routine drainage inspection and maintenance program is established as part of the overall site asset management plan.

8.2.7 Erosion and sediment control

During operation, the main mitigation measure is to ensure that any exposed areas of the Project Site are covered as soon as possible, to prevent erosion and sediment mobilisation.

8.2.8 On-site landscape irrigation

Irrigation of landscaped areas using harvested stormwater is proposed for the on-site landscape. A water efficient irrigation system will be designed and implemented to minimise water use. In addition, native and drought-tolerant

plants will be used in the landscaping design to reduce the need for watering. Given the proposed low irrigation demand and that the depth of the groundwater table is in excess of ten metres; water logging is considered highly unlikely, and consequently no mitigation or management measures are proposed.

8.3 Groundwater

Mitigation and management measures would be implemented to minimise or manage impacts to the groundwater.

8.3.1 Reduced groundwater recharge impacts

No mitigation or management measures are proposed for reduced recharge as these impacts are expected to be minimal.

8.3.2 Groundwater drawdown impacts

No mitigation or management measures are proposed for induced groundwater drawdown during construction since groundwater is at least 10 metres below ground surface and the building infrastructure is unlikely to extend to these depths. Consequently dewatering would not be required.

8.3.3 Water quality impacts during construction

Preparation of a site specific CEMP by the contractor prior to construction would detail control measures for fuel spills and sedimentation.

Mitigation measures would be to construct the water storages with concrete, and if required a cut-off trench, to reduce any leakage. The water storages should also be constructed with outer bunds to capture any leakages caused by a wall breach.

During construction there is a potential for fuel and chemical spills petrol, diesel, hydraulic fluids and lubricants contaminating groundwater. Mitigation measures would include providing bunding and spill kits around fuel depots and stockpile areas. Response plans would be developed to address fuel leaks and spills at machinery compounds or during refuelling including a spill emergency procedure.

9.0 Residual impacts

Residual impacts for groundwater and surface water are discussed in the following sections.

9.1 Residual water quantity impacts

The operation of the ethanol plant requires 2,640 kL/day of clean water, of which 1,368.2 kL/day would be recycled wastewater and 1271.8 kL/day would be Council supplied water. Council has indicated a commitment to develop a mains extension to the Project Site to provide water for the plant. Overall, the Project is considered to have an acceptable impact on local water supply sources.

Changes to the Project Site layout, including increasing the impermeable area, could increase stormwater runoff from the Project Site; this would be addressed through stormwater harvesting, and the establishment of vegetated drainage swales and on-site flood detention. With these measures in place the Project is considered to have a negligible impact on stormwater quantity discharging from the Project Site.

9.1.1 Stormwater Quality

With the mitigation measures presented in Sections 8.2.2 and 8.3.3 there is a low likelihood that contaminants from hardstand areas or stored materials would be present in runoff from the Project Site. MUSIC model results confirm that the proposed treatment systems will be sufficient to meet the required pollutants reduction targets. Additionally, the design for the Project includes pavement of active operational areas, and landscaping of other areas, which would reduce the potential for erosion and sediment transport from the Project Site. The Project is considered to have a negligible to minor impact on stormwater quality from the Project Site.

10.0 Summary and conclusion

The preceding sections of this report have identified potential water-related issues arising from the proposed development, and where required, outlines mitigation strategies to be implemented to minimise identified issues. The structure of this document was developed to meet the issued Director-General's Environmental Assessment Requirements (DGR's).

As demonstrated throughout this report, the Project is not expected to have significant impacts on the surrounding environment or communities from a water perspective, beyond those issues that can be adequately mitigated for. Where appropriate, specific mitigation strategies were identified.

Sections 10.1 to 10.3 provide a summary of potential water resource, wastewater, surface water and groundwater impacts and the proposed mitigation measures.

10.1 Water resources and wastewater

A considerable amount of water would be required for the operation of the ethanol plant. It is estimated that 2.7 ML/day would be required for normal operation, and approximately 148 ML would initially be required during the commissioning process. It is proposed to source water during commissioning period from and Council supplied water (1.9 ML/day). During operation the water would source from a combination of Council supplied water (1.3 ML/day) and recycled water from an on-site wastewater treatment plant (1.4 ML/day).

It is estimated that approximately 34 ML would be required during the construction phase of the plant, and this would be sourced from Council supplied water.

Deniliquin Council has indicated a commitment to develop a mains extension to the Project Site to provide water for the plant. Overall, the Project is considered to have an acceptable impact on local water supply sources.

In addition to the above, two alternative sources are being investigated for feasibility, including sourcing water from Barham ERS Pond near the Project Site, which has a capacity of 175 ML, and purchasing an allocation through the Murray Irrigation Supply. As these options are still in the feasibility phase, their potential impacts were not assessed; nevertheless, were they adopted they would go some way to reduce the requirement for Council water.

The on-site wastewater treatment plant would be used to treat process wastewater generated by the ethanol plant. Treated wastewater would be recycled into the plant as process water.

Sewage generated from site facilities (i.e. toilets and kitchen) would be discharged to a new sewer main, which is proposed to be developed by Council. Should the sewer main not be established before construction of the ethanol plant, a septic system designed in accordance with AS/NZA 1546.1:2008 On-site Domestic Wastewater Treatment Units – Septic Tanks standard would be established.

In summary the Project's potential impacts on water resources and wastewater are acceptable.

10.2 Surface water

The Project Site is currently cleared, and was previously used for agricultural purpose. The Project Site is not located in a flood risk area. The Project would increase the impermeable area of the Project Site, which would increase stormwater runoff from the Project Site, and affected the quality of stormwater runoff. A concept Stormwater Management Plan was developed, which will be refined during detailed design stage.

It is proposed to manage stormwater through a combination of stormwater harvesting techniques, the establishment of vegetated swales and on-site bioretention and flood detention basin. The vegetated swales and bioretention and flood detention basin will be designed appropriately to ensure that water discharge quality meets regulatory targets, and that sufficient attenuation is provided on site to ensure that post-development discharge rates do not exceed pre-development rates. A MUSIC model was developed and the model results show that the proposed treatment devices are sufficient to meet pollutant reduction targets.

In summary the Project's potential impacts on surface water are acceptable.

10.3 Groundwater

The impacts to the groundwater regime were assessed in accordance with the NSW Aquifer Interference Policy and Minimal Impact Considerations for Less Productive Groundwater in an 'other porous rock aquifer'. The identified groundwater impacts were considered to be within accordance with the policy.

Groundwater impacts may include the following:

- Reduced groundwater recharge due to the increased paved and hardstand areas. The nett reduction in available recharge area (by approximately 17%) is not considered significant given the Project Site is in a rural area.
- Groundwater drawdown due to construction. This is not expected to occur since the water table is in excess of ten metres below the ground surface and no excavations are expected to extend beyond ten metres in depth.
- Impact on groundwater quality due to the leakage of fuels and chemicals used during construction and operation of the plant. During construction water storage basins would be constructed with concrete, and if required a cut-off trench, to reduce any leakage and an outer bund to capture any leakages caused by a bund breach.

In summary the Project's potential impacts on groundwater are acceptable.

11.0 References

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Appendix A

Director General's Environmental Assessment Requirements (DGRs)

NSW GOVERNMENT | Planning & Infrastructure

Contact: David Mooney
Phone: 02 9228 2040
Fax: 02 9228 6466
Email: david.mooney@planning.nsw.gov.au

Mr Sung-Ho Joo
Dongmun Greentec Pty Ltd
345 Coragulac-beeac Road
WARRION VIC 3249

Our ref: SSD 13_9281
File: 13/16623

Dear Mr Joo

Deniliquin Ethanol Plant (SSD 13_9281)
State Significant Development - Director-General's Requirements

I have attached a copy of the Director-General's environmental assessment requirements (DGRs) for the preparation of an Environmental Impact Statement (EIS) for the proposed Deniliquin Ethanol Plant.

These requirements are based on the information you have provided and have been prepared in consultation with relevant government agencies and Deniliquin Shire Council. Correspondence from the agencies is attached, and should be appropriately addressed when preparing the EIS (see Attachment 2).

Please note that the Department may alter the DGR's at any time, and you must consult further with the Department if you do not lodge a development application and EIS for the project within two years of the date of issue of these DGRs. The Department will review the EIS for the project carefully before putting it on public exhibition, and will require you to submit an amended EIS if it does not adequately address the DGRs.

I wish to emphasise the importance of effective and genuine community consultation and the need for proposals to proactively respond to the community's concerns. Accordingly a comprehensive, detailed and genuine community consultation and engagement process must be undertaken during preparation of the EIS. This process must ensure that the community, including key special interest, is both informed of the proposal and is actively engaged in issues of concern to them. Sufficient information must be provided to the community so that it has a good understanding of what is being proposed and of the potential impacts.

Your project may require separate approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Department encourages you to confirm whether such an approval will be required as soon as possible. If an EPBC Act approval is required, I would appreciate it if you would advise the Department accordingly, as the Commonwealth approval process may be integrated into the NSW approval process, and supplementary DGRs may need to be issued.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit the development application and EIS for your development. This will enable the Department to determine:

- the applicable fee (see Part 15 of the *Environmental Planning and Assessment Regulation 2000*);
- consultation and public exhibition arrangements; and
- number of copies (hard-copy and CD-ROM) of the Development Application and EIS that will be required for exhibition purposes.

If you have any enquiries about these requirements, please contact David Mooney on 9228 2040.

Yours sincerely

C. Ritchie

Chris Ritchie 23/12/13
Acting Director
Industry, Key Sites and Social Projects
As the Director-General's nominee

Director-General's Environmental Assessment Requirements

Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*

State Significant Development

Application Number	SSD 13_9281
Proposal	The Deniliquin Ethanol Plant, which includes: • the construction and operation of an ethanol plant with production capacity of up to 115 mega litres per year of ethanol; • feed-grain silos, storage for ethanol, dried distillers grain, and sludge waste; • an on-site rail siding; • a wastewater treatment facility utilising the existing 170 mega-litre dam; and • an effluent irrigation area.
Location	Barham Road, Deniliquin (Lots 234, 272 and 273 DP 756325)
Proponent	Dongmun Greentec Pty Ltd
Date of Issue	December 2013
General Requirements	The Environmental Impact Statement (**EIS**) for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 to the *Environmental Planning and Assessment Regulation 2000*. In addition, the EIS must include a: • detailed description of the site, and any existing or approved operations; • detailed description of the development, including: – need for the development; – alternatives considered; – engineering and/or architectural plans; – justification for the development taking into consideration its location, any environmental impacts of the development, the suitability of the site and whether the development is in the public interest; – likely staging of the development; and – likely interactions between the development and existing, approved and proposed operations in the vicinity of the site including any grain storage and transport development. • consideration of any relevant statutory provisions; • risk assessment of the potential environmental impacts of the development, identifying the key issues for further assessment; • detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes: – a description of the existing environment, using sufficient baseline data; – an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes; and – a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage significant risks to the environment; and • consolidated summary of all the proposed environmental management, mitigation and monitoring measures, highlighting all commitments included in the EIS. The EIS must also be accompanied by a report from a qualified quantity surveyor providing: • a detailed calculation of the capital investment value (**CIV**) of the development (as defined in clause 3 of the *Environmental Planning and*

	Assessment Regulation 2000), including details of all assumptions and components from which the CIV calculation is derived; • a close estimate of the jobs that will be created by the development during construction and operation; and • verification that the CIV was accurate on the date that it was prepared.
Key Issues	• **Soils and Water** - including: – description of the water demands and a breakdown of water supplies; – description of the measures to minimise water use; – a detailed water balance; – description of the construction erosion and sediment controls; – a description of the surface and stormwater management system, including on site detention, and measures to treat or reuse water; – an assessment of potential surface and groundwater impacts associated with the development, the wastewater irrigation and the onsite water storage compounds, including impacts on Groundwater Dependent Ecosystems, and potentially affected groundwater users; – details of impact mitigation, management and monitoring measures; – a technical assessment of the suitability of the soil for use in the construction of the onsite water storage compounds, and to sustain on-going wastewater irrigation; and – an assessment of any potential existing soil contamination. • **Wastewater** – including: – a clear and detailed description of the wastewater treatment process for the development including details of the volume of wastewater generated, treated, reused/recycled, or stored on site; – details of the key pollutant concentrations of the wastewater before and after treatment with reference to relevant water quality guidelines; – a full evaluation of options to manage any brine stream resulting from wastewater treatment and a detailed assessment of the environmental impacts of each option; and – an Irrigation Management Plan that details irrigation practices and includes a detailed soil nutrient and water balance. • **Air Quality and Odour** - including: – description of all potential odour sources and predicted odour emissions from the construction and operation of the ethanol plant and its wastewater treatment system; – a comprehensive air quality assessment of all potential air quality and odour impacts from the development, including details of air quality and odour impacts on private properties, in accordance with relevant Environment Protection Authority guidelines; – details of mitigation, management and monitoring measures for preventing and/or minimising both point and fugitive emissions; and – an assessment of the effectiveness of the proposed air quality and odour mitigation measures. • **Waste Management** – including: – the quantity and type of all liquid and solid waste to be generated on site and how this waste would be handled, processed and, if necessary, disposed; – investigation of appropriate options for sludge disposal; and – details of the measures to dispose/remove distillers grain, and details of contingency arrangements should these disposal measures become unavailable. • **Noise** – including: – description of all potential noise sources such as construction, operational, on and off-site rail noise and traffic noise; – a comprehensive noise impact assessment including a cumulative noise impact assessment in accordance with relevant Environment Protection Authority guidelines; and – details of noise mitigation, management and monitoring measures.

	• **Traffic and Transport** – including: – details of all traffic and transport demands likely to be generated during construction and operation, including a description of haul routes; – details on access to the site from the road network including intersection location, design and sight distance; – an assessment of predicted impacts on road safety and the capacity of the road network to accommodate the project; – plans of any road upgrades, rail and other infrastructure works or new roads required for the development; – an assessment of where far-field road works are required as a result of traffic impacts from the development; – details of any proposed rail siding and associated rail traffic and assessment of the predicted impact of this on the rail network; and – detailed plans of the proposed layout of the internal road network and parking on site in accordance with the relevant Australian standards. • **Hazards and Risk** – including: – a Preliminary Hazard Analysis (PHA) in accordance with Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis and Multi-Level Risk Assessment; – details of fire/emergency measures and procedures; and – detail contingency plans for any potential incidents or equipment failure during the operation of the project. • **Flora and Fauna** – including an assessment of the potential impacts to threatened species, populations and communities, and their habitat(s), and if required describe how the principles of "avoid, mitigate, offset" have been used to minimise the impacts of the proposal on biodiversity • **Visual** – including height, scale, signage and lighting, particularly from: – nearby public receivers; and – significant vantage points of the broader public domain. • **Greenhouse Gas** - including: – a full greenhouse gas assessment (including an assessment of the potential scope 1, 2 and 3 greenhouse gas emissions of the project, and an assessment of the potential impacts of these emissions on the environment; and – a detailed description of the measure that would be implemented on site to ensure that the project is energy efficient. • **Aboriginal and non-Aboriginal Cultural Heritage**.
Plans and Documents	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*. These documents should be included as part of the EIS rather than as separate documents.
Consultation	During the preparation of the Environmental Impact Statement, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups or affected landowners. In particular you must consult with: • Environmental Protection Authority; • Deniliquin Shire Council; • Department of Primary Industries including the NSW Office of Water, Agriculture NSW and NSW Trade and Investment; • NSW Roads and Maritime Service; • NSW Transport; • Office of Environment and Heritage (including the Heritage Branch); • Murray Catchment Management Authority; • NSW Fire Brigade; • Rural Fire Service; • Vic Rail; and • local community and other stakeholders. The EIS must describe the consultation process and the issues raised, and

	identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.
Further consultation after 2 years	If you do not lodge an EIS for the development within 2 years of the issue date of these DGRs, you must consult with the Director-General in relation to the requirements for lodgement.
References	The assessment of the key issues listed above must take into account relevant guidelines, policies, and plans as identified. While not exhaustive, Attachment 1 contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this development.

ATTACHMENT 1
Technical and Policy Guidelines

The following guidelines may assist in the preparation of the Environmental Impact Statement. This list is not exhaustive and not all of these guidelines may be relevant to your proposal.

Many of these documents can be found on the following websites:
http://www.planning.nsw.gov.au,
http://www.bookshop.nsw.gov.au,
http://www.publications.gov.au

Policies, Guidelines & Plans

Aspect	Policy /Methodology
Air Quality	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
	Action for Air (DECC)
Odour	
	Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC)
	Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC)
Waste	
	Waste Avoidance and Resource Recovery Strategy 2007 (DECC)
	Waste Classification Guidelines (DECC)
	Environmental Guidelines: Assessment Classification and Management of Non-Liquid and Liquid Waste (NSW EPA)
	Environmental guidelines: Composting and Related Organics Processing Facilities (DEC)
	Environmental guidelines: Use and Disposal of Biosolid Products (NSW EPA)
	Composts, soil conditioners and mulches (Standards Australia, AS 4454)
Soil and Water	
Soil	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & NHMRC)
	National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC)
	Draft Guidelines for the Assessment & Management if Groundwater Contamination (DECC)
	State Environmental Planning Policy No. 55 – Remediation of Land
	Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land (DOP)
Surface Water	National Water Quality Management Strategy: Water quality management - an outline of the policies (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Policies and principles - a reference document (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Implementation guidelines (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for

	Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	State Water Management Outcomes Plan
	NSW Government Water Quality and River Flow Environmental Objectives (DECC)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Greater Metropolitan Regional Environmental Plan No. 2 – Georges River Catchment
	Managing Urban Stormwater: Soils & Construction (Landcom)
	Managing Urban Stormwater: Treatment Techniques (DECC)
	Managing Urban Stormwater: Source Control (DECC)
	Technical Guidelines: Bunding & Spill Management (DECC)
Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC)
	NSW State Groundwater Quality Protection Policy (DLWC)
	NSW State Groundwater Quantity Management Policy (DLWC) Draft
	Guidelines for the Assessment and Management of Groundwater Contamination (DECC)
Transport	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RTA)
Noise	
	NSW Industrial Noise Policy (EPA, 2000) and Industrial Noise Policy Application Notes
	NSW Road Noise Policy (EPA, 2011)
	Environmental Noise Control Manual (DECC)
	Interim Construction Noise Guideline (DEDCC, 2009)
	Assessing Vibration: a Technical Guide (DEC, 2006)
	Interim Guidelines: Assessment of Noise from Rail Infrastructure Projects
	Rail Infrastructure Noise Guideline draft for Consultation
	Other Rail Noise: http://www.environment.nsw.gov.au/noise/railnoise.htm
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DUAP)
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Biodiversity	
	Principles for the use of Biodiversity Offsets in NSW (DECC 2008);
	OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State Significant Development (SSD) and State Significant Infrastructure (SSI) projects
	State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44)
	Draft Guidelines for Threatened Species Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* (DEC)
	Policy & Guidelines - Aquatic Habitat Management and Fish Conservation (NSW Fisheries)

	The NSW State Groundwater Dependent Ecosystem Policy (DLWC)
Visual	
	Control of Obtrusive Effects of Outdoor Lighting (Standards Australia, AS 4282)
	State Environmental Planning Policy No 64 - Advertising and Signage
Greenhouse Gas	
	AGO Factors and Methods Workbook (AGO)
	Guidelines for Energy Savings Action Plans (DEUS, 2005)
Heritage	
Aboriginal	Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC)
	NSW Heritage Manual (NSW Heritage Office & DUAP)
Non- Aboriginal	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)

Our reference: SF13/5645 DOC13/87638
Contact: Chris Burton 02 6022 0609

The Manager
Major Projects Assessment – Industry Projects
Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: David Mooney

Dear Mr Ritchie

Re Proposed Ethanol Plant at Deniliquin

I refer to your electronic mail dated 27 November 2013 to the Environment Protection Authority (EPA) seeking our requirements for the preparation of an Environmental Impact Statement (EIS) for the proposed ethanol plant at Deniliquin.

The EPA has considered the details of the project as outlined in the preliminary assessment report and provided at the planning focus meeting on 2 December 2013. The EPA's key information requirements for the project relate to the assessment of air, noise, water, waste and chemicals. The specific issues that we consider to be critical to an assessment of the proposed development include:

- Potential air quality and odour impacts from the ethanol production facility;
- Noise impacts from both the ethanol plant and the projected increase in traffic movements;
- Demonstration that the waste water reuse is sustainable in relation to hydraulic, nutrient, salt and organic loadings;
- Protection of ground waters through adequate design and construction of waste water storage and re-use systems; and
- Details on the off-site sales of wet distillers grain and solubles and contingencies for storage and management if the production of this product exceeds demand.

In addition to the key issues outlined above, Attachment A outlines supplementary information required by the EPA in order to adequately assess the project. In carrying out the assessment the applicant should refer to the relevant guidelines identified in Attachment B.

PO Box 544 Albury NSW 2640
Second Floor, Government Offices
512 Dean Street Albury NSW 2640
Tel: (02) 6022 0600 Fax: (02) 6022 0610
ABN 30 841 387 271
www.environment.nsw.gov.au

It is strongly recommended that the applicant consult with the EPA during the assessment period.

If you have any further enquiries about this matter please contact Chris Burton by telephoning 02 6022 0609.

Yours sincerely

BRIAN WILD 6 December 2013
Head Albury Unit
Environment Protection Authority

ATTACHMENT A

Environmental impacts of the project

The following environmental impacts of the project need to be assessed, quantified and reported on.

(a) Air;
(b) Noise;
(c) Water;
(d) Waste; and
(e) Chemicals.

The EIS should address how the required environmental outcomes and goals will be met for each impact. The EIS should also describe mitigation and management options that will be used to prevent, control, or abate identified environmental impacts associated with the project and to reduce risks to human health and prevent the degradation of the environment.

Impacts on air quality

The goal of the project in relation to air quality should be to ensure sensitive receptors are protected from any adverse impacts from dust and odour.

Odour is the primary concern from the ethanol plant production process and the management of ethanol plant wastes such as the treatment, storage and disposal of waste waters, and the storage and handling of wet distillers grain and solubles (WDGS).

Dust is also a concern with potential emissions including but not necessarily limited to construction, traffic movements, open exposed areas, and material processing and handling. Details would need to be provided on the proposed measures to manage dust from all sources.

Emissions from plant should meet the design criteria detailed in the *Protection of the Environment Operations (Clean Air) Regulation 2010*. Details need to be provided on the proposed air pollution control techniques, including proposed measures to manage and monitor efficiency and performance.

The EPA expects that an assessment for odour and dust be undertaken in accordance with our guidelines (as listed in Attachment B) and in conjunction with analyses of local meteorologic and terrain data in order to inform decisions about design and management options for the proposed development. This assessment should also identify all sensitive receptors within a minimum 5 kilometre radius of the proposed development.

Impacts of noise

The goal of the project should be to ensure the facility is designed, constructed, operated and maintained so that there are no adverse impacts from noise. The EPA expects that potential noise sources will be enclosed and that appropriate equipment is chosen to minimise noise levels. The development should be assessed and designed in accordance with the NSW Industrial Noise Policy (DEC, 2000). High noise generating activities should be limited to normal day time operating hours where possible.

The proposed development would see a significant increase in traffic movements along the Riverina Highway and other arterial and access roads to the proposed site. The potential noise impacts associated with these traffic increases needs to be assessed in accordance with the 'NSW Road Noise Policy (DECCW, 2011).

Impacts on water quantity and quality

The goal of the project should ensure:

- There is no pollution of waters (including surface and groundwater);
- Polluted water (including process waters, wash down waters, polluted stormwater or sewage) is captured on the site and collected, treated and beneficially reused, where this is safe and practicable to do so; and
- It is acceptable in terms of the achievement or protection of the River Flow Objectives and Water Quality Objectives.

The EIS should document the measures that will achieve the above outcomes.

The EPA recommends that a water balance be prepared to model water management through the entire life cycle of the ethanol production facility. This water balance should also quantify all waste water streams and characterise the quality of these waste waters. Proposed water pollution controls should be identified.

Details should be provided in regards to access to a suitable water supply and the storage of this supply in periods where access is limited. Design of the proposed storage dams needs to consider reducing evaporative losses and the prevention of seepage losses to groundwater.

The EIS needs to include a hydro-geological assessment of potential groundwater impacts from the storage of waste waters and proposed irrigation of the waste water. This should include details of the design and location of all water storages.

Waste

The goal of the development should ensure:

- It is in accordance with the principles of the waste hierarchy and cleaner production;
- The handling, processing and storage of all materials used at the premises does not have negative environmental or amenity impacts;
- The beneficial reuse of all wastes generated at the premises are maximised where it is safe and practical to do so; and
- No waste disposal occurs on site except in accordance with an Environment Protection Licence.

The EIS should describe the management strategies for the treatment and disposal/utilisation of all liquid and solid wastes generated by the proposed activities.

In relation to the proposed irrigation of waste waters, the EIS must describe the proposed management regime as well as demonstrate that the land available can sustainably assimilate the organic, nutrient, hydraulic and salt loads from the waste.

The EIS must provide details of the proposed management of the WDGS co-product from the ethanol production process including estimated quantities produced and proposed treatment, storage, and handling methods. If the product is to be sold off site the EIS needs to demonstrate that sufficient demand exists in the local market and outline contingencies should other disposal methods be required.

Chemicals

The goal of the project should ensure that environmental risks from hazardous chemicals and chemical waste are minimised. The EIS needs to identify the proposed type, quantity and location of chemicals to be stored on site. Spill management measures, including items such as bunding, and emergency procedures should be clearly outlined.

ATTACHMENT B

Guidance Material

Assessing Environmental Impacts

Air quality

- *Protection of the Environment Operations (Clean Air) Regulation 2010*
- Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DECC, 2005). Available online http://www.epa.nsw.gov.au/resources/air/07001amsaap.pdf
- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DECC, 2005). Available online http://www.epa.nsw.gov.au/resources/air/ammodelling05361.pdf
- Technical framework: Assessment and Management of Odour from Stationery Sources in NSW (DECC, 2006). Available online http://www.epa.nsw.gov.au/resources/air/20060440framework.pdf
- Technical notes Assessment and management of odour from stationary sources in NSW (DECC, November 2006). Available online http://www.epa.nsw.gov.au/resources/air/20060441notes.pdf
- Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia', March 2011. Available online http://www.epa.nsw.gov.au/resources/air/CALPUFFModelGuidance.pdf

Greenhouse gases

- Draft Guidelines: Energy and Greenhouse in EIA (DoP, 2002)

Factors and Methods Workbook (AGO, 2006)

Noise and vibration

- NSW Industrial Noise Policy (DECC, 2000). Available online http://www.epa.nsw.gov.au/resources/noise/ind_noise.pdf
- Appendices - NSW Industrial Noise Policy. Available online http://www.epa.nsw.gov.au/resources/noise/ind_noise_app.pdf
- NSW Road Noise Policy (DECCW, 2011) Available online http://www.epa.nsw.gov.au/resources/noise/2011236nswroadnoisepolicy.pdf
- Assessing Vibration: a technical guideline (DECC, 2006) Available online http://www.epa.nsw.gov.au/resources/noise/vibrationguide0643.pdf

Interim Noise Construction Guideline (DECCW, 2009). Available online http://www.epa.nsw.gov.au/resources/noise/09265cng.pdf

Water quality

- National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000)
- National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ, 2000)
- Using the ANZECC Guidelines and Water Quality Objectives in NSW (DECC, 2006)

Groundwater

- The NSW State Groundwater Policy Framework Document (DLWC, 1997)
- The NSW State Groundwater Quality Protection Policy (DLWC, 1998)
- The NSW State Groundwater Dependent Ecosystems Policy (DLWC, 2002)
- National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC, 1995)

Stormwater

- Managing Urban Stormwater: Soils and Construction (Landcom, 2004)
- Managing Urban Stormwater: Treatment Techniques (Draft) (DECC, 1997)

Wastewater

- Environmental Guidelines: Use of Effluent by Irrigation (DECC, 2004). Available online http://www.environment.nsw.gov.au/resources/water/effguide.pdf
- Effluent Management Guidelines for Intensive Piggeries in Australia (ANZECC, 1999). Available online http://www.environment.gov.au/water/publications/quality/pubs/intensive-piggeries-australia-paper17.pdf
- National Water Quality Management Strategy - Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) - November 2006. Available online http://www.environment.gov.au/water/publications/quality/pubs/water-recycling-guidelines-health-environmental-21.pdf

Waste

- Environmental Guidelines: Composting and Related Organics Processing Facilities (DECC, 2004). Available online http://www.epa.nsw.gov.au/resources/waste/envguidlns/composting_guidelines.pdf
- Technical guidelines: Bunding and Spill Management (DECC, 1997). Available online http://www.epa.nsw.gov.au/mao/bundingspill.htm
- Waste Classification Guidelines, Part 1: Classifying Waste, December 2009. Available online http://www.epa.nsw.gov.au/resources/waste/091216classifywaste.pdf

David Mooney - Deniliquin ethanol - DGR's

From: Greg Paine <greg.paine@trade.nsw.gov.au>
To: <david.mooney@planning.nsw.gov.au>
Date: 17/12/2013 9:05 AM
Subject: Deniliquin ethanol - DGR's
CC: <wayne.jones@trade.nsw.gov.au>

David,
Response by Department of Primary Industries below.
However - I am still waiting on some comment from Agriculture NSW □ I should get that later this morning and will send through.
All will follow under formal DPI letterhead shortly.
Greg Paine
Business Services
Tel: 9338 6778

Comment by the NSW Office of Water

The NSW Office of Water requests the Environmental Impact Statement address the following key issues, and the detailed list of assessment requirements in Attachment A:

1. Adequate and secure water supply for the proposal. Confirmation that water supplies for construction and operation are sourced from an appropriately authorised and reliable supply. It is requested the proponent demonstrate the ability to obtain the proposed water requirement of approximately 445 ML/year.

2. Identification of site water demands, water sources (surface and groundwater), water disposal methods and water storage structures in the form of a water balance. The water balance is to outline the proposed water management on the site and to also include details of any water reticulation infrastructure that supplies water to and within the site.

3. An impact assessment on adjacent licensed water users (surface and groundwater), riparian ecosystems and groundwater-dependent ecosystems. This is to meet the requirements of relevant state policy including the Aquifer Interference Policy in addition to the objects and principles of the *Water Management Act 2000*. Refer: http://www.water.nsw.gov.au/Water-management/Law-and-Policy/default.aspx

4. A description and assessment of any potential requirement to intercept groundwater, including predicted dewatering volumes, zone of drawdown and associated impact, water quality and disposal methods.

5. An impact assessment of the construction and operation of the waste water management system with specific regard to surface water and groundwater quality and quantity management.

6. An assessment of any proposed modification to surface water management including modelling of redistribution of waters and an assessment of impact on neighbouring properties and the associated watercourse and floodplain.

7. Identification of any proposed pipelines to the site and an impact assessment of proposed watercourse crossings for both the pipeline and any permanent or temporary vehicle crossings.

8. Existing and proposed water licensing requirements in accordance with the *Water Act 1912* and *Water Management Act 2000*. This is to demonstrate that existing licences (include licence numbers) and licensed uses are appropriate, and to identify where additional licences are proposed.

9. Adequate mitigating and monitoring requirements to address surface water and

groundwater impacts.

The proposal is located within the Water Sharing Plan (WSP) for the Lower Murray Shallow Groundwater Source, the WSP for the NSW Murray Darling Basin Fractured Rock Groundwater Sources and the WSP for the Murray Unregulated and Alluvial Water Sources. The project is also indicating the need to acquire High Security entitlement from the regulated Murray River which is administered by the WSP for the NSW Murray and Lower Darling Regulated Rivers Water Sources. Any requirement for additional groundwater or surface water entitlement will need to be obtained through purchase and trade in accordance with these plans. These plans can be accessed at:
http://www.water.nsw.gov.au/Water-management/Water-sharing/default.aspx
For further information please contact Tim Baker, Senior Water Regulation Officer (Dubbo office) on 6841 7403, or at: Tim.Baker@water.nsw.gov.au.

Comment by Fisheries NSW

Fisheries NSW advise no issues.

For further information please contact Luke Pearce, Fisheries Conservation Manager (Albury office) on 6042 4213, or at: luke.pearce@dpi.nsw.gov.au.

Comment by Crown Lands

Crown Lands advise no issues.

For further information please contact Rebecca Johnson, Coordinator Client Services (Newcastle office) on 4920 5040, or: ebecca.johnson@lands.nsw.gov.au.

Attachment A
Deniliquin Ethanol Plant (SSD 13_6281)
Request for Input into Director General Requirements
Additional comment by the NSW Office of Water

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1. Relevant Legislation

The assessment is required to take into account the requirements of the following legislation (administered by the NSW Office of Water), as applicable:

- *Water Management Act 2000 (WMA 2000).*
- *Water Act 1912.*

In particular, proposals and management plans should be consistent with the Objects (s.3) and Water Management Principles (s.5) of the *WMA*.

2. Water Sharing Plans

Gazetted Water Sharing Plans (WSPs) prepared under the provisions of the *WMA* establish rules for access to, and the sharing of water between the environmental needs of the surface or groundwater source and water users. If the proposal is within a gazetted WSP area the assessment is required to demonstrate how the proposal is consistent with the relevant access and trading rules of the WSP. Refer to: http://www.water.nsw.gov.au/Water-Management/Water-sharing/default.aspx The following WSPs are relevant to the site.

- *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2012*
- *Water Sharing Plan for the Murray and Lower Darling Regulated River Water Sources 2003*
- *Water Sharing Plan for the Lower Murray Shallow Groundwater Source 2012*
- *Water Sharing Plan for the Murray Unregulated and Alluvial Water Sources 2012*

3. Relevant Policies

The assessment is required to take into account the following NSW Government policies, as applicable:

- *NSW Aquifer Interference Policy (2012)*
- *NSW Groundwater Policy Framework Document ? General (August 1997)*
- *NSW Groundwater Quality Protection Policy (1998)*
- *NSW State Groundwater Dependent Ecosystem Policy (2002)*
  - ? *NSW State Rivers and Estuaries Policy (1993)*
  - ? *NSW Sand and Gravel Extraction Policy for Non-Tidal Rivers (1992)*
  - ? *NSW Wetlands Policy (2010)*

These documents can be found at:
http://www.water.nsw.gov.au/Water-Management/Law-and-Policy/Key-policies/default.aspx

4. Guidelines

The assessment is required to take into account the following guidelines as applicable:

? *Australian Groundwater Modelling Guidelines (2012)*
? *MDBC Guidelines on Groundwater Flow Modelling (2000)*
? *Guidelines for the Assessment and Management of Groundwater Contamination (2007)*
? *Guidelines for Controlled Activities on Waterfront Land*:
- Riparian corridors (and associated Vegetation Management Plans)
- Watercourse crossings
- Laying pipes and cables in watercourses
- Outlet structures
- In-stream works

These documents can be found at:

? http://www.water.nsw.gov.au/Water-Licensing/Approvals/Controlled-activities/default.aspx
? http://archive.nwc.gov.au/library/waterlines/82

5. Groundwater

The Office of Water is responsible for the management of groundwater resources so they can sustain environmental, social and economic uses for the people of New South Wales.

Groundwater Source

The assessment is required to identify groundwater issues and potential degradation to the groundwater source and provide the following:

- Details of the predicted highest groundwater table at the development site.
- Details of any works likely to intercept, connect with or result in pollutants infiltrating into the groundwater sources.
- Details of any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Describe the flow directions and rates and the physical and chemical characteristics of the groundwater source.
- Details of the predicted impacts of any final landform on the groundwater regime.
- Details of the existing groundwater users within the area (including the environment) and include details of any potential impacts on these users.
- Assessment of the quality of the groundwater for the local groundwater catchment.
- Details of how the proposed development will not potentially diminish the current quality of groundwater, both in the short and long term.
- Details on preventing groundwater pollution so that remediation is not required.
- Quantification of impacts on groundwater dependent ecosystems (GDEs).
- Details on protective measures to minimise any impacts on groundwater dependent ecosystems.
- Details of proposed methods of the disposal of waste water and approval from the relevant authority.
- Assessment of the potential for saline intrusion of the groundwater and measures to prevent such intrusion into the groundwater aquifer.
- Details of the results of any models or predictive tools used to predict groundwater drawdown, inflows to the site and impacts on affected water sources.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Details of any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- Description of the remedial measures or contingency plans proposed.

Licensing

- All proposed groundwater works, including bores for the purpose of investigation, extraction, dewatering, testing or monitoring must be identified in the proposal and an approval obtained from the Office of Water prior to their installation. Approved SSD and SSI projects may be excluded from the requirement for approvals due to Section 89J and 115ZG of the *Environmental Planning and Assessment Act 1979.*

- All predicted groundwater take must be accounted for through adequate licensing.

Groundwater Dependent Ecosystems (GDEs)

The assessment is required to identify any impacts on GDEs. GDEs are ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater. GDEs represent a vital component of the natural environment. GDEs can vary dramatically in how they depend on groundwater from having occasional or no apparent dependence through to being entirely dependent. GDEs occur across both the surface and subsurface landscapes ranging in area from a few metres to many kilometres. Increasingly, it is being recognised that surface and groundwaters are often interlinked and aquatic ecosystems may have a dependence on both.

Ecosystems that can depend on groundwater and that may support threatened or endangered species, communities and populations, include:

- Terrestrial vegetation that show seasonal or episodic reliance on groundwater.
- River base flow systems which are aquatic and riparian ecosystems in or adjacent to streams/rivers dependent on the input of groundwater to base flows.
- Aquifer and cave ecosystems.
- Wetlands.
- Estuarine and near-shore marine discharge ecosystems.
- Fauna which directly depend on groundwater as a source of drinking water or that live within water which provide a source.

The *NSW Aquifer Interference Policy* and the *NSW Groundwater Dependent Ecosystem Policy* provide guidance on the protection and management of GDEs, and set out management objectives and principles to:

- Ensure the most vulnerable and valuable ecosystems are protected.
- Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity.
- Ensure sufficient groundwater of suitable quality is available to ecosystems when needed.
- Ensure the *precautionary principle* is applied to protect GDEs, particularly the dynamics of flow and availability and the species reliant on these attributes.

A number of gazetted WSPs list and map high priority GDEs and set out the management strategies and actions for sharing and protecting groundwater quality, quantity and dependent ecosystems. As indicated above, any GDEs that may be affected significantly need to be clearly identified and the impacts quantified to enable proper assessment.

6. Surface Water

The Office of Water is responsible for the management of rivers, estuaries, wetlands and adjacent riverine plains so they can sustain environmental, social and economic uses for the people in New South Wales.

Watercourse/Riparian

The assessment is required to consider the impact of the proposal on the watercourses and associated riparian vegetation within the site and provide the following:

- Identify the sources of surface water.
- Details of stream order (using the Strahler System).
- Details of any proposed surface water extraction, including quantity, purpose, location of existing pumps, dams, diversions, cuttings and levees.
- Details of available surface water licences that could be purchased to account for any proposed extractions.
- Detailed description of any proposed development or diversion works including all construction, clearing, draining, excavation and filling.
- An assessment of the impacts of the proposed methods of excavation, construction and material placement on the watercourse and associated vegetation.
- A detailed description of all potential water related environmental impacts of any proposed development in terms of riparian vegetation, sediment movement, water quality and hydrologic regime.
- A description of the design features and measures to be incorporated into any proposed development to guard against anything more than minimal long term actual and potential environmental disturbances, particularly in respect of maintaining the natural hydrologic regime and sediment movement patterns and the identification of riparian buffers. (See note below)
- Details of the impact on water quality and remedial measures proposed to address more than

minimal adverse effects.

Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. The protection or restoration of vegetated riparian areas is important to maintain or improve the geomorphic form and ecological functions of watercourses through a range of hydrologic conditions in normal seasons and also in extreme events. Refer to NSW Office of Water *Guidelines for Controlled Activities* (July 2012) - available at: http://www.water.nsw.gov.au/Water-Licensing/Approvals/Controlled-activities/default.aspx

Water Management Structures/Dams

The Office is responsible for the management and licensing of these structures under water legislation. If the proposal includes existing or proposed water management structures/dams, the assessment should provide information on the following:

- Date of construction (for existing structure/s).
- Details of the legal status/approval for existing structure/s.
- Details of any proposal to change the purpose of existing structure/s.
- Details if any remedial work is required to maintain the integrity of the existing structure/s.
- Clarification if the structure/s is on a watercourse.
- Details of the purpose, location and design specifications for the structure/s.
- Size and storage capacity of the structure/s.
- Calculation of the Maximum Harvestable Right Dam Capacity (MHRDC) for the site.
- Details if the structure/s is affected by flood flows.
- Details of any proposal for shared use, rights and entitlement of the structure/s.
- Details if the proposed development/subdivision has the potential to bisect the structure/s.

NSW Office of Water s *Farm Dams Assessment Guide* provides details on harvestable rights and the calculation of the MHRDC. Refer to: http://www.water.nsw.gov.au/Water-Licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff/default.aspx

7. Basic Landholder Rights

The *WMA* identifies Basic Landholder Rights (BLRs) for access to water whereby landholders over an aquifer or with river or lake frontage can access water for domestic (household) purposes or to water stock without the need for a water licence (although a works approval may still be required for a bore utilising BLR). Pipeline constructions and easements may therefore affect existing BLR users and therefore all potentially affected BLR users need to be identified and the impacts quantified.

8. Sustainable Water Supply

Competition for water in NSW is extremely high. In areas where a Water Sharing Plan (WSP) has commenced, a long term average extraction limit has been established which constrains overall growth in extractions in an area. In these areas there are limited types of new licenses that can be issued, for example for aboriginal cultural purposes or growth in town water supplies. Therefore in most instances new enterprises are required to enter the water market to purchase adequate water licences to meet their water demand requirements.

In areas where a WSP has not yet commenced, the NSW Government has established embargoes on applying for new licences. There are limited exemptions in some areas which need to be considered and applied for by a proponent. If an exemption does not apply, then again new enterprises need to enter the water market to purchase the required water licences. In some areas where a WSP has not yet commenced, there is still available water and the proponent may be able to apply for a new licence to account for the water taken from that water source.

The onus is on the proponent to assess which of the above is relevant and identify the potential sources of water of an appropriate reliability and quantity to meet their water supply requirements. The water supply requirements and potential water available should be identified in the EIS to enable NOW to assess the viability of the water supply required. Assurances should also be made that the proponent will enter the water market as required.

Therefore the assessment is required to address the issue of provision of a sustainable water supply for any project proposal. The assessment should include Water Management Plans detailing how a sustainable water supply can be sourced and implemented. Through the implementation of BASIX, Integrated Water Cycle Management and Water Sensitive Urban Design, any proposed development should also exhibit high water use efficiency.

End Attachment A

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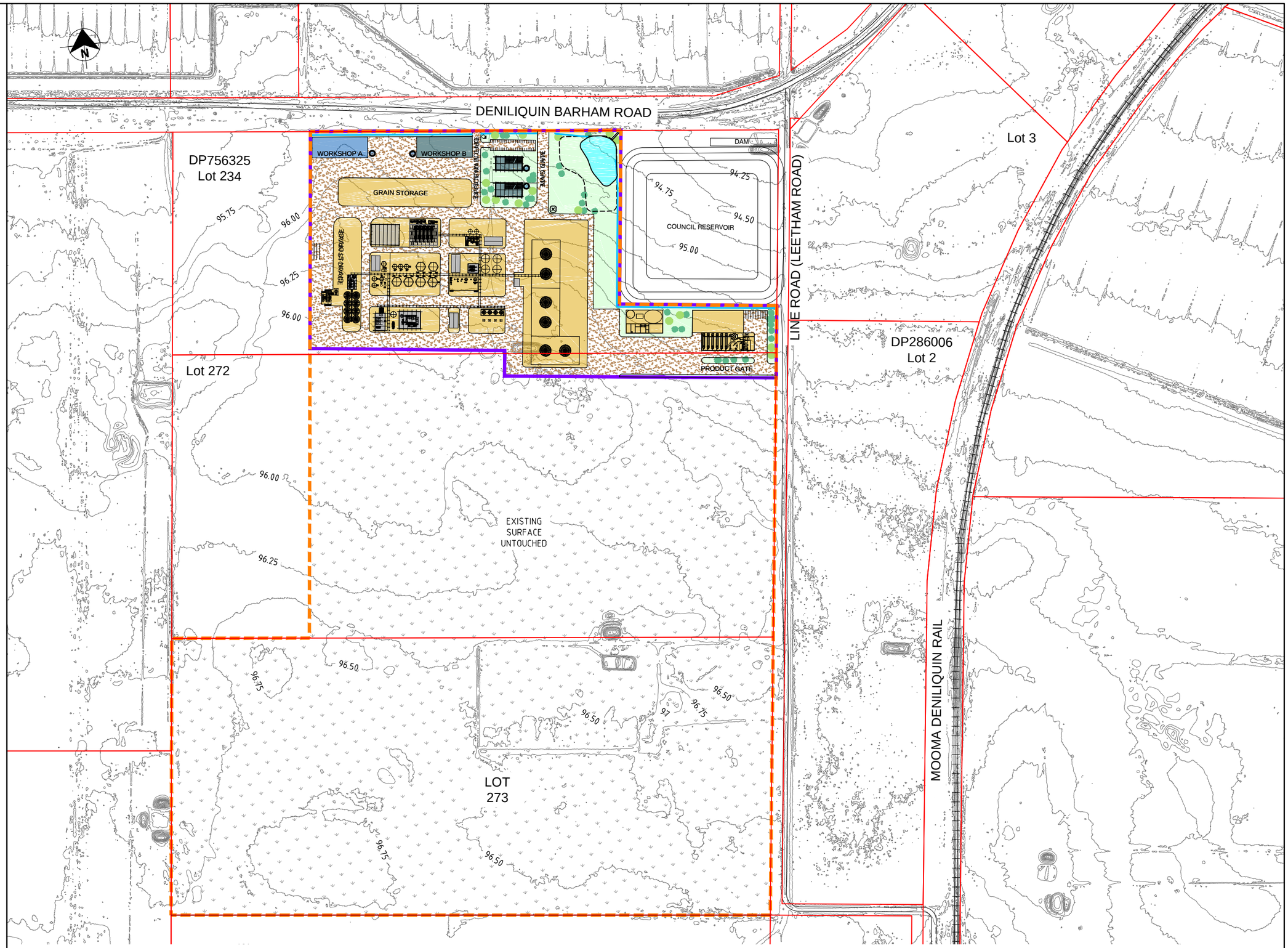
individual sender, and are not necessarily the views of their organisation.

Appendix B

Proposed Project Site Layout

LEGEND

- CADASTRAL BOUNDARY
- 95 EXISTING CONTOURS
- ROADWAY
- SITE BOUNDARY
- PROJECT BOUNDARY
- PAVEMENT AREA
- HARDSTAND AREA
- ROOFWATER CATCHMENT
- BIO-RETENTION BASIN
- VEGETATED SWALE
- STORMWATER HOLDING TANK
- LANDSCAPING
- RAIN HARVESTING TANK
- FLOOD DETENTION BASIN



NOT FOR CONSTRUCTION

This drawing is confidential and shall only be used for the purposes of this project.

No.	BY	DATE	DESCRIPTION	APPD
05	PM	21.08.15	EIS	
04	PM	14.08.15	FOR CLIENT REVIEW	
03	PM	11.08.15	FOR CLIENT REVIEW	
02	AR	07.08.15	FOR CLIENT REVIEW	
01	AR	26.05.15		

REVISIONS

Scale

SCALE 0 50000 100000 150000mm
1:6000 (A3) 1:3000 (A1)

THE SIGNING OF THIS TITLE BLOCK CONFIRMS THE DESIGN AND DRAFTING OF THIS PROJECT HAVE BEEN PREPARED AND CHECKED IN ACCORDANCE WITH THE AECOM QUALITY ASSURANCE SYSTEM TO ISO 9001-2000

DESIGNED		CHECKED	
DRAWN	AR	CHECKED	MB
APPROVED		DATE	

AECOM

RPEQ No.
AECOM Australia Pty Ltd A.B.N. 20 093 846 925

DENILIQUIN ETHANOL PLANT ENV

SITE LAYOUT

Status: CONCEPT DESIGN

Drg No. 60344248-0001-CI-DW

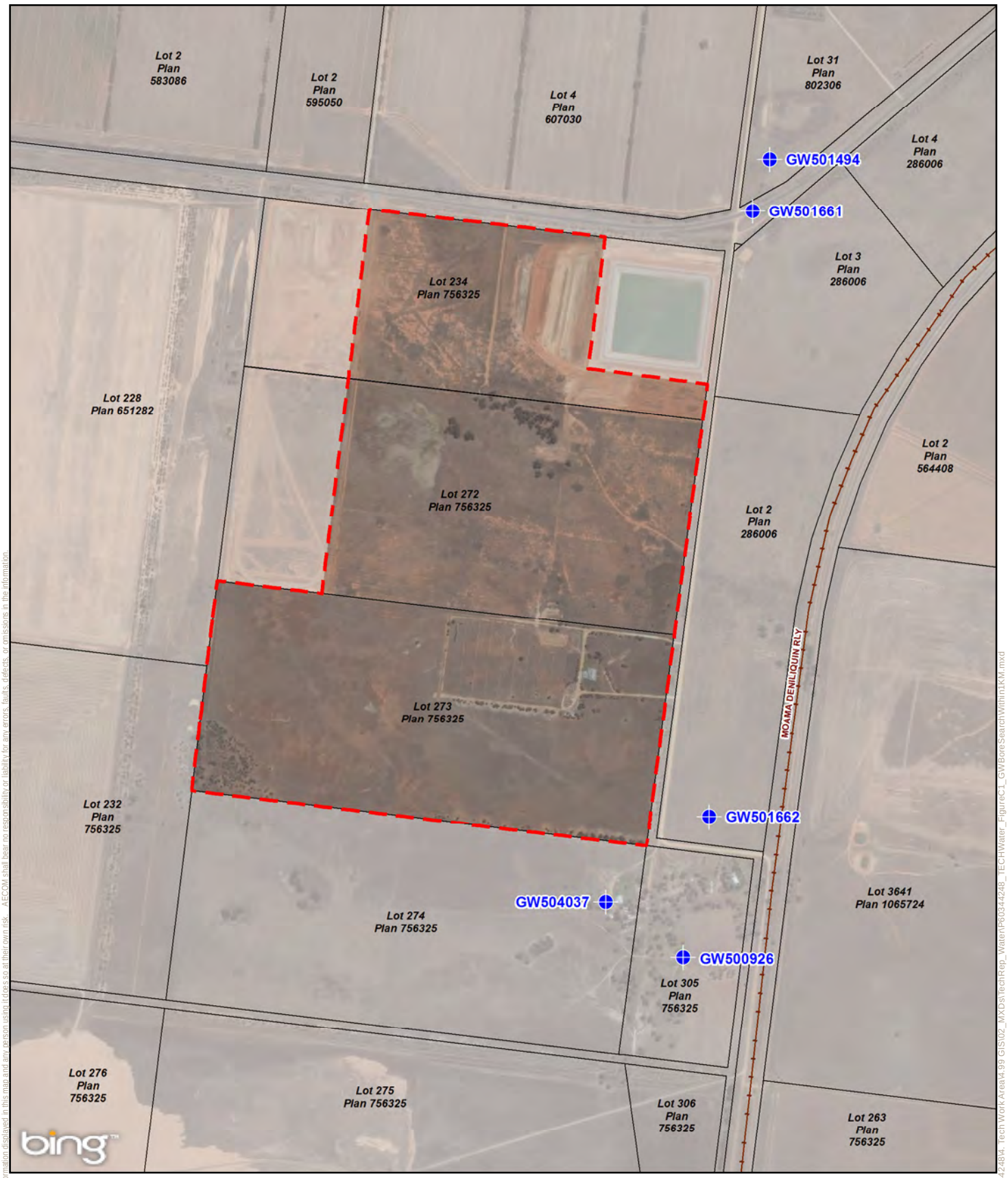
Rev. 05

LAST MODIFIED: 19/11/2015 5:38 PM
CAD REF: P:\603X\60344248\S CAD\28-SHEETS\60344248-0001-CI-DW.DWG

Appendix C

NOW Groundwater Database Search Results

Groundwater Bore Search within 1 km



LEGEND

- Groundwater Bore
- Railway (existing)
- Cadastral Boundaries
- Project Site

Data Sources:
1.Imagery: © 2015 DigitalGlobe © 2015 GeoEye Earthstar Geographics SIO © 2015 Microsoft Corporation
2. Roads, Railway, Drainage, Suburbs, Parks, Localities: @ Street Pro, 2011
3. Key Map Base Layer: ESRI Online
4. Registered Groundwater Bores: NSW

AECOM
www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 55

N 0 50 100 150
Metres

FIGURE C1

A4

D R A F T

Table C1: Summary of Bore search within 1km of the Project Site

Bore ID	Depth of Bore (m)	Standing Water Level(m)	Distance to study area	Closest lot of study area	Purpose	Geology (m BGL)		
GW500926	114.00	23.20	850m south east	Lot 273	Water Supply (domestic /stock)	0.00	4.00	CLAY
						4.00	5.00	CLAY
						5.00	9.00	SAND
						9.00	33.00	CLAY
						33.00	36.00	SAND
						36.00	48.00	CLAY
						48.00	54.00	SAND
						54.00	66.00	CLAY
						66.00	67.00	SAND
						67.00	70.00	CLAY
						70.00	75.00	SAND
						75.00	101.00	SAND
						101.00	103.00	CLAY
						103.00	105.00	SAND
						105.00	108.00	SAND
						108.00	112.00	SAND
						112.00	126.00	SAND
						126.00	130.00	CLAY
						130.00	133.00	SAND
GW501494*	21.00	12.41	750m north east	Lot 234	Unknown	Unknown	Unknown	Unknown
GW501661*	21.00	11.23	700m north east	Lot 234	Unknown	Unknown	Unknown	Unknown
GW501662*	17.70	15.26	700m south east	Lot 273	Unknown	Unknown	Unknown	Unknown
GW504037	39.00	16.00	600m south east	Lot 273	Water Supply (domestic /stock	0.00	1.00	TOPSOIL
						1.00	7.00	CLAY
						7.00	11.00	SAND
						11.00	32.00	CLAY
						32.00	34.00	SAND
						34.00	35.00	CLAY
						35.00	40.00	SAND
						40.00	41.00	CLAY

* These bores have ongoing monitoring data. The SWL provided in the table is an average of monitoring data available

NSW Office of Water
Work Summary

GW500926

Licence: 50WA510064 **Licence Status:** CANCELLED

Authorised Purpose(s): DOMESTIC,STOCK
Intended Purpose(s): J, C

Work Type:
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:** 114.00 m
Completion Date: 08/07/2000 **Drilled Depth:** 133.00 m

Contractor Name: Watson Drilling
Driller:
Assistant Driller:

Property: BARKOHAN LOT 305 LINE ROAD DENILIQUIN 2710 **Standing Water Level:** 23.200
GWMA: 016 **Salinity:**
GW Zone: **Yield:** 3.000

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	TOWNS	TOWNS.081	305 DP756325
Licensed:	TOWNSEND	SOUTHDEN	Whole Lot 305//756325

Region: 50 - Murray **CMA Map:**
River Basin: - Unknown **Grid Zone:** ? **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6061660.0 **Latitude:** 35°34'14.3"S
Elevation Source: **Easting:** 310453.0 **Longitude:** 144°54'30.0"E

GS Map: - **MGA Zone:** 55 **Coordinate Source:**

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Pvc Class 12	0.00	60.00	125			Welded
1	1	Casing	Pvc Class 12	60.00	109.50	100			Welded
1	1	Opening	Screen - Wire Wound	109.50	110.50	100		1	Stainless Steel, Welded, A: 1.50mm
1	1	Opening	Screen - Wire Wound	110.50	112.00	100		1	Stainless Steel, Welded, A: 1.75mm
1	1	Casing	Pvc Class 12	112.00	114.00	100			Welded

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
109.00	112.00	3.00	Unknown						

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	4.00	4.00	clay grey	Clay	
4.00	5.00	1.00	clay brown and grey	Clay	
5.00	9.00	4.00	sand grey brown	Sand Grains (Lithic)	
9.00	33.00	24.00	clay light grey and brown	Invalid Code	
33.00	36.00	3.00	sand fine brown	Sand	
36.00	48.00	12.00	clay grey and brown	Clay	
48.00	54.00	6.00	sand brown	Sand	
54.00	66.00	12.00	clay brown and grey	Clay	
66.00	67.00	1.00	sand brown	Sand	
67.00	70.00	3.00	clay brown	Clay	

70.00	75.00	5.00	sand fine brown	Sand	
75.00	101.00	26.00	sand grey medium dirty	Sand Grains (Lithic)	
101.00	103.00	2.00	clay grey	Clay	
103.00	105.00	2.00	sand grey	Sand Grains (Lithic)	
105.00	108.00	3.00	sand fine grey dirty	Sand	
108.00	112.00	4.00	sand coarse grey	Sand	
112.00	126.00	14.00	sand yellow grey dirty	Sand	
126.00	130.00	4.00	clay white soft	Clay	
130.00	133.00	3.00	sand medium Renmark	Sand	

Remarks

***** End of GW500926 *****

NSW Office of Water
Work Summary

GW501494

Licence:
Licence Status:

Authorised Purpose(s):
Intended Purpose(s):

Work Type:
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 20/11/2000
Final Depth: 21.00 m
Drilled Depth: 21.00 m

Contractor Name:
Driller:
Assistant Driller:

Property:
GWMA:
GW Zone:
Standing Water Level:
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 50 - Murray
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone: ?
Scale:

Elevation: 94.68 m (A.H.D.)
Elevation Source:
Northing: 6063505.0
Easting: 310653.0
Latitude: 35°33'14.6"S
Longitude: 144°54'39.5"E

GS Map: -
MGA Zone: 55
Coordinate Source:

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Fibreglass	0.00	19.80				
1	1	Opening	Slots	19.80	21.00			1	

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

07/10/2004: Form A Remarks:
Deni Bore DB134
09/12/2009: Updated details as per existing data.

***** End of GW501494 *****

NSW Office of Water
Work Summary

GW501661

Licence: **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s):

Work Type:
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:** 21.00 m
Completion Date: 30/11/2003 **Drilled Depth:** 21.00 m

Contractor Name:
Driller:
Assistant Driller:

Property: **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 50 - Murray **CMA Map:**
River Basin: - Unknown **Grid Zone:** ? **Scale:**
Area/District:

Elevation: 93.98 m (A.H.D.) **Northing:** 6063385.0 **Latitude:** 35°33'18.4"S
Elevation Source: **Easting:** 310613.0 **Longitude:** 144°54'37.8"E

GS Map: - **MGA Zone:** 55 **Coordinate Source:**

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Fibreglass	0.00	19.80				
1	1	Opening	Slots	19.80	21.00			1	

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

11/11/2004: Form A Remarks:
deniboota Bore 134
09/12/2009: Updated details as per existing data.

***** End of GW501661 *****

NSW Office of Water
Work Summary

GW501662

Licence: **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s):

Work Type:
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:** 17.70 m
Completion Date: 30/11/2003 **Drilled Depth:** 17.70 m

Contractor Name:
Driller:
Assistant Driller:

Property: **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 50 - Murray **CMA Map:**
River Basin: - Unknown **Grid Zone:** ? **Scale:**
Area/District:

Elevation: 96.32 m (A.H.D.) **Northing:** 6061985.0 **Latitude:** 35°34'03.8"S
Elevation Source: **Easting:** 310513.0 **Longitude:** 144°54'32.7"E

GS Map: - **MGA Zone:** 55 **Coordinate Source:**

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Fibreglass	0.00	17.10				
1	1	Opening	Slots	17.10	17.70			1	

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

11/11/2004: Form A Remarks:
Deniboota bore 135
09/12/2009: Updated details as per existing data.

***** End of GW501662 *****

NSW Office of Water
Work Summary

GW504037

Licence: 50WA506993 **Licence Status:** CURRENT

Authorised Purpose(s): DOMESTIC,STOCK
Intended Purpose(s): J, C

Work Type:
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 12/10/2009

Final Depth: 39.00 m
Drilled Depth: 41.00 m

Contractor Name: Watson Drilling
Driller:
Assistant Driller: Ian Wade

Property: N/A (LAVARS) 144 LEETHAM ROAD DENILIQUIN 2710 NSW
GWMA: 016
GW Zone:

Standing Water Level: 16.000
Salinity:
Yield: 3.400

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	TOWNS	TOWNS.81	274//756325
Licensed:	TOWNSEND	SOUTHDEN	Whole Lot 274//756325

Region: 50 - Murray
River Basin: 409 - MURRAY RIVERINA
Area/District:

CMA Map: 7826-N
Grid Zone: ?
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source:

Northing: 6061788.0
Easting: 310274.0

Latitude: 35°34'10.0"S
Longitude: 144°54'23.0"E

GS Map: -

MGA Zone: 55

Coordinate Source: Google Earth

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Pvc Class 12	0.00	32.00	125			seated, Screwed and Glued, S: 38.00-39.00m
1	1	Opening	Screen - Wedge Wire	32.00	38.00	125		1	Stainless Steel 304, Other
1	1	Casing	Pvc Class 12	38.00	39.00	125			seated, Screwed and Glued

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
32.00	38.00	6.00	Unknown	16.00		3.40			3500.00

Geologists Log
Drillers Log

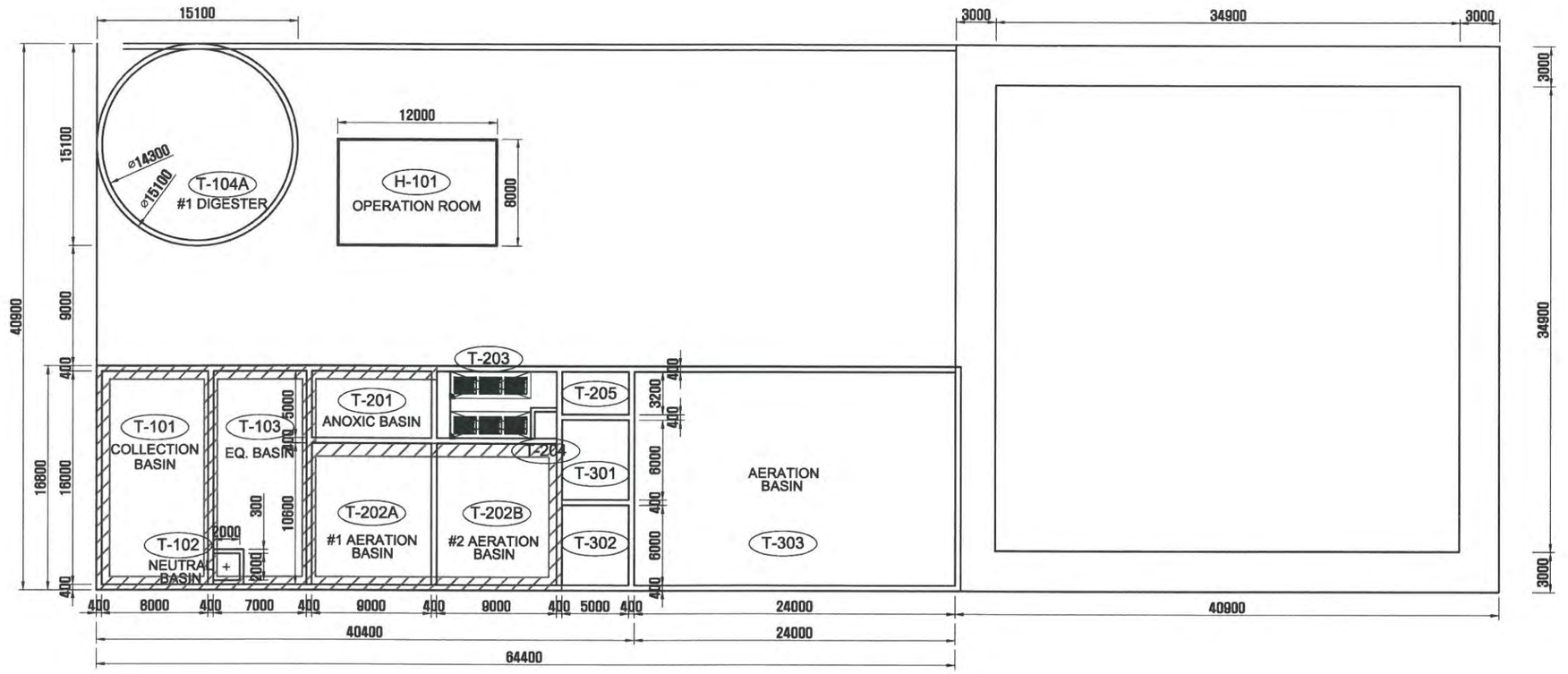
From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	Topsoil, clay, brown	Topsoil	
1.00	7.00	6.00	Clay, brown	Clay	
7.00	11.00	4.00	Sand fine, brown	Sand Grains (Lithic)	
11.00	32.00	21.00	Clay, brown	Clay	
32.00	34.00	2.00	Sand, medium grey gml	Sand	
34.00	35.00	1.00	Clay, gritty layered, grey pml	Clay	
35.00	40.00	5.00	Sand medium lightly clayted, grey mml	Sand Grains (Lithic)	
40.00	41.00	1.00	Clay gritty, brown grey	Clay Loam	

Remarks

12/10/2009: Form A Remarks:
Entered by Clare Hillier

Appendix D

On-site Wastewater Treatment Process



TAG NO.	EQ. NAME	DIMENSION	Q'Ty	VOL(㎥)	RT(hr)
T-101	COLLECTION BASIN	8000 × 16000 × 5500H(5000D)	1	704[640]	10.6
T-102	NEUTRALLIZATION BASIN	2000 × 2000 × 3200H(2700D)	1	12.8[10.8]	11min
T-103	EQUALIZATION BASIN	6000 × 16000 × 5500H(5000D)	1	528[480]	7.9
T-104	#1,2 ANAEROBIC FILTER	Φ14300 × 11000H(10000D)	1	1776[1606]	1.2d
T-201	ANOXIC BASIN	5000 × 10000 × 5500H(4700D)	1	275[235]	3.9
T-202A/B	AERATION BASIN	10000 × 10600 × 5500H(4600D)	2	1166[975.2]	16.1
T-203	MBR BASIN	5000 × 10000 × 5500H(4600D)	1	275[230]	3.9

TAG NO.	EQ. NAME	DIMENSION	Q'Ty	VOL(㎥)	RT(d)
T-204A/B	MBR CLEANING BASIN	1650 × 2000 × 2400H(-)	1	-	-
T-205	SLUDGE STORAGE BASIN	3200 × 5500 × 5500H(5000D)	1	96.8[88]	-
T-301	INTERMIDIATE BASIN	5500 × 6000 × 5500H(5000D)	1	181.5[165]	-
T-302	REUSING BASIN	5500 × 6000 × 5500H(5000D)	1	181.5[165]	-
T-303	AERATION BASIN	16000 × 25000 × 5000H	1	2000 (30day)	-
H-101	OPERATION ROOM	8000 × 12000 × 9000H	1	2nd FLOOR	-
					-

PROJECT TITLE: Deniliquin Ethanol Plant

CLIENT: DONGMUN I.R.S. CO., Ltd

ENGINEERING BY:

DWG. TITLE: **LAY-OUT**

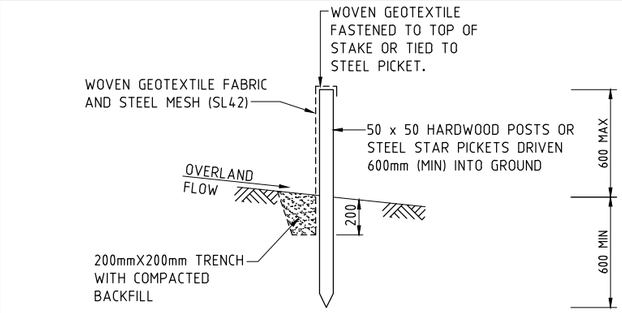
SCALE | REV. △ | DATE

CUST NO. - | DWG NO.

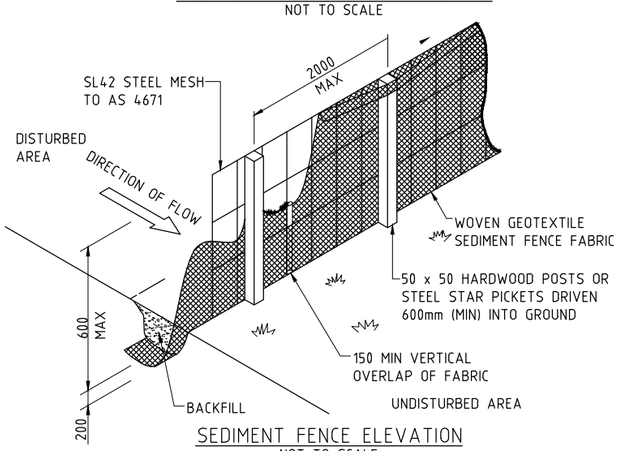
CH NO. -

Appendix E

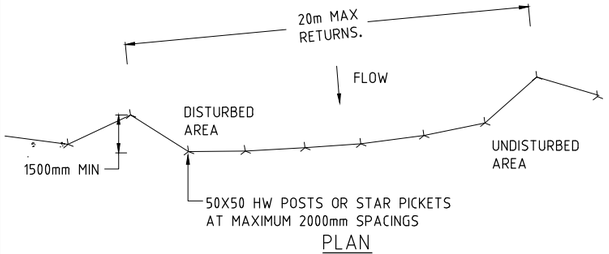
Conceptual Erosion and Sediment Control Plan



SEDIMENT FENCE SECTION DETAIL
NOT TO SCALE



SEDIMENT FENCE ELEVATION
NOT TO SCALE



PLAN

DETAIL A - SEDIMENT FENCE
NOT TO SCALE

A DETAILED EROSION AND SEDIMENT CONTROL PLAN WILL BE PREPARED BY THE CONTRACTOR AS PART OF THE CONSTRUCTION MANAGEMENT

AREA

25.6ha = SITE AREA
91.3ha = NO EARTHWORKS REQUIRED

LEGEND

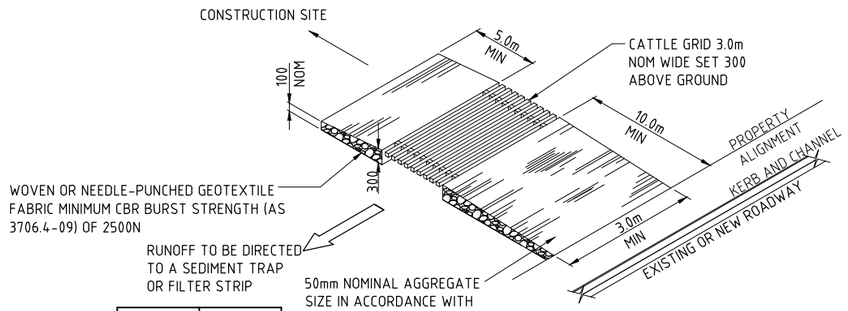
- CADASTRAL BOUNDARY
- 95 — EXISTING CONTOURS
- SEDIMENT FENCE DETAIL A
- VEGETATION SWALE
- SITE ENTRY AND EXIT
- FLOW ARROWS
- SITE AREA

EROSION AND SEDIMENT CONTROL NOTES

1. THE CONTRACTOR SHALL INSTALL AND MAINTAIN THE MINIMUM EROSION AND SEDIMENT CONTROLS INDICATED ON THE DRAWINGS AND SHALL INSTALL AND MAINTAIN ANY OTHER MEASURES THAT MAY BE NECESSARY TO COMPLY WITH CONDITIONS OF CONTRACT.
2. HORIZONTAL BAR STEEL MESH TO BE FLUSH WITH TOP OF GEOTEXTILE FABRIC WITH NO VERTICAL BARS PROTRUDING PAST TOP OF SEDIMENT FENCE.
3. NO SHADE CLOTH TO BE USED FOR SEDIMENT FENCING.
4. CATCHMENT DRAINING TO SEDIMENT FENCE SHOULD BE MAX 0.6ha.
5. UPSTREAM SLOPE TO BE 1:2 max AND SLOPE LENGTH 60m MAX.
6. SEDIMENT FENCES ARE TO BE INSTALLED PARALLEL TO CONTOURS WHERE POSSIBLE AND HAVE RETURNS EVERY 20 METRES, TO LIMIT CONTRIBUTING CATCHMENT AND ENCOURAGE PONDING
7. SEDIMENT FENCES TO BE INSTALLED NO MORE THAN 5 METRES FROM DISTURBED AREAS OR STOCKPILES.
8. THE GEOTEXTILE TO BE STAPLED OR OTHERWISE FIXED TO THE FENCE.

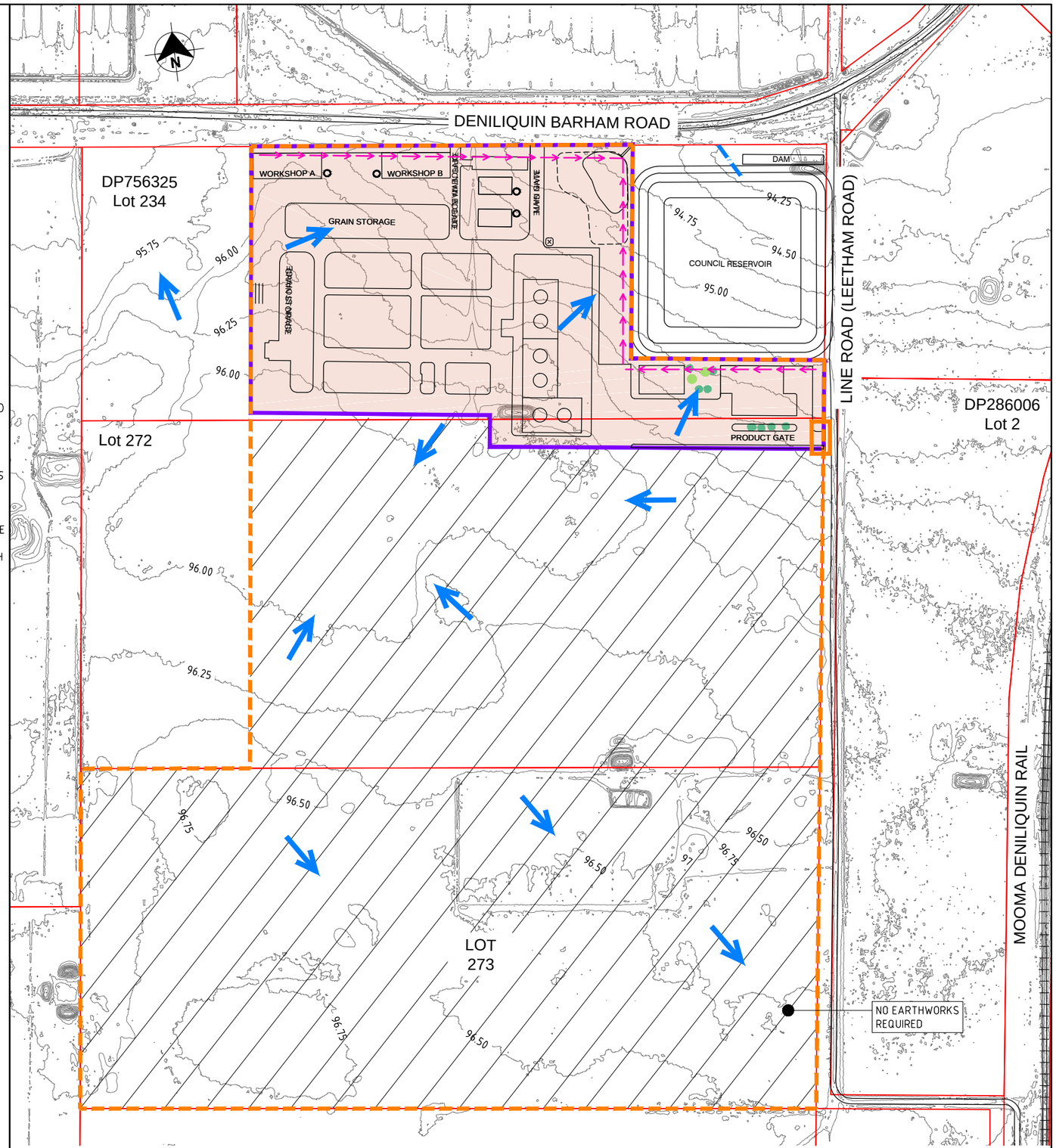
SITE ENTRY/EXIT NOTES

1. ACCESS SHOULD BE CLEANED AND MAINTAINED AFTER EVERY RAINFALL EVENT (>5mm) AND WHEN SEDIMENT ACCUMULATION IS NOTED.
2. FINE ACCUMULATED SEDIMENTS SHOULD BE REMOVED FROM UNDER GRID AND CLEANED FROM AGGREGATE REGULARLY.
3. PROVIDE WHEEL WASH FACILITY PRIOR TO SITE EXIT OVER CATTLE GRID



SIEVE SIZE	% PASSING
75.0	100
37.5	50-70
19.0	10-20
2.36	0

SITE ENTRY/EXIT DETAIL
N.T.S



NOT FOR CONSTRUCTION

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
05	PM	21.08.15	EIS	
04	PM	14.08.15	FOR CLIENT REVIEW	
03	PM	11.08.15	FOR CLIENT REVIEW	
02	AR	07.08.15	FOR CLIENT REVIEW	
01	AR			

Scale
SCALE 0 50000 100000 150000mm
1:6000 (A3) 1:3000 (A1)

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DENILIQUIN ETHANOL PLANT ENV

CONCEPT EROSION AND SEDIMENT CONTROL LAYOUT PLAN

Status: CONCEPT DESIGN
Drg No.: 60344248-0003-CI-DW
Rev.: 05

LAST MODIFIED:19/11/2015 5:37 PM
CAD REF:P:\605X\60344248\5. CAD\3S-SHEETS\60344248-0003-CI-DW.DWG

Appendix F

Conceptual Stormwater Management Plan

LEGEND

- CADASTRAL BOUNDARY
- 95 EXISTING CONTOURS
- ROADWAY
- CATCHMENT BOUNDARY
- PAVEMENT AREA
- HARDSTAND AREA
- ROOFWATER CATCHMENT
- BIO-RETENTION BASIN
- VEGETATED SWALE
- STORMWATER HOLDING TANK
- LANDSCAPING
- RAIN HARVESTING TANK
- FLOOD DETENTION BASIN

N

VEGETATED SWALE

DENILIQUIN BARHAM ROAD

DISCHARGE TO EXISTING TABLE DRAIN

INDICATIVE BIO-RETENTION SYSTEM (ESTIMATED FOOTPRINT 4000m²)

INDICATIVE FLOOD DETENTION BASIN (ESTIMATED FOOTPRINT 10000m² CAPACITY 6000m³)

DP756325
Lot 234

WORKSHOP A

WORKSHOP B

GRAIN STORAGE

CATCHMENT A

CATCHMENT B

DAM

COUNCIL RESERVOIR

94.25

94.75

94.50

95.00

95.75

96.00

96.25

96.00

FALL

PRODUCT GATE

Lot 272

LINE ROAD (LEETHAM ROAD)

Lot 3

DP286006
Lot 2

VEGETATED SWALE

EXISTING SURFACE UNTOUCHED

CATCHMENT C

96.00

96.25

96.50

96.75

96.50

96.50

97

96.75

LOT 273

96.75

96.50

MOOMA DENILIQUIN RAIL

NOT FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION	APPD
05	PM	21.08.15	EIS	
04	PM	14.08.15	FOR CLIENT REVIEW	
03	PM	11.08.15	FOR CLIENT REVIEW	
02	AR	07.08.15	FOR CLIENT REVIEW	
01	AR	28.05.15	FOR CLIENT REVIEW	

REVISIONS

Scale

SCALE 0 50000 100000 150000mm

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DESIGNED		CHECKED	
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APPROVED		DATE	

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DENILIQUIN ETHANOL PLANT ENV

CONCEPT STORMWATER MANAGEMENT PLAN

Status: CONCEPT DESIGN

Drg No. 60344248-0002-CI-DW

Rev. 05

LAST MODIFIED:10/11/2015 5:37 PM C:\AD\REPA\603X\60344248\5 CAD\30-SHEETS\60344248-0002-CI-DW.DWG