FOUR ARROWS ETHANOL PTY LTD

PREFERRED PROJECT REPORT
for a
PROPOSED INTEGRATED ETHANOL
and
DAIRY DEVELOPMENT
at
COLEAMBALLY, NEW SOUTH WALES

Booth Associates

Agribusiness and
Environmental Solutions

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FOR A
PROPOSED INTEGRATED ETHANOL
AND
DAIRY DEVELOPMENT
AT
COLEAMBALLY, NSW

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September 2007

CERTIFICATION

Submission of Preferred Project Report (PPR)
Prepared under the Environmental Planning and Assessment Act 1979 Part 3A and Environmental Planning and Assessment Regulation 2000.

PPR Prepared by:

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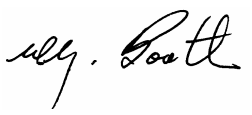
In respect of:	The construction and operation of an Ethanol Plant and Intensive Dairy at Coleambally, NSW.
Land to be Developed Lot No. 79, 80, 112 Parish Boona County Boyd	The proposed project is to be carried out on land shown on the maps included in the PPR. The land is owned by Four Arrows Ethanol Pty Ltd. ☒ Figure(s) attached
Preferred Project Report	☒ A Preferred Project Report (PPR) is attached
Certification	I certify that I have prepared the contents of this Preferred Project Report and to the best of my knowledge the information contained within this report is true in all material particulars and is neither false nor misleading.



Signature

Name: William G Booth

Date: 12 September 2007

Signature

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Date: 12 September 2007

Document History:

Date Issued	Revision No.	Author	Reviewed By	Approved	Comments
14 June 2007	V1	WG Booth SA Lee CK Neilson	CK Neilson	WG Booth	
17 July 2007	V2	WG Booth SA Lee CK Neilson	KL Tyson	MG Ryan	

Distribution of Copies:

Issue Date	Revision No	Issued To	Quantity
14 June 2007	V1	Ann-Maree Carruthers	1 Electronic
15 June 2007	V1	Ann-Maree Carruthers	2 Hard Copies 1 Electronic
17 July 2007	V2	Rodney Price Ryan Petrov Prem Kumar Ann-Maree Carruthers	2 Hard Copies 1 Hard Copy 1 Hard Copy 1 Electronic
12 September 2007	V3 (Final)	Anne-Maree Carruthers	7 Hard Copies 3 CD
12 September 2007	V3 (Final)	RF Price	2 Hard Copies 1CD

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LIST OF ABBREVIATIONS

AGO	Australian Greenhouse Office
AUL	Auxiliary left turn
AUR	Auxiliary right turn
BTU	British Thermal Unit
CCX	Chicago Climate Exchange
CIA	Coleambally Irrigation Area
CICL	Coleambally Irrigation Co-operative Limited
CIP	Clean-In-Place (chemicals)
CEMP	Construction Environmental Management Plan
CLWMP	Coleambally Land and Water Management Plan
CSIRO	Commonwealth and Scientific Research Organisation
DEC	Department of Environment and Conservation
EM Survey	Electro-magnetic survey
BOD	Biological Oxygen Demand
D	Decile
D5	Decile 5 or median year
D9	or 90th wettest year in 100 years
D9.5	Decile 9.5 or 95th wettest year in 100 years
DDG	Dry Distillers Grain
DECC	Department of Environment and Climate Change
DG	Director General
DGR	Director General's Requirements
DGS	Director General's Specifications
DNR	Department of Natural Resources
DoP	Department of Planning
DWE	Department of Water and energy

DX Year	Decile Extreme Year
EA	Environmental Assessment
EBS	Environmental Balance Sheet
EMS	Environmental Management System
EPA	Environmental Protection Agency
ESD	Ecologically sustainable development
GGE	Greenhouse Gas Emissions
GHG	Greenhouse Gas
HSCW	Hot Score Carcase Weight
HAZCHEM	Hazardous Chemicals
HAZMAT	Hazardous Materials
K	Potassium
LCA	Life Cycle Analysis
LWMP	Land and Water Management Plan
MCMA	Murrumbidgee Catchment Management Authority
MLA	Meat and Livestock Australia
N	Nitrogen
NATA	National Association of Testing Authorities (accreditation scheme)
NSL	Natural Surface Level
OEMP	Operations Environmental Management Plan
OH&S	Occupational Health and Safety
ou	odour units
P	Phosphorus
pa	per annum
PPR	Preferred Project Report
RAW	Readily Available Water
RTA	Roads and Traffic Association
RTO	Regenerative Thermal Oxidizer

SAR	Sodium Adsorption Ratio
SEPP	State Environmental Planning Policy
SOC	Statement of Commitments
T	Trillion
TAPM	The Air Pollution Model
TDI	Tolerable Daily Intake
TIS	Traffic Impact Statement
VOC's	Volatile Organic Compounds
WDG	Wet Distillers Grain

GLOSSARY OF TERMS

bund	an embankment or causeway to contain products and/or materials
Diptera	Household fly
flocculated	form aggregated or compound masses of particles
in situ	situated in the original, natural, or existing place or position
larvae	immature wingless feeding stage of an insect that undergoes complete metamorphosis
mangans	manganese coated soil particles
pathogens	Any disease producing agent, esp. a virus, bacterium or other micro-organism
pers comm	personal communication
per se	by, of, for, or in itself; intrinsically
piezometer	any instrument for measuring pressure of a fluid or the compressibility of a substance when subjected to such pressure
plethora	over-abundance, excess
sequestration	removal or separation
squeegee	an implement edged with rubber for removing water from windows after washing, sweeping from wet decks, etc.
vectors	An insect or other organism which transmits a pathogen fungus, virus, bacterium, etc.
impetus	impulse

1.0 EXECUTIVE SUMMARY

This Preferred Project Report (PPR) has been developed in response to submissions received during the public display of the Four Arrows Ethanol Pty Ltd proposed integrated 300ML Ethanol Plant and 18,000 head dairy.

The PPR responds to a range of issues, some of which required detailed additional investigations. The culmination of these efforts provides the detail for this report.

An augmented Statement of Commitments (SOC) has been produced to include any guarantees made by Four Arrows Ethanol Pty Ltd within this report. This augmented SOC will provide the required surety to the community and agencies that the company is prepared to implement all aspects of the reviewed assessment and enhanced project infrastructure and operations. This attention to best practice will further ensure that the development does not adversely affect property, health or any natural processes.

The main areas of concern are addressed below.

1.1 Consultation

With the perceived lack of full community consultation during the EA process, it has been expressed that Booth Associates had not fulfilled the Director General's requirements concerning the consultation process. In response Booth Associates actively ensured all identifiable organisations were contacted to obtain a comprehensive list of all inhabitants surrounding the proposed project site that could potentially be affected by the proposed development and every effort was made to contact and consult with all stakeholders.

Unfortunately legal constraints prevented Murrumbidgee Shire Council from providing a detailed list of rate payers within the buffer zone of the proposed development. Consequently farm numbers were obtained and a process was undertaken to identify ownerships of these individual holdings. Identification of individual farms and dwellings was undertaken by visual assessment of aerial imagery. Civic organisations were provided with project information that they could relay to concerned parties upon request. Further full details of Booth Associates were made available. A series of public functions were held to inform the community and to promote the team's availability for private consultation if the need arose. Enquiries were encouraged at all times and the maintenance of a local office in Griffith was available for any concerned parties to gain information.

The EA process also required that the EA was given a publicised one month public exhibition period whereby all parties could make comment. This afforded both the affected individuals and other interested parties the opportunity to make comment upon all aspects of the EA and have their responses lodged and addressed within this PPR.

1.2 Environmental Balance Sheet

A respondent felt that the Environmental Balance Sheet (EBS) presented within the EA was biased in favour of Option A and discounted any investigations in the consideration of Option B or C as an alternative to locate the proposed facilities.

In the interest of further validating Option A as a credible choice, the EBS has been remodelled using two different techniques. Both of these have resulted in Option B and C scoring below that of the original Option A. Although having achieved this result, the EBS should not be seen as definitive reasoning for choosing a preferred option but rather as a qualitative tool to generate discussion across a broad range of factors.

1.3 Groundwater and Hydrology

Some respondents questioned the suitability of the site in view of proposed waster water management and the disposal of carcasses and other waste products. In particular the respondents were concerned that groundwater would not be adversely impacted by the proposal. In particular the respondents were seeking to ensure that groundwater will not be adversely impacted. These concerns were more specifically founded upon the requirement that information and references used in the EA needed to be produced to validate claims made within the EA that ensured that all waste management areas were suitable for their proposed purpose.

The specific references detailed in the original EA, are reaffirmed in detail in this PPR and are summarised below:

- Coleambally LWMP hydrogeological study by CSIRO; and
- Piezometer logs, monitoring records, EM surveys, rice soil logs, etc supplied by CICL.

The CSIRO study was detailed and is still current. The drivers of groundwater flows were well defined and are still dominated by regional piezometric heads, CIA irrigation practices and the heavy extractive demand of bore irrigators along the north and north-west fringes of the CIA. Accordingly the flows under and around the project site will remain to the north and north-west as defined in the EA unless a new and locally significant production bore is established almost adjacent to the project site.

A new monitoring piezometer has been installed on the project site as agreed with DNR and DEC. The soil profile log essentially matched those of the pre-existing nearby CICL piezometers, as did the depth to groundwater of around 10M below NSL.

The water sample from the new project piezometer was tested (NATA laboratory) and the groundwater quality was found to be of no better quality overall and substantially more saline with a significantly higher SAR than the waste water likely to be generated by the proposed development.

Geotechnical soil testing (NATA laboratory) affirmed the Wrigley-Dillon assessment that the soils to be used for waste water infrastructure may readily achieve the maximum permeability rates of 1×10^{-9}m/sec. Likewise geotechnical laboratory tests of soils around significantly less than the approved and commissioned “Tubbo” Irrigation water storage were obtained by RJ & HJ Wrigley in their report for that facility. The Wrigley report affirms the suitability of the soils for mortality disposal on “Tubbo”. The Wrigley report also noted the consistency of his finding with the earlier soils reports by *Stannard, Talsma and others* for CIA expansion into “Tubbo” Station.

1.4 Air Quality

Booth Associates have secured material and information from ICM Incorporated, a leading manufacturer of ethanol plants encompassing both ***construction and operations***. Appropriate details of the ICM Inc. report are included in this document, particularly the identification of all odour sources and their quantification plus emissions data.

The ICM Inc. information includes both the necessary equipment to be installed to control odorous and hazardous emissions, and describes the appropriate associated management regime to be implemented.

The issue of expedient and regular ***removal of wet distillers grain*** (WDG) has been raised by some respondents. These markets are currently available however may subside once similar production facilities are constructed, also producing the WDG and dry distillers grain (DDG) by-product. This cumulative affect will have to be considered within future ethanol development applications. Four Arrows Ethanol Pty Ltd have attracted a number of interested parties to purchase the WDG including a firm expression of interest from Strategic Bovine Services and SunRice to pelletise the product for domestic use and exportation to at least New Zealand.

Partially drained ***manures will be moved*** off site on a regular (daily) basis to "Tubbo" Station for incorporation into agricultural soils. Any short term stockpiling at "Tubbo" Station will be upon bunded compacted clay pads to prevent deep percolation of nutrients, salts and bio-organisms. "Tubbo" Irrigation is located in a sufficiently remote area to ensure that receptors in the vicinity are not affected by resulting odours.

The ***control of flies*** are directly related to odour issues and Four Arrows Ethanol Pty Ltd commits to best management practice within the dairy cattle pens which will ensure the health and welfare of employees and livestock within the dairy itself and the ethanol plant.

Management strategies will focus upon the daily collection and removal of ***manures*** from the freestall sheds and monthly drylot pen areas along with spilt and ***decaying feed***. Accompanying this will be the expedient removal of WDG from the site as well as any damaged grain. By achieving these odour goals this will in turn ensure minimal fly numbers throughout the facility.

A chemical control strategy will also be implemented to enhance other management initiatives including the installation and maintenance of fly traps and the implementation of knock-down strategies as required.

Potential odour emissions from ***sedimentation basins*** and ***storm surges*** are within acceptable criteria from the investigations conducted and detailed within the original EA document.

1.5 Greenhouse Gas Emissions

Further investigations to the original EA submission has involved a recalculated spreadsheet detailing all CO_2 and equivalents produced by the combined enterprises being from grain production to end user delivery. The best case scenario using purely sorghum as feedstock would place the ethanol facility in large carbon ***credits***. Even with the inclusion of a carbon debit produced by methane from the dairy enterprise, the overall project would still remain in credit.

However, when the CO_2 model is re-calculated using a mixture of feedstock, the overall combined production of GGE places the combined enterprises in a relatively modest carbon ***debit***. Carbon offsets are able to be arranged through commercial agreements with private companies who specialise in this field and would be finalised upon the receipt of the development approval.

Other options open to the ethanol and dairy production enterprises are the adoption of gaseous capture technology for both CO_2 produced within the ethanol production and also for the methane capture from the ethanol dairy waste management systems.

1.6 Project Water Reliability

The Murrumbidgee CMA (MCMA) questioned the ability of the Four Arrows Group to secure sufficient volumes of water required for the development overall. Several aspects have been presented in this report that assures sufficient water can be acquired to guarantee production across the facilities.

These points are as follows:

- The Four Arrows Group currently has ownership of substantial volumes of high security water and bore entitlements (>40,000ML in total) and has the capability to permanently purchase additional entitlements as necessary.;
- Neighbouring bore irrigators have also shown a keen interest in supplying water for the project. The prices and volumes to be determined at the time of negotiation in extreme drought years;
- The ethanol plant will become more effective and efficient with recycling of existing production water as technology increases. Four Arrows Ethanol Pty Ltd is committed to and is commercially driven into adopting this new technology to ensure new potable water demands are kept to a minimum at all times; and
- The proposal is being based upon an integrated water management plan that has involved the CICL within all stages of water management planning.

The MCMA suggestion of basing a long term viability appraisal on a 1:1,000 year extreme drought scenario is considered inappropriate.

1.7 Hazard Assessment

A respondent notes discrepancies between the traffic impact study being based on a 365 day year whilst the hazard assessment was based on 360 day year. It has been explained in some detail within the PPR that this small variation would make no overall impact on the conclusions of the hazard assessment.

There is also some concern that a complete and detailed list of chemicals to be used throughout the facilities should be provided within this report. Under SEPP 33 legislation this list is not required to be presented at this time. However, the EA as displayed did list the main chemicals. A surety is given that all activities and the handling of chemicals within the proposed facilities will be according to best management practice and all Australian standards of licencing requirements.

1.8 Native Vegetation

The Murrumbidgee Catchment Management Authority (MCMA) has requested involvement with native vegetation management and the landscape enhancement of the proposed development site. Four Arrows Ethanol Pty Ltd is committed to this relationship and will actively seek MCMA's expertise at all times in relation to native flora and fauna management.

Four Arrows Ethanol Pty Ltd intends to develop and implement a ***native vegetation management plan*** with the main focus to interconnect the Boona and Brett State Forests using locally indigenous species. Local specialist native vegetation nurseries will also be engaged to collect, germinate and to plant out and manage landscaped areas. These discussions have already commenced and all activities will be in adherence with and in the spirit of the CIA Land and Water Management Plan (LWMP).

1.9 Traffic Movements

A respondent noted that there was an exclusion of some vehicle numbers, particularly those which pertained to the delivery of petrol onto to the site for the purpose of denaturing ethanol.

This respondent also made a number of observations which included:

- Operations are calculated at 365 days which he believes the plant would not operate at;
- Feed stock volumes did not take into account bulk densities, and therefore this would make a difference to the calculations of vehicles delivering to the site. The respondent did not agree that vehicles of 38 tonne capacity will be used to transport silage and this figure should be downgraded to 20 tonne;
- The respondent believes that manure volumes produced should be recalculated and this will affect the amount of vehicles travelling from the site; and
- The downgrading of manure transport from 40 tonnes to 25 tonnes.

The spreadsheets were updated using preceding figures, which on an hourly basis made a ***difference of one vehicle*****.** This has been seen as insignificant from a modelling perspective, and therefore all comments regarding impacts from vehicle movements remain and are considered valid.

The respondent makes a point that there will be considerable variation to traffic volumes on a seasonal basis. It is not seen that such variations will be significant as the ethanol plant requires a consistent feedstock supply. The purchase would more likely be made from a grain supply organisation rather than from individual farm sources where local delivery is undertaken that traffic will replace the modelled traffic for the period of the local deliveries.

Seasonal variations are not a scenario which can be reliably modelled at this time. Therefore the information contained within the spreadsheet should be viewed as a firm indication of average vehicles per hour and per day across the year.

The final observation is that the Willbriggie/Junee rail is presently closed and requires substantial funding to upgrade. This respondent's comment is correct and since the project's inception there has been considerable discussion between the Four Arrows Group, Booth Associates and various levels of Government as to the possibility of the rail reinstatement and the funding required.

It must be appreciated that this project relies on a substantial amount of feedstock being transported to the project site for the purpose of ethanol production and the success of this operation relies on the reopening of the Willbriggie line to cater for this demand. From a community and local government perspective there has been a longstanding effort to re-open the Willbriggie line for a wide range of sound reasons. The establishment of the Four Arrows ethanol project is expected to provide the final affirmation of the need for funding the rail line upgrade.

1.10 Waste Management

1.10.1 Soils – Geotechnical

Further NATA laboratory geotechnical investigations of the soils at the proposed project site have affirmed that the deep percolation rates would be ***<1 x 10^{-9}m/sec***. With appropriate mixing and compaction the soils on the project site can be used as compacted earthen liners for waste water storages, etc containing elevated salinity. In fact these soils display characteristics that include soil aggregate stability which would retard soil permeability even at waste water salinity levels substantially greater than that expected.

Both DEC and DNR have requested further evidence as to the volumes of clays available on the site for water storage/waste water liner construction and for other earthworks on the site. An analysis of all borrows and sinks required for infrastructure has demonstrated that there are sufficient volumes of appropriate soils on the project site and that the sources and sinks will be balanced.

1.10.2 Soils – Agricultural

Agricultural soil samples were collected throughout the site to assess their suitability for what had been an intended ***enhanced waste water irrigation management system.*** The outcomes of the analyses described these soils as being typical of those encountered over the majority of the central to eastern sections of the Riverine Plains.

These results confirm the Wrigley-Dillon assessment that the soils on the proposed development site are suitable for the growing of agricultural crops under waste water irrigation with overall soil health benefiting from the addition of soil conditions to enhance production.

Whilst subsequent statements of agency policies have over-ridden the concept of waste water irrigation, the captured data has been included herein for future reference.

1.10.3 Waste Water Nutrient Loadings

Waste water nutrient loadings have been ***re-calculated*** within this PPR from first scientific principles. That is, the cattle ration in the EA was modelled by Dr Ian Lean using his proven computer model and a full mass balance of all relevant nutrients and salts into and out of a dairy cow was established. From this mass balance, the recent work by R Wrigley on waste water management strategies for Dairy Australia were supplied to arrive at a ***mass balance*** of nutrients and salts through the proposed new enhanced waste water management system.

The net outcome of all the additional detailed modelling was:

- The ration in the EA itself required additional potassium input to satisfy the cows' needs and would be introduced by elevated K fertiliser applications on forage (silage) crops;
- The ration in the EA itself would generate waste water with substantially less salts and significantly lower SAR than the existing groundwater; and
- The generated waste water would need augmentation with artificial fertilisers and CICL fresh water to enable a sustainable irrigation system – assuming policy would have permitted a waste water irrigation system.

The detailed modelling and enhanced waste water management strategies within this PPR are also supported by the new Meat and Livestock Australia report titled FLOT.328 prepared for the beef feedlot industry.

1.10.4 Waste Water Salinity

Salinity of waste water at the dairy enterprise cannot be related to that of a typical beef feedlot. The difference between beef feedlots and freestall dairies are the volumes of waste water required to flush the freestall and the differing nutritional needs and the production goals for milk rather than beef.

Typical salinity and nutrient concentration data for beef feedlot waste water is now becoming even more inappropriate as new operational and management efficiencies are producing substantially reduced salt and nutrient loadings in beef feedlot waste water. This new trend data has been made available by Meat and Livestock Australia (MLA).

1.10.5 Waste Water and Groundwater

The detailed salt and nutrient mass balances for this PPR have affirmed that overall waste water salt levels and waste water management strategies will result in waste water that is superior in quality to that of existing groundwater. Whilst the proposed fully engineered waste water management system is designed to prevent any accessions to groundwater, the observation is made in the event if a totally unplannable event occurs and waste water does accede to groundwater then the quality of the existing groundwater would be improved rather than be diminished in quality.

1.10.6 Disposal of Mortality Products

Disposal of mortality products will be on a ***succession of sites*** around the east of the nearby "Tubbo" Station irrigation area. The need for a succession of sites is to optimise risk management when there is no need to continually use one site.

The soil's suitability for this purpose has been assessed via data produced for an investigation into the proposed water storage on this property and is backed up by a succession of soils reports by *Stannard, Talsma, Butler* and other respected soils specialists.

The geomorphological and geotechnical findings stemming from this report have provided reliable information that the soils on "Tubbo" Station are suitable for the disposal of carcasses etc. from the proposed enterprise.

The proposed disposal areas are also remote to odour receptors and the characteristics of these soils being mainly of the Willbriggie, Wunnamurra and Yooroobla type clays ensuring groundwater hazards will be alleviated when conducting mortality disposal activities.

1.10.7 Truck Wash

The truck wash will capture up to 95% of the removed material and this will be ***exported*** to "Tubbo" Station and directly applied onto irrigation and/or other suitable agriculture lands. This material includes:

- Manures and soils deposited on truck wheels; and
- Organic matter from the carrying of by-product and feedstock.

All other materials such as chemicals and waste oils will be disposed of separately according to regulations.

1.10.8 Administrative Waste

As displayed in the EA waste from the administrative areas will be contained and treated in pre-packaged, fully contained and technically sound effluent treatment systems. Grey and black water will be separated and used accordingly around the site for limited irrigation landscape purposes. Appropriate systems will meet all EPA guidelines and requirements.

Database sets supplied by CICL were originally reviewed and assessed to develop the original site plan and the proposed development suite focussing upon possible groundwater contamination. These deliberations were further supported by in-field slot-trench analysis by the project geotechnical expert.

1.10.9 Distillers Grain

Distillers grain is a ***valuable resource*** rather than being a waste product. Notwithstanding, some submissions questioned the viability of the market for this product and also the fall-back position if markets failed, especially at short notice (cattle disease, etc).

For the EA as displayed, the written requests for regular supply contracts by regional beef feedlots were relied upon. Subsequently one feedlot has decided to proceed with its own ethanol proposal. Not surprisingly there has been a growing list of other feedlots, freestall dairies and other intensive animal industries have also sought assured access to the product. Finally, a request for contract pelletisation for export has been made which eventually covers the full distillers grain output.

The reality is – the markets are demonstrably there, they are diverse, they have the capacity to absorb the product and the markets are in fact, expected to grow significantly.

Most importantly, the desire for only partially dried product is strongly evident which reduces the energy and dollar costs of drying.

1.11 Enhanced Waste Water Management Plan

Submissions to the EA as displayed questioned the sustainability of the waste water management system therein. The primary concern was the Category 3 waste water system containing nutrients, salt and particularly pathogens and manure loadings.

Submissions in respect to Category 1 and Category 2 water raised minor issues of clarification. This waste stream associated with Category 1 and Category 2 water remains acceptable and unchanged.

The Category 3 waste water stream however, needed to be subjected to a fresh appraisal of the overall strategy. Driving the need for a review was the benefit of a more recent full but separate study of waste and waste water management for Dairy Australia by a team member.

The Category 3 waste water review resulted in a move from the initial "sustainable ponds" strategy to initially a "sustainable irrigation" system. Subsequent provision of the latest DWE groundwater policy required a further move to a strategy of engineered evaporation basins.

The sustainable irrigation and engineered evaporation strategies have many common physical and operational components, viz:

- Physically they capture reduced solids run-off, remove most residual solids by sedimentation and then pump the resultant effluent to recycle ponds where, after a suitable period of appropriate management, the water is recycled by flushing the freestall flush lanes;
- Periodically waste water in the recycle ponds is extracted for use on irrigated lands or for evaporation; and
- The removed waste water, and that lost in the recycle process, is replaced with fresh CICL water so that a full turnover of water in the recycle ponds will occur in less than 12 months.

Since an engineered evaporation basin system is the only means of satisfying the stated current groundwater policy then the evaporation basins will now replace the "sustainable irrigation" components of the above strategy. Further refinements of the above strategies are described as follows:

- Import minimisation – to actively seek to import only those salts and nutrients onto the site which are absolutely necessary. The project dairy specialist, Dr I Lean, reviewed the cattle nutritional needs and is able to sustainably manage cattle rations at low salt and nutrient levels without compromising the health and production levels;
- Early interception – to capture and remove as much manure with accompanying salts and nutrients before it enters the Category 3 waste water system. Some 85% of manure is to be removed from the freestall flush lanes prior to flushing and another 60% of that dropped in the drylot and loafing pens. After "dust" losses some 80+% in total is either intercepted and removed before it enters the sedimentation basins or is lost as dust etc;
- Efficient sedimentation – of that manure reaching the sedimentation basins, well designed and managed basins would remove 60% of the remaining manure for a total removal of over 90% before the Category 3 waste water enters the recycle ponds; and
- Organic matter breakdown – the recycle ponds will be aerated to prevent anoxic and/or anaerobic conditions developing and to accelerate OM breakdown.

Other options to even further enhance the overall efficiency and sustainability of new proposed engineered evaporation basins include rotary drum or similar screening of the waste water being pumped from the:

- Sedimentation basins to the recycle pond/s and/or;
- Recycle pond/s to the evaporation basins.

Whilst the screens would remove solids, those solids would also include significant quantums of both salts and many beneficial nutrients for disposal at “Tubbo” irrigation.

LanePiper, specialist geotechnical engineers and specialist consultants to the waste water industry in the urban, industrial and agricultural sectors, in close liaison with the project geotechnical engineer, have prepared site and situation specific concept plans for both the proposed recycle ponds and evaporation basins.

The refined Category 3 waste water management system has resulted in many other benefits such as:

- A major down-sizing in the size of the storages required to cope with reduced waste volumes; and
- Retention in the capacity of the “air space” to capture and sustainably manage run-off from severe storm events and in extreme wet years.

Management of the tailings from the periodic maintenance of the recycle pond/s shall be the broadcast application to the irrigation lands at “Tubbo”. The rate of application may need to be reduced over that normally accepted for manure application to ensure sustainability.

Management of the tailings from the evaporation basins has needed to recognise the elevated nutrient and organic components as much as the contained salts. The proposed and very pro-active approach to import minimisation, early interception and efficient sedimentation has resulted in tailings of significant value rather than as a concentrated waste *per se*. Viable options for sustainable management include storage on-site and/or very light spreading on irrigation lands. Given that the accumulated material in the basins will take some decades to reach a mass of concern, new developments in biosolids management will have overtaken current knowledge. This will be to this project’s advantage.

The net overall benefit has been the development of a substantially smaller capacity system which fully complies with the current ruling policies on groundwater protection.

2.0 INTRODUCTION

2.1 Purpose of this Report

This document has been prepared in response to a Department of Planning (DoP) request dated 11 December 2006 for additional information (Annexure 1.0) in accordance with Section 75 (H)5 and 75(H)6 of the Environmental Planning and Assessment Act 1979 (NSW).

This document addresses the issues raised during the public display period where the Four Arrows Ethanol Pty Ltd Environment Assessment (EA), being part of the Four Arrows Ethanol Pty Ltd Development Application (DA) for an integrated ethanol production facility and associated dairy, was exhibited and a critique of its content was obtained.

The DoP subsequently received a number of responses that were forwarded on to Booth Associates for comment and further investigation. The issues raised provided the basis for variations to the original proposal and this Preferred Project Report (PPR) integrates all of those concerns put forward for consideration.

The content herein includes a detailed account of the revised development which is the culmination of all inputs from agency, public and expert sources. The intended outcome of this process being to ensure that the development achieves its economic aims whilst providing far reaching social benefits, however not to the detriment of the environment, which may adversely affect any of the stakeholders concerned or vital natural processes.

All of the issues raised have been assessed and equitably considered. Several have required further investigation resulting in a somewhat modified proposal particularly in regard to waste water management. The following sections will present each of the issues revised and an appropriate response to satisfactorily address these concerns.

2.2 Structure of this Report

This document details the results of further investigations undertaken to satisfactorily address the issues raised by public and agency respondents during the exhibition of the Four Arrows Pty Ltd combined ethanol and associated dairy EA.

Section 2.3 presents these concerns and a copy of the response submissions has been included as Annexure 2.0a. Some of these are directly addressed within the relevant section as it was considered these queries required no further investigation other than that previously included with the original EA submission however did deem further clarification. Where practicable readers are directed to a particular relevant section, otherwise the appropriate information may be included under several headings.

Section 3.0 provides detail of the additional research and results required to provide confidence and security that there will be no significant environmental impact resulting from the proposed development. Supplementary investigations and information addresses operational and biophysical aspects of the facilities. These are specific to those issues raised as detailed in Section 2.3.

Annexure 26.0 presents further requests resulting from a meeting between the agencies and Booth Associates on the 22 June 2007 where a review of the draft PPR was deliberated. The results of requested additional investigations stemming from this meeting are included within this document with particular references made within Section 4.0.

The proposed sustainable irrigated waste water management system as presented within the draft PPR included as Annexure 3.0 was heavily scrutinised at this meeting. To further discuss this proposal a meeting between the agencies and Booth Associates was held on 3 August 2007. At this meeting the Department of Water and Energy (DWE previously DNR) stated they would not support the proposal in its present form as current groundwater policy dictates that no waste water shall be irrigated within the Coleambally area due to the risk of contaminating the town's groundwater supply. This resulted in the replacement of the irrigation component of the new waste water management system with engineered evaporation basins.

Section 4.0 addresses those concerns raised at the June meeting described above.

Section 5.0 is the culmination of considerations due to further investigation and critique of the original EA concepts and plans and the rejected proposal contained within the draft PPR (Annexure 3.0). This section describes in detail the proposed modified development that integrates all comments and concerns submitted as a result of the display period and subsequent agency meetings.

Section 6.0 augments the Statement of Commitments (SOC), detailed within the original EA, to accommodate concerns. Additional commitments are included to ensure the proposed development is operated and managed sustainably whilst the inclusion of several updated design commitments will support the revised waste and waste water management infrastructure that is the core of this PPR.

2.3 Summary of Issues Raised

2.3.1 Overview

The public exhibition period encouraged responses from interested parties on all aspects of the proposal including any perceived omissions or deficiencies. The responses were derived from an array of stakeholder representation with submissions received from within both the public and agency sectors. The following section presents a summary of those responses and the areas that were addressed in order to satisfy stakeholder concerns. A copy of the original responses can be viewed in Annexure 2.0a.

2.3.2 Department of Natural Resources

The Department of Natural Resources' (DNR) submission focused on the following issues:

- The proposed project site is underlain by highly permeable sand and gravel soil substrates;
- The sand and gravel soil substrates can and/or have held elevated groundwater tables; and
- Regional and local groundwater has been and is still being used for household domestic water supplies as well as irrigation purposes.

DNR required ***further geotechnical investigations to affirm the viability of the site for the proposed development*** and ***to review the best management waste water infrastructure for the specific needs of the project.***

DNR also required further information on the need for the ***importation of suitable clay material*** for the optimal construction of the waste water infrastructure. Should imported clay material be required, the volume and source of that material would need to be detailed.

Finally, DNR required that ***off-site waste disposal areas should be nominated and investigated, and the details incorporated into this major project application.***

The above concerns are addressed within the following sections of the revised proposal.

2.3.3 Department of Environment and Conservation

The Department of Environment and Conservation (DEC) noted the following with respect to drought and the ***additional needs for assessment of groundwater at the project site:***

- A ***detailed hydrogeological assessment*** to quantify groundwater levels, direction of groundwater flow and existing groundwater quality at the project site;
- It is acknowledged that high risk groundwater users have been identified based upon the predicted groundwater flows, however from the limited information provided within the EA it was not clear how direction was determined; and
- An ***assessment of the impact on the closest stock and domestic groundwater users*** located within 500m to the north, and within 1km to the south-east of the site should be considered as high risk, and that risk be assessed accordingly.

With respect to the ***geotechnical and soil investigations***, the DEC required attention to the following:

- An adequate and ***detailed design level geotechnical investigation*** be conducted prior to DEC making their assessment;
- The geotechnical and soil investigations are to consider the water storages, dry lot pen areas and waste disposal areas to ascertain site suitability;
- To determine whether ***sufficient suitable in situ clays are available on-site*** for the construction of the water storages, dry lot pens, carcass disposal pits and whether or not material will need to be sourced off-site;
- To quantify existing ***soil chemistry and physical properties in the waste utilisation areas*** and provide commentary on anticipated nutrient and organic loadings to ensure sustainable waste management; and
- The waste utilisation areas are to include the “Tubbo” property and any proposed waste management areas associated with staff amenities and truck wash.

With respect to air quality, specifically that of odour emissions, the DEC suggests that the revised project provides a clear and unambiguous picture of the proposal as a whole which includes sufficient information as to the ***design of the ethanol plant facility***, and which ***identifies all odour sources quantifying these emissions and detailing their management***.

The DEC suggested the following information should satisfy the requirements of this request:

- A ***detailed process diagram for the plant and associated equipment*** highlighting processes which have the potential to generate odour, and that these emissions are quantified;
- If dryers are not to be utilised, then information must be provided that demonstrates the production of wet distillers grain (WDG) will not exceed total demands; and
- Consideration must be given as to the affects on demand, should ***increased WDG (tonnages) become available to the market*** due to establishment of similar projects currently proposed in New South Wales.

It is suggested that all air quality assessment should be benchmarked against international best practice and must be conducted in accordance with ***"Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales" (2005).***

With regard to ***Greenhouse Gas Emissions (GGE)*** the DEC considers the information provided as limited. A ***more comprehensive/accurate account of the full life-cycle for GGE*** is required that demonstrates how the emissions will be minimised over the lifetime of the proposed development. This includes all contributions to GGE from the growing of the grain through to delivery to the end user/consumer. ***All intended sequestration strategies should be included*** within the reviewed proposal to demonstrate Greenhouse Gas contributions.

The assessment must include, but not be limited to details of:

- The capture efficiency of the proposed CO_2 scrubber ie manufacturers' performance specifications;
- Number and size of CO_2 storage tanks;
- Identification and end users/consumers of CO_2 and expected volume of consumption; and
- Any other proposed measures to offset greenhouse emissions from the facility eg tree planting.

The above concerns will be addressed within the following sections of the revised proposal.

2.3.4 Murrumbidgee Catchment Authority

With regard to ***water security*** the Murrumbidgee Catchment Management Authority (MCMA) raised the following issues:

- Queried whether the ***vendor has overstated the reliability of water supply,*** noting that the expected level of 95% for high security water is not a safeguard;
- MCMA noted that in the 2006/07 water year, allocations are well below the estimates provided in the EA; and
- The level of ***water security in the EA as proposed may have been under estimated*** and noted the decile 1 year as modelled does not include a year such as 2006/07 and the operation of the proposal should be modelled in the context of the worst scenario, or current conditions.

We refer MCMA to Section 3.10: Project Water Reliability

To address the issues raised in the response, the MCMA has suggested that ***an integrated water management plan be developed,*** and be inclusive of stormwater, drainage and all waste water treatments in consultation with CICL.

> *We refer MCMA to Section 3.10.2: Integrated Water Management Plan.*

The MCMA within their response also provided comment that ***areas of remnant vegetation should be enhanced*** in species richness to provide valuable biodiversity outcomes.

> *The proposed plantings of native vegetation and their future management has been described in detail in the EA as displayed. The broad intent is to inter-connect the Boona and Brett State Forests using local provenances of indigenous species and to undertake all work in full consultation with the MCMA and encourage the active involvement of CICL to ensure full integration with the CIA Land and Water Management Plan (LWMP).*
>
> *We refer MCMA to SOC commitment 251.*

> *Similarly it is intended that local specialist native vegetation nurseries would be engaged to collect, germinate, plant out and then independently manage the landscaped areas. Opening discussions had already begun in this regard with a native specialist nursery.*
>
> *We refer MCMA to SOC commitment 252.*

The MCMA notes that ***assistance will be given in achieving enhanced biodiversity goals*** through the negotiation of a biodiversity incentive through the property vegetation process:

> *It is appreciated that the MCMA has provided information regarding the possibility of negotiation of a biodiversity incentive via the property vegetation planning process as per the Native Vegetation Act 2003.*

The ***MCMA requests to be included within the proposed vegetation planning process*** by providing input to the design of property scale plans and on-going monitoring schemes of habitat enhancement.

> *The proponent has no issue with the request made by the MCMA, and the SOC has been amended to reflect a commitment to directly involving the MCMA in the planning of all habitats, restoration and enhancement works on the project site.*
>
> *We refer MCMA to SOC commitment 253.*

Vegetation management plans should also include ***the maintenance and enhancement of indigenous heritage***.

> *We refer MCMA to SOC commitment 254.*

The above concerns were relevant will be further addressed within the following sections of the revised proposal.

2.3.5 RTA

The RTA has stated that they have received the EA and would not object to the proposed development subject to the following comments being included in the DoP's conditions of development consent:

- The current policy of the RTA is to minimise the number of conflict points along classified roads to promote road safety and efficiency on the main road network. Therefore, the number of vehicular accesses onto Kidman Way is to be minimised by using shared driveways and local street frontages. In this case vehicular access for management and staff is to be consolidated thus reducing the number of access points off Kidman Way to two from three as proposed in the traffic report;
- Proposed access locations on Kidman Way are to have a Safe Intersection Sight Distance (SISD) in either direction in accordance with the RTA's Road Design Guide for the prevailing speed limit (ie 225m in both directions for 100km/hr speed zone);
- Proposed driveways off Kidman Way are to be constructed with a minimum entry width of 6m and exit width of 4m – 6m in accordance with AS 2890.1-2004 for a class 1 parking facility and Category 3 access driveway. The access driveways are to be constructed to accommodate largest size vehicles likely to service the site;
- An Auxiliary Right Turn (AUR) and Auxiliary Left Turn (AUL) treatment is to be constructed at the proposed access location off Kidman Way. In addition, separate acceleration lanes for both north and south bound vehicles is to be constructed at the subject junction of the proposed access driveways and Kidman Way in accordance with the RTA's Road Design Guide for the prevailing speed limit. Detail design plans of Auxiliary Right Turn (AUR),

Auxiliary Left Turn (AUL) and acceleration lane treatment are to be submitted to the RTA for approval prior to the commencement of any works.

- The swept path of the largest vehicle entering/exiting the subject site and manoeuvrability through the site is to be in accordance with current Australian Standards and to Council's satisfaction;
- It is noted that the intersection of Willbriggie Rail siding and Kidman Way will have substantial increases in heavy vehicle movements due to the likely use of the site for pick up of the majority of grain and raw material for ethanol production and transportation of the product. A further assessment is to be undertaken in regards to the potential upgrade of the subject intersection in accordance with the RTA's Road Design Guide. Detail design plans of proposed intersection treatment are to be submitted to the RTA for approval prior to the commencement of any works;
- In accordance with the Roads Act 1993 the RTA has responsibility in relation to roadwork, traffic control facilities and other works/structures on the classified road network. Kidman Way is a state road. The RTA and Council have certain responsibilities under the requirements of the Act. RTA's consent is required for all roadworks under Section 61 of the Act. Council is the roads authority for Kidman Way. As the proposed development requires construction on or adjoining road network, the developer will be required to sign a Works Authorisation Deed (WAD) with the RTA before undertaking any design or construction work. The applicant needs to contact the RTA within 10 days once the Notice of Determination (Conditions of Consent if approved) is issued by the Minister of Planning for the subject development. In addition, construction of the state road requires a pre-qualified contractor to be engaged for works associated with the development;
- "No Stopping" restriction is to be implemented along the Kidman Way frontage of the subject site prior to commencement of any works;
- Layout of the car park including internal roadway width, aisle widths, parking bay dimensions and loading dock is to be in accordance with AS 2890.1-2004 and AS 2890.2-2002;
- Number of on-site car parking spaces associated with the development is to be in accordance with the Council requirement and meet the parking requirement applicable for the development;
- Appropriate directional signage and line marking throughout the car park and site is to be installed to assist in directing vehicles around and through the facility;
- The applicant to provide facilities for pedestrians within the car park to facilitate safe pedestrian movements throughout the car park;
- Consideration is to be given to implement traffic calming measures within the car park to control speeding vehicles and to reduce vehicular/pedestrian conflict;
- Suitable provision should be made on-site for all construction vehicles to alleviate any need to park on Kidman Way;
- Suitable provision is to be made to retard any increased storm water runoff directly from the subject site on to Kidman Way; and
- All works associated with the development shall be at no cost to the RTA.

We refer readers to SOC Commitment 255.

2.3.6 The Wiseman Family

The submission for Wiseman Organic Produce was prepared by Hutchins Agronomic Services of Darlington Point. Mr Hutchins makes the point that he did not have time to fully review the EA therefore he may have found sufficient detail to address his queries if a thorough examination had been able to be undertaken.

Notwithstanding the project team have addressed each of the issues raised and cross referenced with the EA where appropriate to facilitate the response outcome.

The five areas of key concern were:

- Lack of consultation;
- Odour;
- Flies;
- Dust and Q-Fever; and
- Salinity.

Mr Hutchins notes that there ***appears to be a lack of consultation with those that are not affected*** by the development and a degree of misrepresentation in the EIS:

> *We refer the Wiseman family to Section 3.1: Consultation*

The Wiseman family have a number of concerns relating to odour and note that it may affect them on a number of levels.

Mr Hutchins identifies the ***sources of odour are likely to arise from the management or less than best management*** of the anaerobic ponds, aerobic ponds, manure stockpiles, cattle sheds, storm surge ponds and possibly the run-off wetlands.

> *The management of odour from the sources identified have been investigated and documented within the EA with findings indicating all generated odour emanating from the site would be within acceptable levels.*
>
> *We also refer the Wiseman Family to revised waste water management system in Section 5.4: Revised Waste Water Management Strategy which will involve considerably lower odour impacts than the model originally proposed.*
>
> *We refer the Wiseman family to Section 3.5: Air Quality which further comments upon odour impacts.*

> *We refer the Wiseman family to SOC commitment 256.*

Mr Hutchins has highlighted a ***potential for misunderstanding of surface water management*** in drawing the erroneous conclusion that excess water from the original Category 3 aerobic pond would be directed to the Category 2 wetland.

> *It seems that Mr Hutchins has interpreted the EA as saying the run-off wetland (ie Category 2 water storage) was to be utilised as an evaporation basin for excess Category 3 water allowing a considerable build-up of salt in that area.*
>
> *This interpretation is erroneous as the EA as displayed specifically states that the wetland was to capture near Category 2 water only (near Category 1 water) and was to be augmented by water direct from CICL channels on an "as required" basis.*

Mr Hutchins rightly raises the ***issue of flies*** that are likely to occur in manure stockpiles and cattle sheds.

> *We refer the Wiseman Family to Section 3.5.6: Odour and Flies and Cattle Sheds. Also Section 3.6: Fly Management Plan which details a fly management plan implicit within intensive dairy best management practice.*

Concerns relating to dust apply to the following areas:

- Cattle sheds;
- Cattle yards;
- Manure pads; and
- Roadways.

These observations suggest the ***requirement for a dust management plan***. This will address the two main issues that the Wiseman family perceives that will affect their enterprise being:

- The affect on their organic status; and
- The affect on their workforce particularly in relation to Q-fever.

The proponent has included a number of specific strategies within the original Statement of Commitments (SOC) that outlines these as being part of an Integrated Construction Environmental Management Plan (CEMP) and an Operations Environmental Management Plan (OEMP) that will address issues related to the generation of dust.

It is believed that these actions combined with the suggested design aspects will be sufficient to suppress dust so that it does not provide a vector for the transference of disease etc. to neighbouring properties.

We refer the Wiseman family to SOC commitment 257.

Mr Hutchins could not see where ***salinity*** had been addressed within the EA and he therefore raised the issue as a possible rather than as a real problem. He noted that typically, effluent from aerobic ponds in a beef feedlot would vary from approximately 100mg/L – 200mg/L of sodium which equates to 100kg – 200kg sodium in every megalitre of effluent water.

We refer the Wiseman family to Section 3.8: Salinity and Section 5.3.3: Minimising Waste Products.

Any responses not addressing the Wiseman family concerns within this section will be presented within the remainder of the document.

2.3.7 Mr B Flanagan

Mr Flanagan offers a plethora of responses upon most aspects of the EA report. Although he highlights that he is not adverse to the development, he feels that a more favourable option would be to locate the facilities on "Tubbo" Station and not on the proposed Coleambally site.

Primarily, Mr Flanagan expresses that the ***Environmental Balance Sheet (EBS) offered as supporting evidence for choosing the proposed site is flawed*** and that the assessment only justifies Option A providing no data or results of investigation into Options B or C.

Mr Flanagan offers the following as validation for Option C as the preferred project site:

- Closer to intensive animal industries, major commercial centres, electricity and water;
- Greater access to transport, freight services and a national highway, being the Sturt Highway, whilst the Kidman Way is only a secondary road; and
- Option C would provide better outcomes in achieving the objectives of the Coleambally Land and Water Management Plan (CLWMP).

We refer Mr Flanagan to Section 3.2: Environmental Balance Sheet

Mr Flanagan continues with his rejection of the present proposed site in favour of Option C as detailed within the EBS and responds by making comment that the ***EBS was inadequate in consideration of local, state and federal planning matters*** in light of the proposed development.

Booth Associates within their interpretation of those planning matters which pertain to the development, consider Option A to provide the best economic, social and environmental outcomes as expressed within the EBS. Without more specific references to the reasons why Mr Flanagan objects to Booth Associates' interpretation of an Option A preference with regard to planning matters, there can be no further comment made within this response document.

As with the Wiseman family, Mr Flanagan also expresses concern that the ***stakeholder consultation process was lacking*** in its approach and observes that several adjacent landholders had not been contacted. He notes that investigators have been lax in their interpretation and implementation of the Director General's consultation requirements and with regard to affected residences the requirements having not been met.

We refer Mr Flanagan to Section 3.1: Consultation.

Mr Flanagan also expressed a view that the ***EA did not include detail that complied with the Department's (DNR) request in relation to water balances*** that would include water balance requirements for ethanol and dairy enterprises.

We refer Mr Flanagan to Annexures 4.5.3, 4.5.4, 4.5.5, 4.5.6, 4.5.7a, 4.5.7b and 4.5.8 as a Consolidated Water Balance in a decile 1, 5, 9 and 10++ (DX) year included within the original EA documentation.

Mr Flanagan recognises that the township of Coleambally is outside the nominated 5km buffer zone that constitutes the affected area surrounded by the combined ethanol and dairy facility. However, Mr Flanagan feels that although current residential occupancy surrounding the site of Option A is limited, ***many of the farms have existing rural residential rights*** that need to be considered as part of the process. Mr Flanagan continues with his preference for Option C and notes that the adoption of Option C would negate any potential affects concerning rural residential rights.

It is unreasonable for the proponent of this proposed development to be required to undertake a development assessment that will take into account the speculative and very subjective nature of the desire for surrounding landholders to "potentially" develop rural dwellings on properties if no such application has been received by authorities to date.

Mr Flanagan comments that the ***synthetic TAPM generated data*** is suspect:

The TAPM generated data is considered accurate at this time as presented by Holmes Air Sciences within their Air Quality and Assessment Report; Coleambally Ethanol Plant and Intensive Dairy (2006) in this application.

Mr Flanagan notes that a ***meteorological station*** has been operating at the site since 16 February 2006. He suggests that the ***data collected thus far be used to check the validity of the TAPM generated data.***

As Mr Flanagan has noted, only a small set of data has been collected to date. This would not be a sufficient sample to be used to either discredit or support the TAPM outputs. This may be a future option once this station has been in-situ for an extended period.

We refer Mr Flanagan to SOC commitment 258.

Mr Flanagan's ***comments relating to emission dispersion rates*** are appreciated.

Mr Flanagan ***notes that the footprint (m^2) are different*** to that found in 4.1.6b and 4.1.7b and that they are also different from those used in Tables 4.2.6 and 4.2.7 for odour emissions.

These variations are of little consequence to the quantum and impacts of odour emissions given the revised waste water management strategy.

We refer Mr Flanagan to Section 5.4: Revised Waste Water Management Strategy.

With regard to infrastructure, Mr Flanagan notes that the feasibility study relied upon for the ***assessment of gas infrastructure is out-of-date*** and there is ***no reference to more recent studies or indications that the supply of gas is viable in the present climate.***

Mr Flanagan in his response continues to promote Option C as a more favourable alternative to supply gas to a plant located at "Tubbo" Station, as the ***main gas trunks can be tapped in the vicinity of Narrandera or Yanco/Leeton***; the distance and infrastructure being half that required to supply gas to the proposed Coleambally site.

It is also noted that ***high voltage lines already exist*** running through and in the proximity of "Tubbo" Station.

Mr Flanagan's comments are appreciated in relation to infrastructure. However, it is considered that the gas feasibility study utilised within the EA prepared by Infrapro Pty Ltd (2003) is current and is sufficient upon which to base infrastructure evaluations and decisions.

In addition, through maintaining Option A as the preferred project site, on-flow benefits for Coleambally Township will be realised by providing easier access for connection to the gas pipeline infrastructure.

We refer Mr Flanagan to Section 4.2: Greenhouse Gas Assessment.

Also in relation to electricity we refer Mr Flanagan to Annexure 4.0 that describes outcomes from a consultation with Country Energy which has revealed that suitable high voltage lines already exist adjacent to the proposed site.

Mr Flanagan also makes some challenges to ***noise investigations and other traffic movement related issues***. He has detected that truck movements for the transportation of denaturing fuels were not included within the spreadsheet calculations. This omission has been remedied as well as the inclusion of varied truck numbers for the transport of grains which Mr Flanagan claims will create further impacts upon noise levels.

The adjustments resulted in the addition of one truck per hour which is not considered to have a significant impact on noise levels and other traffic movement related issues.

We refer Mr Flanagan to Section3.12: Traffic Movements.

Mr Flanagan's response is peppered with ***queries relating to potential hazard*** created by the development's operations and the subsequent risk associated with these specifically for chemical usage and related accidents.

> *We refer Mr Flanagan to the Section 3.11: Hazard Assessment herein.*

Mr Flanagan expresses concern as to the disposal/sale of CO_2 by-product, particularly in light of ***current apprehensions concerning Greenhouse Gas Emissions*** (GGE). Mr Flanagan suggests the commissioning of a feasibility study into the sale of the by-product and suggests that there is in place enforceable undertakings/Heads of Agreement to ensure that CO_2 is in fact utilised within industry and not discharged into the environment. He adds that if the sale of this by-product is not feasible then a strategy should be in place to off-set this liability.

> *We refer Mr Flanagan to Section 3.9: Greenhouse Gas Emissions and Section 4.2: Greenhouse Gas Assessment.*

Mr Flanagan raises further ***concerns related to cattle vocalisation*** where he challenges the "assumption" that 15% of cattle will be vocal for 30 seconds in a 15 minute period. He explains that cattle are not only vocal during feeding but also if disturbed when pens are being cleaned or they are scared by industrial noise or the environment such as storm etc.

> *Mr Scannell utilises the above scenario as an industry standard on which to base noise levels produced by a dairy herd within his report Environmental Noise Impact Assessment, for an Ethanol Manufacturing Plant and a Freestall Dairy in Coleambally (2006). Mr Scannell has had many years experience and is considered an expert within his field. Booth Associates rely on Mr Scannell's expertise within this matter and believe that the stated assumption is correct and presents an accurate description of vocalisation upon which to base forecasted levels.*

In relation to pollutants overall, Mr Flanagan comments that the data scaled up to calculate pollutant emission and odour emissions from the Dalby ethanol plant was not a very scientific approach.

> *The "scaling-up" of data to assess pollutant emissions at the outset of the project was necessary as an ethanol facility of this magnitude had never been built in Australia. Consequently little data was available in regards to emissions for facilities of this scale.*
>
> *Even US data relies upon the addition of multiple plants to derive pollutant emissions. Therefore the "scaling up" of data was an accepted method at the time the EA was being composed.*
>
> *New and relevant information has since been received and forwarded for review. Holmes Air Science have responded and commented that the original emissions resulting from the "scaling up" of the Dalby Plant corresponds well with those provided by recent sources.*
>
> *We refer Mr Flanagan to Section 4.1: Air Quality.*

Mr Flanagan also expressed that the ***Gooloogong data is invalid*** as Gooloogong is greater than 250km northeast of Coleambally and a different climate exists.

> *This data source was relied upon as there is little comparative information available for developments of this magnitude. The utilisation of this data was therefore considered necessary and provides the most valid forecasts possible.*

Comments regarding ***air quality with specific reference to particulate*** pollutants include:

- Ethanol – description of milling operations contains no reference to dust or particulate matter studies;

> *We refer Mr Flanagan to Section 3.5.2: Air Quality Management at the Proposed Ethanol Development.*

- Traffic – no studies as to the effect the project will have on particulate matter, and the environment with regard to the additional traffic generated on unformed and dirt roads in the area;

The Director General's Environmental Assessment Requirements presented as Annexure 5.0 asks for a comprehensive air quality impact assessment prepared in accordance with the Approved Methods for Modelling and Assessment of Air Pollutants in NSW (Dec 2005), and the Assessment and Management of Odour from Stationary Sources in NSW, with particular focus on particulate and odour emissions.

Although modelling was completed under these stipulations the factor of dust from external roadways was not included as this was not considered to be required as a condition of the DG requirements in this regard. It is viewed that all additional vehicle movements generated by the development will be primarily utilising the Kidman Way. Most of the traffic will be to and from Willbriggie with a percentage of vehicles continuing loaded with product. Others will travel south past Jerilderie and beyond.

Mr Flanagan notes within his response that Four Arrows Ethanol Pty Ltd intends to purchase feedstock locally which will occur throughout the year. It is not considered that this will increase vehicle movement along dirt roads within the region as these trucks would have already been delivering grain along these routes to railheads and storage facilities. In this case demand from the development simply diverts these deliveries to the ethanol and dairy facilities. Therefore, it is not considered that this process will require extra significant movements which will utilise dirt roads for delivery and extractive purposes.

In relation to odour specifically, Mr Flanagan suggests that the ***Moira assumption of average odour emission rates of 2.0ou for dry lot pens is erroneous***, as the Department of Primary Industries and Fisheries (DPI&F) Queensland, quotes that a U.S. study indicates that the odour strength over a dry feedlot pad is more likely to be in the range of 2 – 7ou.

He goes on to express that ***figures used to model odour in relation to manure production on dry lot pens differs from those included in the mass balance calculations*** offered within Annexure 4.1.4 of the EA. Mr Flanagan notes the differences being:

- The average weight quoted within annexure was 295.7kg not 310kg as used within the odour calculations;
- The average area per beast quoted within annexure was 18.4m^2 not 21.3m^2 as used within the odour calculations; and
- This results in a value of 16.1kg/m^2 not the 14.6kg/m^2 as used within odour calculations.

The 4.6% difference between 295.7Kg and 310Kg average live weight is noted. Predicting animal live weights is not a precise science and the 4.6% variation is well within reasonable standards. The use of the upper 310Kg for odour modelling demonstrates conservatism.

The averaged areas per beast and the Kg of beast per m^2 are noted and are considered to not have any material impact on the odour modelling outcomes. In fact the allocated areas (mapped footprints) for the cattle do enable >22m^2 per beast subject to final configuration of yards and laneways etc.

Mr Flanagan also raises concern as he can ***find no reference to hydrogen sulphide and ammonia*** produced from the dairy manure and ponds.

Holmes Air Sciences within Air Quality and Assessment Report, Coleambally Ethanol Plant and Intensive Dairy (2006) have already considered the full range of odour sources under the worst case scenario presented in the original EA. That worst case scenario has been replaced by the substantial benefits arising from the revised re-cycling ponds facility.

We refer Mr Flanagan to Section 5.4: Revised Waste Water Management Strategy.

We also affirm that the 18,000 head of cattle is a possible short term peak should sales be slow or there be delayed deliveries. The normal capacity is approximately 14,000 head with all the stocking density reductions in the drylot pens for a more likely 18.4m^2 x 11,000 ÷ 7,000 = 28.9m^2/beast.

Mr Flanagan feels that all ***affected studies need to be re-done using correct and consistent figures***; however Booth Associates commend the above explanations.

With respect to waste and waste management at the project site, Mr Flanagan's submission included the following:

- Manure production from the feedlot and dry lot pens are at levels different to the Queensland DPI in their "Feedlot Waste Management Manual". Queries were raised by Mr Flanagan as to the average moisture content;
- With respect to sizing and management of the anaerobic ponds, there was significant discussion in the Flanagan response regarding rainfall decile predictions, calculated run-offs, and the use of water drawn from the aerobic and anaerobic ponds to wash cattle areas, particularly as salt concentrations increase;
- Queries were raised with regard to the removal off-site of salts in sludge from the storages and allowing that salt and sludge to enter directly into DC400;

- That there was the potential risk for groundwater contamination as highlighted within the EA;
- That there were two domestic bores within 4km of the site which were not shown in the EA;
- Freestall dairy waste and in particular waste water issues, perspectives and management requirements are substantially different to that in beef feedlots;
- The primary difference is the substantial volumes of water, at 7.2ML/day in this project, needed to flush the freestall lanes;
- The freestall flushes completely dominate the run-off from the heifer dry lot pens; and
- The security of water may have been overstated.

We refer Mr Flanagan to 5.0: Preferred Project.

Any responses not specifically addressing Mr Flanagan's issues within this section will be presented within the remainder of the document in response to the wider range of submissions.

3.0 RESPONSE TO KEY ISSUES

3.1 Consultation

Responses were received with regard to the consultation process undertaken during the preparation of the Environmental Assessment (EA), and concerns raised over:

- A perceived lack of direct consultation with relevant stakeholders; and
- The omission of potential affected residences adjacent to the proposed project site.

It is pertinent at this stage to outline the procedure undertaken to address the requirements for consultation with relevant stakeholders from which the respondent's concerns were derived.

Upon examination of the Director General's requirements, the authors of the EA initiated communication with major public and private sector organisations within and surrounding the region. Requests were made for assistance in the identification of stakeholders to facilitate consultation requirements in preparation of the document.

Below is listed the organisations and groups contacted to provide information where appropriate:

- Murrumbidgee Shire Council;
- Coleambally Irrigation Co-operative Limited (CICL);
- Coleambally Chamber of Commerce;
- State and Regional Development;
- Griffith City Council; and
- Murray and Riverina Regional Organisation of Councils.

It was made clear, in the first instance, that Murrumbidgee Shire Council were unable/unwilling to provide detailed lists of rate payers within the vicinity of the proposed development. Consequently, information was obtained in regard to farm numbers throughout the region, and a process of identification of ownership of farm numbers was initiated. From this investigation, a list of registered names was created and endeavours made to contact each of the identified people directly via telephone. The list of immediately neighbouring properties was provided in the original EA document. Based on respondent's comments it appears apparent that this list was not a satisfactory representation of potentially affected stakeholders within the area.

The authors of the EA were aware of this risk of omission at the outset of public community consultation. Consequently opportunity was provided via the Murrumbidgee Shire Council, Coleambally Chamber of Commerce and other local community organisations identified above to provide contact details for Booth Associates to any and all parties who had potential or actual concern or interest in the proposed development. Regular communication was held with these organisations and regular presentations made to CICL shareholder meetings, committee gatherings etc. At all times a request was made to attendees to keep the non-attendees advised and to encourage stakeholders to seek personal contact with Booth Associates if they so desired. This process was aimed to provide detail on the proposed project to as broad a public audience as possible in the hopes that the information would filter down through various interested parties, resident stakeholders and surrounding community members.

Whilst it is unfortunate that various stakeholders and surrounding community members feel a lack of opportunity to voice their concerns or show interest in the project, or even ask for further information regarding the proposed development, it is and always will be a potential risk that not all stakeholders can be directly contacted prior to a public display period. Notwithstanding, it is clearly evident that the respondents who raised concerns have availed themselves the right to lodge a submission during the period of public display.

Respondents have also raised concern that various receptors near the proposed development were not identified in the EA document. It is not a reasonable assumption that all receptors could be identified. Information on receptors surrounding the proposed development was obtained through utilisation of the system as outlined for community consultation and through visual assessment of aerial imagery identifying where possible, all dwellings and residences, places of work, gathering and meeting points etc. Certain discretion has been undertaken during the analysis of aerial imagery to disregard some ancillary farm structures such as silos, dams, hay sheds, etc.

The receptors as outlined as being known in the area of Receptor 22 are well beyond the radial distance of all modelled impacts with specific reference to noise, air quality and odour issues. Regardless of the potential for additional receptors near Receptor 22, the air quality modelling places all potential receptors in this geographic location beyond the range of potential impacts. The results of the investigation and the quantification of potential impacts on other surrounding receptors would not change. These receptors are beyond the area of impact, and consequently whilst of significance to the proposal from the viewpoint of having been overlooked, are not significant to the proposal in regards to potential environmental impacts requiring mitigation and management.

3.2 Environmental Balance Sheet

An individual response to the EA public display was made in regards to the Environmental Balance Sheet (EBS) prepared for the proposed development. It has been outlined that the assessment process for the EBS is flawed, providing no justification to reject Options B or C above the Option A as investigated.

As was clearly outlined in the original EA the EBS process is not an exacting science and is open to critique through its very nature. The EBS is merely provided as a tool to stimulate discussion to arrive at a preferred outcome for site selection prior to undertaking costly and expensive detailed investigation post completion of an EBS.

As was originally detailed, the EBS is a qualitative rather than quantitative assessment and as such various outcomes will be obtained if the EBS is undertaken by other parties. That notwithstanding, it is clearly evident from the EBS provided in the original EA that both Options B and C result in an overall decline in project site suitability if moved from the location proposed in Option A. That said, we have undertaken a second EBS in reviewing the suitability of Option C over Option A. The specific Heads of Consideration that have been reviewed less critically are outlined in Table 1.0.

Table 1.0: Reviewed Heads of Consideration

Heads of Consideration		Original			Version Less Control			Respondent's Ideal		
Item No.	Option	A	B	C	A	B	C	A	B	C
14	Electricity	8	5	3	NC	NC	NC	NC	NC	10
15	Water Availability	8	5	8	NC	NC	NC	NC	NC	10
16	Roads	8	5	2	NC	NC	NC	NC	NC	10
21	Odour	7	8	7	NC	NC	9	NC	NC	NC
23	Noise	6	7	2	NC	6	5	5	NC	NC
25	Traffic	5	3	1	NC	NC	3	NC	NC	NC
26	Safety	7	5	1	NC	NC	NC	NC	NC	NC
27	Access	8	6	1	NC	NC	5	NC	NC	NC
28	Consistency	7	5	1	NC	NC	3	NC	NC	NC
47	Economic	9	9	9	NC	NC	NC	NC	NC	10
48	Nationally	9	9	9	NC	NC	NC	NC	NC	10
49	Commercial Project Itself	9	6	7	NC	NC	9	NC	NC	10
50	Other	8	7	5	NC	NC	7	NC	NC	10

NC = no change Higher Lower

As can be seen from the preceding table Option C has been amended to exhibit a loss of 46 score points in the original EBS to a loss of 26 points in the amended EBS (Annexure 6.0). An alternative exercise was undertaken whereby the specific Heads of Consideration related to the respondent's concerns were all given a maximum score of 10 above and beyond the original EBS results. Annexure 7.0 shows that when providing an absolute best case score for the Heads of Consideration identified as being flawed in the original EBS, Option C still only represents a loss of score points of 27 below the original. This score is in line with Annexure 6.0 attached, which is the less critically analysed EBS taking into consideration Heads of Consideration beyond those, as well as including those outlined by the respondent.

At no time has the EBS been outlined as the most appropriate decision making tool for undertaking further detailed EA, however some form of preliminary decision making needs to be undertaken before incurring large cost and consumption of time through investigating all potential project sites, to arrive at an outcome that could well be less than appropriate in the first instance. This is why Options A, B and C were presented.

Option A was always considered the preferred outcome and so was established as a benchmark for the assessment. It can be said that had Option C originally been proposed as the preferred project site location, that following the EBS analysis, Option C would have been discounted in that instance as an appropriate site for further investigation, and current Option A which would have been presented as Option B or C would have remained the site outcome most appropriate for more detailed analysis.

The respondent clearly outlined that Option C would present as a preferred outcome based on transport issues and the Sturt Highway being a national highway whilst the Kidman Highway is only a secondary road. By shifting the preferred project site to either Options B or C within the EBS, not only is heavy vehicular transport moved from a road recognised as a major thoroughfare with a 100km speed zone, but would force heavy transport numbers to traverse the region through local secondary roads. These secondary roads are often unsealed; creating dust, noise, hazardous material transport and visual impacts, and also traversing Coleambally Irrigation Area (CIA)

infrastructure that has not been designed and engineered to cope with the loads of transports proposed by the development. Consequently Option A, being able to limit heavy vehicle transport to what is a limited number of roadways, is the preferred outcome.

The respondent also identified that Option C would provide better outcomes in achieving the outcomes of the Coleambally Land and Water Management Plan (CLWMP), and in particular 1, 3, 5 and 6 of the CLWMP. As is often the case with an EBS, the objectives of the CLWMP and whether Options A, B or C would result in a preferred outcome for set objectives, is a subjective measure. If one were to consider each of the options, all options provide risks to the objectives as outlined in the CLWMP.

Option A as a preferred project site, does present environmental risks and various hazards that need to be managed. The purpose of the EA and public display is to clearly ensure that these management options are achievable. Whilst particular aspects of Options B and C may present as a lesser risk or preferred alternative to preferred site Option A, any and all of the Heads of Consideration should not be considered in isolation or sub-groups of the picture as a whole. Option A still presents, even under the scenarios presented by the respondent, as the preferred site to limit environmental risk and maximise opportunities for management of risk and flow-on effect, both social and economic, to the surrounding community.

3.3 Groundwater Movement and Quality

Department of Environment and Conservation (DEC) has documented the need for additional information on groundwater flows and levels plus water quality within the area of the project site and has verbally indicated the need to provide details of the source of the research relied upon in the EA as displayed.

Section 4.5.3 at Page 4-55 in the EA was based upon two primary researched data sets. These data sets were detailed in the EA and are:

- *Groundwater Dynamics in the Coleambally Irrigation Area*. A report prepared by CSIRO Land and Water, Griffith of November 2000 (CSIRO); and
- A series of data sets on soil surveys, EM surveys, rice drilling logs and piezometer readings from specifically the project site and its immediate surrounds as provided by Coleambally Irrigation Co-operative Limited (CICL).

The relevance of the above data sets is discussed in the following sections.

3.3.1 The CSIRO Report

The Commonwealth Scientific and Research Organisation (CSIRO) report is comprehensive, recent and included a review of all relevant prior reports. The CSIRO report defined, discussed and placed in context all the drivers of groundwater flows within each geological formation and detailed the inter-relationships between each formation.

Most importantly, the CSIRO report placed the groundwater dynamics at the project site in full context with the overall dynamics of groundwater both in and around the Coleambally Irrigation Area (CIA).

Also of significance is that the CSIRO report documented the major influence the substantial volumes of groundwater being extracted for irrigation purposes in the Darlington Point area had on groundwater dynamics to the immediate north and northwest of the CIA in 2000. The dominating influence of the numerous and substantial regional production bores on groundwater flow at the project site is well demonstrated in a copy of a map from Section 3.3.2 in the CSIRO report inserted on the following page.

Therefore the groundwater flows and dynamics at the proposed project site at the north west edge of the CIA remains dominated in 2006/07 and for the foreseeable future by the:

- Local and immediate regional recharge dynamics within the CIA; and
- The continuing and substantial volumes of groundwater being extracted for irrigation to the immediate and near north/northwest of the project site.

Between the above two main drivers of groundwater flows regionally, the actual flows at and surrounding the main project site are currently and will remain as flows to the north/northwest. The only potential change to the current groundwater flow would be the installation and operation of a significant production bore/s to the near south or southeast of the project site.

The recharge dynamics from upstream or east of the CIA where the proposed mortality and manure disposal sites are to be located, are driving groundwater flows to the west by the past land clearing in the wider catchment (recharge) and the natural hydraulic head changes in the geological landscape.

Given the quality and recent timing of the report by CSIRO and the identified specific drivers of the groundwater dynamics at and around the project site, it was considered that an additional hydrogeological study was not warranted for the EA.

Despite this conclusion and should DNR require additional hydrogeological data then it is reasonable that DNR prepare a specific brief of their needs with supportive scientific reasoning as to the need for each specific task listed therein.

3.3.2 Existing Groundwater Quality

A water sample was extracted from the project piezometer after appropriate pre-bailing to ensure removal of any adverse impacts from the installation process and to ensure representativeness of the sample. The bailing and sampling equipment and the sample container were also cleaned to ensure no contamination of the water sample. The water sample is from the upper Shepparton formation. The water sample was forwarded for analysis to the NATA accredited laboratory owned and operated by Incitec Pivot.

A copy of the analysis is attached hereto as Annexure 8.0. In summary, the existing groundwater has high sodium, calcium, chloride and Tolerable Dissolved Solids (TDS) levels. The Sodium Adsorption Ratio (SAR) is elevated but still satisfactory at 6.8 and the groundwater calcium levels could assist in limiting soil sodicity hazards if the existing groundwater were to be used for irrigation purposes.

Extract From CSIRO Groundwater Report

3.3.2 Groundwater Flow Patterns in the Calivil Formation

The August 1998 piezometric levels and the groundwater flow patterns for the Calivil formation are drawn in Figure 12 with red dots showing the location of observation bores. The overall magnitudes of flow vectors are higher than in the Shepparton formation (0.029 to 13mm/day) due to the continuos and more permeable nature of the Calivil formation.

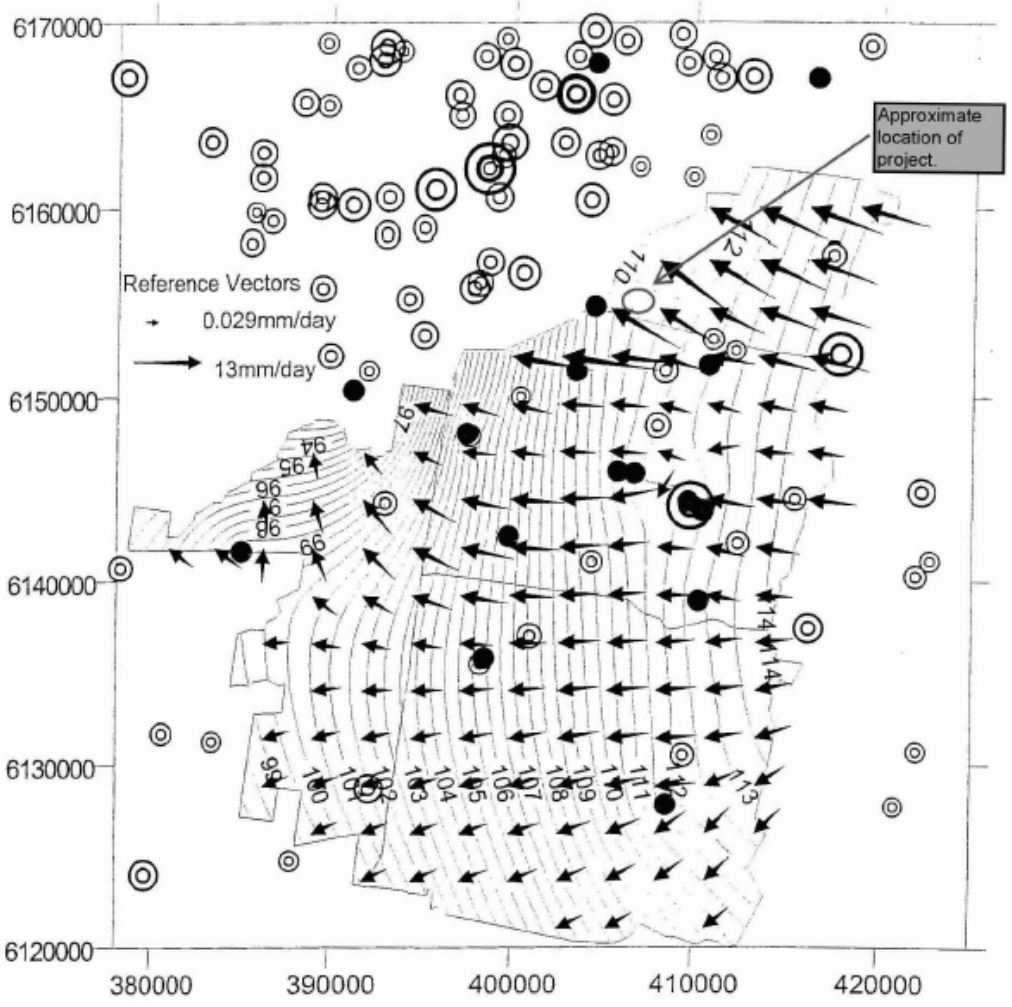


Figure 12: Groundwater elevation contours and flow vectors for the Calivil aquifer under the CIA, September 1998. Purple dots indicate locations of pumping bores and are scaled to represent pumping rates from a minimum of 0 to a maximum of 6000ML/year.

The following conclusions are drawn from the flow vectors in the Calivil formation:

- The general flow vectors in the Calivil formation are directed from East towards West.
- The flow magnitudes are highest in the Northern CIA with arrows pointing towards the bore block next to this area. This situation will result in higher flows from the Shepparton to the Calivil formations in locations where the connection between the two aquifers is better due to the presence of sandier deposits from the prior streams and the

The current poor quality of the existing groundwater reflects irrigation and land use practices in and around the CIA wherein:

- In the pre-European settlement and pre-irrigation environment the elevated ion levels had been parked over the prior millennia at 1 – 2 meters below Natural Surface Level (NSL) in the Riverine soils by non-saturated soil leaching processes;
- Following widespread irrigation since the 1960's, the ions have moved down through the soil profile when driven by flood irrigation leaching processes or essentially saturated flow conditions.

Even given these considerations it would be reasonable to expect that over future decades there will be significant beneficial responses to the now implemented LWMP. That is, groundwater may be expected to improve or at least not deteriorate any further in quality and that, in the absence of a succession of very wet years, groundwater levels will continue to fall.

The pre-existing groundwater quality is already of a standard to give cause for concern if that water were to be used for on-going irrigation and domestic purposes. The preferred mitigation strategies for protecting the pre-existing groundwater quality are:

(i) To prevent further accessions; and

(ii) To generate waste water this is equal to or better than the quality of the current groundwater.

The proposed waste management system achieve the aims of both these strategies.

We refer readers to Section 3.7.1.2: Extra Waste Water Quality Data and Section 5.0: Preferred Project.

3.4 Soils and Geotechnical Assessments

3.4.1 Original Soils Assessments

The database sets supplied by CICL were provided to the project geotechnical engineer and soils expert who reviewed and assessed same when preparing their soils/geotechnical report. The CICL data sets were also assessed by other project team members for developing the overall site plan which was, in turn, reviewed for appropriateness in minimising groundwater risks before the documented site plan was agreed upon.

Examples of some soils data provided by CICL for this project are (rice suitability EM and drift logs) included over page. The CICL datasets were substantially more detailed but the inclusions herein affirms the source and extent of information provided. A section of soils map prepared for a report by *DC van Dijk and T Talsma (1964)* is also included as a second insert over page as supporting evidence of broad range of soils assessments available for the EA as displayed.

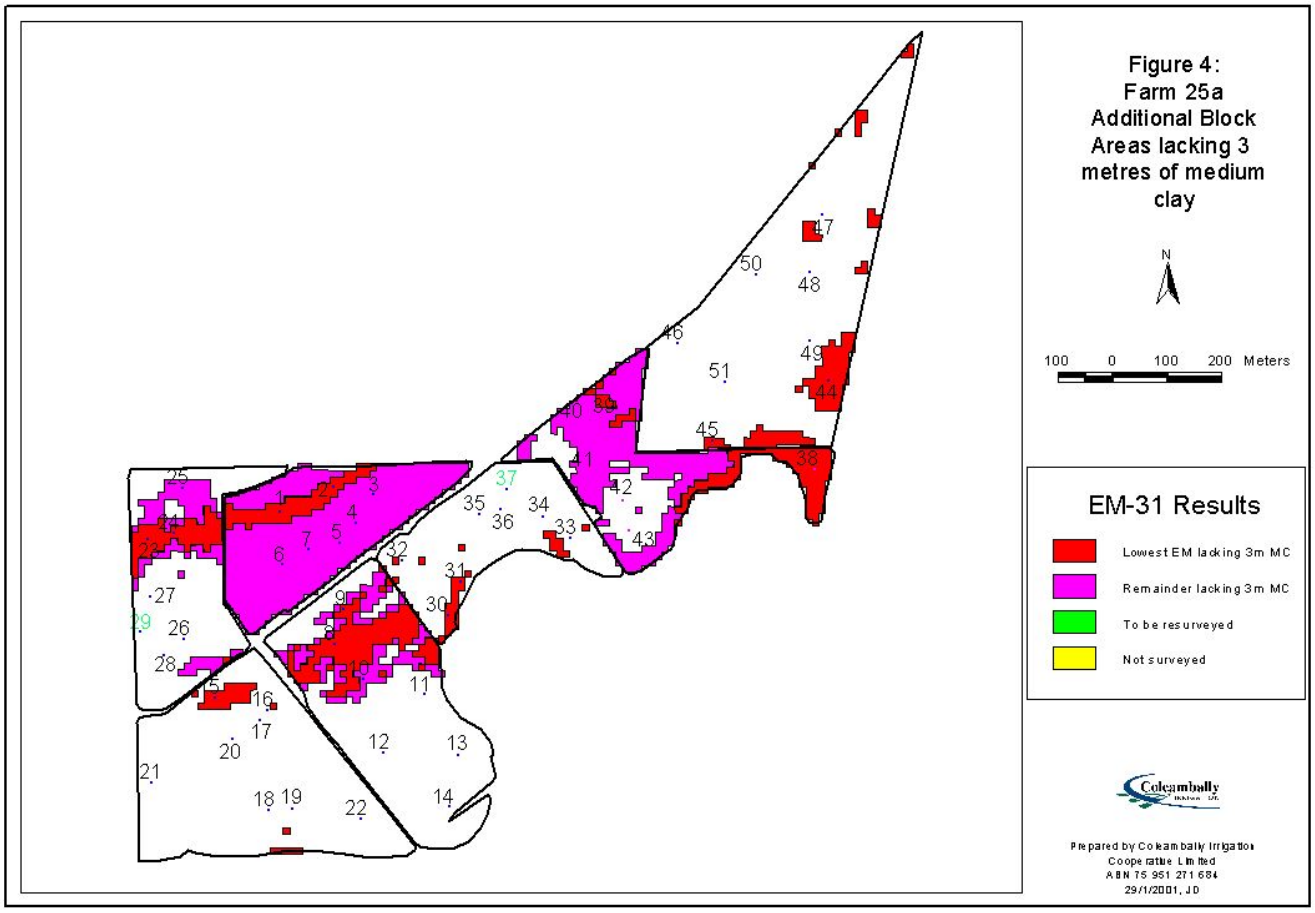
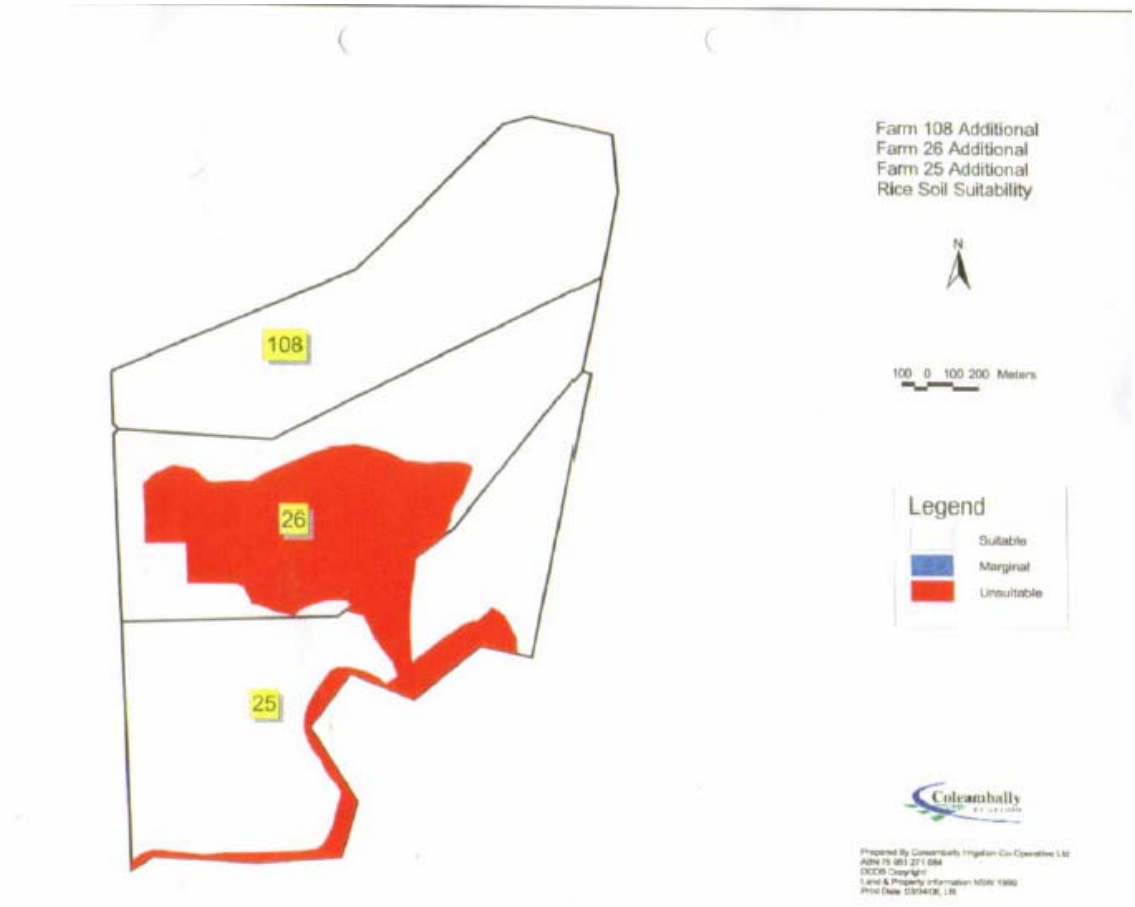


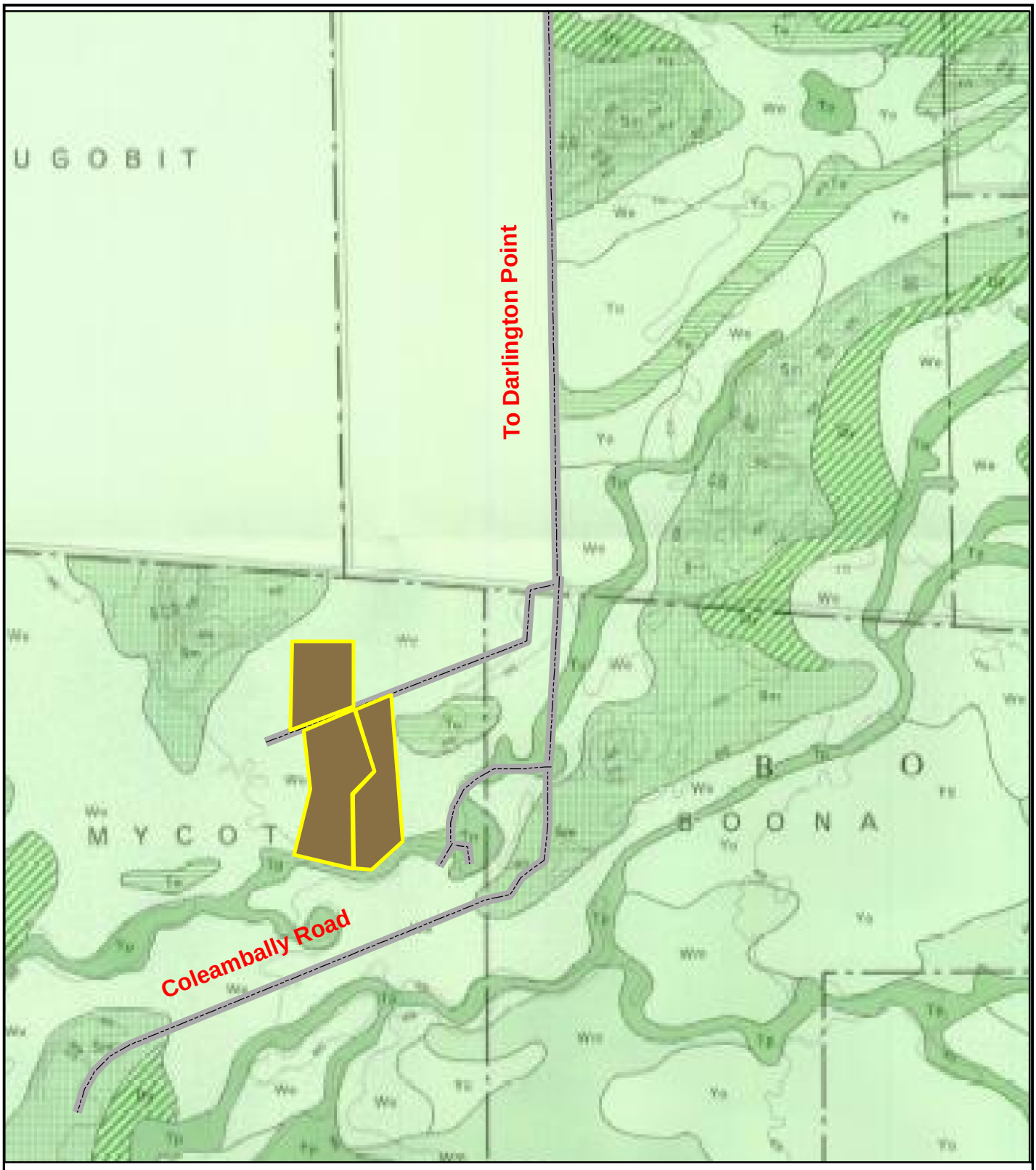
Figure 4:
Farm 25a
Additional Block
Areas lacking 3
metres of medium
clay
N
100 0 100 200 Meters
EM-31 Results
Lowest EM lacking 3m MC
Remainder lacking 3m MC
To be resurveyed
Not surveyed
Coleambally
Prepared by Coleambally Irrigation
Cooperative Limited
ABN 75 951 271 684
29/1/2001, JD


Farm 108 Additional
Farm 26 Additional
Farm 25 Additional
Rice Soil Suitability
N
100 0 100 200 Meters
Legend
Suitable
Marginal
Unsuitable
108
26
25
Coleambally

Soil Portion of Coleambally Irrigation Area, NSW D.C van Djik & T. Talsma

Creation Date: 01/08/2007
File path : T:/Four Arrows/Plan1_040707
Created by : Christelle Borella, GIS Administrator, Booth Associates
Project : Four Arrows Pty Ltd

Booth Associates



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Note: This image was not drawn to scale.

The detailed soils assessment was reported in Section 4.7 of the EA as displayed with the supporting Wrigley-Dillon report attached thereto as Annexure 4.7.1. From a total of 21 slot trenches the Wrigley-Dillon report identified four main soil types with the predominant red/brown earth covering 57% of the project area, the grey transitional soils covering another 25%, sands covered 12% and black self-mulching clays 6% of the project area.

Each of the soil types presented themselves separately and distinctly. Only the sandy soil should be and was excluded from any proposed development.

The red/brown earth was determined to have good prospects for the construction of water and waste water storages, dry lot pens, freestall sheds, loafing pens and other infrastructure. Of the A1 and B1 horizons, 40cm in total were set aside for specific engineering purposes and the B2 and B3 horizons were to be utilised for general construction and water storage liners. The grey transitional soils were deemed to have good prospects for water and effluent storages whilst the black self-mulching clays provided opportunities as extra material for enhancing storage liners.

Subsequent to the Wrigley-Dillon report, soil samples were obtained in accordance with accepted procedures and delivered to the Lane Piper NATA accredited geotechnical laboratory in Melbourne for detailed analysis. The net outcome of the laboratory analyses using elevated salinity test water to assess outcomes and infrastructure integrity relative to waste water management is summarised as:

- The mix of soils on the project site will enable admixture of the suitable soils to optimise particle size distributions for maximising the performance of compacted earthen liners beyond the geotechnical performance of each individual soil type. That is, the mixing of soils is preferred over the use of one soil type only.;
- The appropriate admixture of soils would achieve actual operational soil permeability rates at well below the minimum standard of 1 x 10^{-9}m/sec for engineered and compacted earthen lines;
- The eventual performance of the admixed material would be driven by the ratios and analyses of soils as they presented during the construction phase although guidance would be provided in the detailed design level investigations; and
- The use of laboratory testing water with elevated salinity for these analyses has affirmed soil aggregate stability at such levels to sustain storage liner integrity. The importance of such procedures is documented at Sections 2, 3 and 4 of the copy of a conference paper (*Van de Graaff & Patterson)* is attached hereto as Annexure 9.0.

With the longstanding experience and wide peer respect for the geomorphic, pedological and geotechnical capabilities of Wigley-Dillon combined with:

- *in-field appraisal of 21 slot trenches for this project; and*
- *assessment of the detailed data sets from CICL.*

should have provided the required level of comfort for optimal infrastructure construction and the claimed operational performance.

We refer readers to SOC commitment 259 and 260.

Additional factual data has been obtained subsequent to the preparation and display of the EA. That data will be presented and discussed in the following sub-sections.

3.4.2 Agency Responses Regarding Additional Soils and Geotechnical Assessment

The DNR submission indicates that in their opinion there is a need to:

- Provide additional specific geotechnical and hydrogeological data on the project site; and
- Factually affirm or otherwise, the ability of on-site soil materials to mitigate against contamination of an aquifer which is being used for domestic supplies.

The DEC also submitted similar requests, and further investigations to satisfy the responses of both agencies are detailed in the following sub-sections. We also direct agencies to Section 5.4.4, 5.4.5, and 5.4.6 which contain other relevant discussions regarding site and soil suitability in regard the proposed waste water management system.

Agencies have also expanded upon their concerns relating to geotechnical issues and have expressed the following queries:

- Whether or not there is a sufficient volume of suitable clays on-site with which to construct the compacted earth and compacted liner facilities?
- If the volume of suitable clays is not available on-site then where will such clays be obtained and what will be the impacts of obtaining such clays?

These points for further investigation are attended to in the following sub-sections where additional laboratory data which has been obtained subsequent to the preparation and display of the EA is presented and discussed.

We refer readers to SOC commitment 261.

3.4.3 Volumes of Suitable Soil on Site

The first point to make is that the use of clays alone for constructing earthen liners, compacted embankments and many other specialised infrastructures is not always the best engineering or geotechnical practice. In many instances an appropriate mix of soils provides the best outcome as the various soil fractions are able to minimise void spaces and the risk of soil cracking within foundations and liners is also substantially reduced. With minimised voids and minimised soil cracking in conjunction with best practice compaction techniques, permeability rates through these engineered layers may be reliably reduced to near negligible levels.

The avoidance of those parts of the A horizon with significant organic matter content is also best practice. The A horizon material may still be used as outer embankment cover for growing and stabilising vegetative cover, re-topsoiling of borrow areas and re-topsoiling of the sides of drains etc. to facilitate grass cover and maxmise the potential for erosion control.

The starting point for determining the broad quantum of geotechnical soil availability on the project site is to use the Wrigley-Dillon report included as Annexure 4.7.1 and discussed at Section 4.7 Page 4-74 in the EA as displayed. The initial and generalised calculations are as follows noting that only three of the four of the identified soil types are assumed for this exercise to contain suitable geotechnical material:

- Red/brown earths – the layers from 0.4m to 2.0m are suitable. These soils cover some 57% of the site.

> *Volume 359ha x 57% x 1.6m = 3,275,000m^3.*

- Grey transitional soils – the layers from 15cm to 2.5m are suitable. These soils cover 25% of the site.

> *Volume 359ha x 25% x 2.35m = 2,100,000m^3.*

- Black self-mulching clays – the suitable layers are from 0.25m to over 3.0m. This covers 6% of the site.

> *Volume 359ha x 6% x 3.0m = 650,000m^3.*

- Total available volume is therefore rounded to say 6,000,000m^3.

There is neither the desire nor need to consider mining parts or large sections of the site down to the potential depths of 3$^+$m in the search for "borrow" for the project infrastructure. What the above simple calculations do is demonstrate the scale of the quantums of suitable soils which are available on-site.

Attached as Annexure 10.0 is a realistic and indicative by descriptor, mass balance of the sources and sinks of soils required to establish the foundations and liners for the project infrastructure. The word "soil" has been purposely used to differentiate between the appropriate mix of soils needed for optimal geotechnical performance and the apparent confusion associated with the need for suitable "clays" only.

The calculations have been based on a "struck" cubic metre of soil. That is the volume at the bulk density of the soil in its natural state. A "struck" cubic metre is differentiated from a "loose" cubic meter and a "compacted" cubic metre. A "loose" cubic meter is that volume which contains soil which has been loosened or conversely has lost most of its inherent and integrated structure when being handled by machinery.

A compacted volume is obviously that volume taken up by artificially compacted soils – usually at stated conditions of compactive effort.

Thus in Annexure 11.0:

- "Fills" are of compacted soil expressed in "struck" volumes. For example, to achieve 1.0m^3 of compacted soil requires 1.25m^3 of "struck" soil at 25% compaction;
- "Borrowed" soil is always in "struck" volumes since the "borrows" are of soil in its natural state and not from a cultivated or otherwise loose (heaped) volume.

For construction purposes, only the top 0 – 5cm of "topsoil" would normally need to be removed and not used as part of the compacted layer/s. The word "topsoil" is a loose term denoting a layer of soil with a modicum of organic matter. Any removed "topsoil" would be replaced in locations such as exampled in the following list:

- In the intended drainage lines for the Category 1 and 2 water, to re-topsoil the exposed layers and facilitate re-vegetation which in turn reduces erosion and filters run-off;
- Topsoil borrowed from the Category 3 drains could be used as additional topsoil in the irrigation cells;
- As a compacted under-layer but not part of the compacted specific geotechnical layer required for protecting groundwater against deep percolation losses and providing engineered foundations for buildings etc; and
- For enhancing landscaped areas.

The data in Annexure 10.0 is summarised as follows:

Table 2.0: Indicative Fills and Borrows at Proposed Site

"Fills" Required On Sie (,000m^3)			"Borrows" On Site (,000m^3)	
	Compacted	**Struck**		**Struck**
Freestall Sheds	40.3	50.4	Category 1 Drains	20.0
Freestall Loafing Pens	13.0	16.2	Category 2 Drains	20.0
Freestall Maternity/hospital	10.4	13.0	Category 3 Drains	25.0
Maternity/Hospital Loafing Pens	2.2	2.7	Road/Vehicle Park Table Drains	20.0
Drylot Pens	21.6	27.0	Sedimentation Basins	11.2
Cattle Working Yards	0.9	1.1	Surge Storage	41.0
Milk Barn/Cow Washdown	25.6	12.4	Surge/Sediment Pump Station	0.4
Water Storages (net)	0.0	32.0	Spare Soil Category 2 Storage	21.6
Ethanol Plant footing	0.0	0.0	Ethanol Footings	10.0
Roads and Parking	12.0	15.0	Borrow Pit	11.4
Grain Bunkers	8.6	10.8	Sundry	0.0
Rounding Error	0.0	0	Rounding Error	0.0
Totals	**144.5**	**180.6**	**Total**	**180.6**

Comments arising from the above table include:

- The volume of soil excavated for the ethanol plant and associated infrastructure footings (which also includes excavations for below natural surface components) has been estimated at 10,000m^3;
- The soil for the re-cycle ponds and the evaporation basins have been largely balanced in Annexure 11.0 and hence only the net of "borrows" are included. Notwithstanding there is scope to source soil surplus to embankment needs if needed and deemed appropriate;
- The surplus soil from the Category 2 storage is that soil originally expected to be spread more widely around that facility if it were not required elsewhere; and
- Additional soil will be available around the site when final designs are prepared.

The foregoing comments affirm that there are sufficient volumes of the appropriate soils on the project site and that the "sources and sinks" will be balanced.

3.4.4 Geotechnical Laboratory Testing

Subsequent disturbed core drilling at the project site has affirmed the same soil profiles as in all prior drill logs and moist soil was located at the depth as is found in the CICL monitoring piezometers. All the soil profiles for the Wrigley-Dillon report and the 60 disturbed core holes to 3.6m for the prior and officially documented rice suitability assessments also essentially matched the on-site deeper disturbed core drilling and the CICL piezometer logs.

Following the meeting with DNR, DoP and DEC staff in Griffith on 24 November 2006, and a later telephone conversation with DNR staff and the appropriate team members, the following agreed actions were taken:

- An agreed single permanent piezometer was installed on the western boundary of the project site as depicted on the map in Annexure 12.0. The log of this piezometer hole is attached as Annexure 13.0;
- Representative geotechnical soil samples were taken in accordance with best practice procedures and then personally delivered to the NATA accredited (No. 3145) geotechnical laboratory of Lane Piper Pty Ltd in Melbourne. The specific tests required of Lane Piper were directed by the project soils specialist and geotechnical engineer. The results attached as Annexure 14.0;
- Agricultural soil samples were taken from a number of locations across the, what had been, proposed new enhanced waste water irrigation site, aggregated and a sample forwarded for analysis at the NATA accredited laboratories of Incitec Pivot. The results are attached as Annexure 15.0a; and
- After an appropriate period for settlement post installation and then prolonged bailing of the new permanent piezometer, a groundwater sample was taken and forwarded to the NATA accredited laboratory of Incitec Pivot for analyses. The results are attached as Annexure 8.0.

The new piezometer was located with the prior general knowledge of DNR and it was agreed that one new piezometer on the project site, especially on or near the western side, would suffice for DNR assessments of project sustainability and for their making a determination on this EA.

It is also noted that the drillers log for the permanent piezometer essentially matches the logs for the prior disturbed core drilling for the project investigations and the local area CICL monitoring piezometers provided for the EA as displayed.

In line with the project team's original recommendations, it was further agreed with DNR staff that additional performance monitoring piezometers would need to be installed during the project construction phase and that further baseline groundwater levels and water quality data would also be required prior to filling any water storage and the commissioning of the facilities.

Subject to any new evidence arising during detailed design investigations and the construction phases Booth Associates recommend installing:

- *One piezometer at each corner of the new enhanced waste water management system;*
- *Another one at each corner of the combined freestall and dry lot pen areas; and*
- *Further single piezometer at the north section of the ethanol plant.*

We refer readers to SOC commitment 262.

The geotechnical soil analyses undertaken by LanePiper were conducted with elevated electrolyte water at 700mg/L TDS to ensure soil aggregate stability will remain under relatively adverse waste water salinity levels. The reasons for using elevated salinity testing water is well described in Sections 2, 3 and 4 of the copied conference paper presented in Annexure 9.0. The geotechnical laboratory results are presented in Annexure 14.0. The results of the laboratory analyses are summarised below:

- The assessed permeability rates are 75% to 85% less than the minimum standard of 1 x 10^{-9}m/sec except for one sample which is 2.4 times the minimum;
- The elevated electrolytic testing water affirms the laboratory assessed permeability rates would be the worst case scenario in operational practice;
- The analysed samples fairly represent the suitability of the soils for storage embankment and liner construction; and
- The soils range in particle size over the full clay, silt and sand fractions and:
  - Thereby avoid the problems associated with cracking in clay liners;
  - Enable on-site mixing for optimising water storage liner performance to levels greater than the minimum standard.

In a correctly operating waste water management system the added benefits of soil pore clogging may be achieved with:

- Decaying organic matter including soil microbes;
- Biological slime;
- Mono-saccharides; and
- Dispersed clay and silt particles.

Therefore the actual permeability rate could be reasonably expected to be substantially less than that determined in the laboratory by the LanePiper geotechnical assessments. The maximum rate of accessions (if any) to the groundwater system could be as low as 1.0 to 5.0mm/year against the 31.0mm/year minimum standard (1 x 10^{-9}m/sec) and the 25mm/year averaged rate determined by LanePiper.

It is recommended by the project geotechnical specialists that:

- *A minimum thickness compacted earth liner of 600mm is sufficient and should be employed in the waste water (Category 3) ponds; and*
- *A thicker earthen liner would be preferable to employing bentonite or geo-synthetic liners.*

We refer readers to SOC commitment 263.

3.5 Air Quality

3.5.1 Agency Responses Regarding Air Quality and Assessment

DEC have raised concerns that the EA did not provide a clear and unambiguous picture of the proposal as a whole, and consequently the DEC have been unable to evaluate the proposed development in regard to air quality impacts. There are two specific requests raised by DEC namely:

- A clear picture of the proposed ethanol facility be provided and direct identification of all potential processes that could generate odour and quantification of these emissions be outlined.

The EA needs to more clearly outline the management strategies to be put into place to ensure that:

- The production of WDG will not exceed on and off-site demands and if so, what odour potential exists and how this odour potential will be managed.

In addition the DEC with regards to Wet Distillers Grain (WDG) management has expressed the following requiring further investigation:

- If dryers are not to be utilised, then information must be provided that demonstrates the production of wet distillers grain (WDG) will not exceed total demands; and
- Consideration must be given as to the affects on demand, should increased WDG become available to the market due to establishment of similar projects currently proposed in New South Wales.

Given the preceding requests from DEC for further investigation, these will be addressed separately in subsequent sub-sections of this report.

3.5.2 Air Quality Management at the Proposed Ethanol Development

3.5.2.1 Proposal as a Whole

Four Arrows Ethanol Pty Ltd has previously clearly outlined in the EA as submitted a proposal to build an ethanol facility with a production capacity of 300ML of ethanol per annum. In addressing the concerns raised by the DEC Booth Associates have requested from ICM Inc, being ethanol plant designs and engineers that specifications are provided that will guarantee the plant will not exceed the DEC air quality emissions guidelines limits. ICM Inc were tasked with demonstrating that a facility almost 40% larger than that proposed will still meet the DEC guidelines. Consequently, all air quality and emissions from the proposed development have been modelled on a facility with the capacity to produce 416ML/annum (100 million gallons/year).

3.5.2.2 Process Description

The proposed facility will receive grain by truck to the grain storage facility on the project site. The grain will be mechanically conveyed from receival pits to grain storage. From storage the grain will be conveyed mechanically to a day storage bin. The grain will then be dry milled into a powder where it is mechanically conveyed to a mixer. Emissions control is by high efficiency baghouse.

In the mixer, the grain powder is mixed with recycled process water from the cook water tank to form a slurry. This slurry is then cooked in order to liquefy and break down the starch into sugars. After cooking, the slurry is cooled with non-contact water and conveyed to fermenter process vessels where the fermentation process, along with added yeast, converts the sugars to ethanol and carbon dioxide. The fermentation process produces a fermented mash called beer. The fermented slurry (or beer) is pumped from the fermenters to the beer well. The beer well is a process vessel that provides a continuous flow of beer slurry to the distillation column. The carbon dioxide from the fermenters and beer well passes through a high efficiency water scrubber in order to remove residual amounts of ethanol and other Volatile Organic Compounds (VOC's). The scrubbed CO_2 from the fermentation scrubber may be either discharged to atmosphere or piped to an adjacent CO_2 recovery plant. Should the CO_2 plant go down, the CO_2 would be entirely discharged to the atmosphere. The water from the CO_2 scrubber is pumped to the cook water tank to be recycled into the process.

The beer contains approximately 10% ethanol in addition to non-fermentable grain solids. The ethanol is separated from the beer by distillation and subsequently leaves the distillation section as 190 proof ethanol where it is stored in an internal floating roof tank. The 190 proof ethanol at this point contains residual water. Therefore, the 190 proof ethanol then passes through a molecular sieve in order to remove any remaining water, thereby producing 200 proof ethanol to be stored in an internal floating roof tank. The 200 proof ethanol is then mixed with a denaturant (natural petrol or unleaded petrol) and stored in an internal floating roof tank for truck load out. Emission control from truck and rail load out is by a high efficiency flare system. The VOC vapours from distillation equipment (mixer, slurry tank, cook water tank, yeast tank, condenser) are ventilated to a Regenerative Thermal Oxidizer (RTO).

The distillation process removes the ethanol from the beer, non-fermentable grain solids, and water. The residue mash (whole stillage) leaving the distillation process is transferred from the base of the distillation column to the stillage processing area. The whole stillage then passes through a centrifuge process to remove the majority of water. The underflow from the centrifuge is called WDG. Since the plant will not have a complete drying capability the WDG can be handled in only one way as follows:

- The WDG commonly called wet cake (approximately 65% water) can be loaded directly to customer trucks as high quality animal feed. It can also be stored on a pad (typically for 2 to 3 days) until final sale; and
- For longer haulage and deliver and/or to meet specific delivery needs the wet cake may be belt pressed to take moisture levels down to approximately 35%.

The overflow from the centrifuge, called thin stillage, enters an evaporator to reduce water content. The concentrated stream from the evaporator is mixed with the centrifuge underflow stream (or added later). The water stream from the evaporators goes to the methanator. The methanator is an anaerobic biological water treatment system that converts organic material into fuel gas (primarily methane) which supplements the fuel gas for the boiler(s). When the boiler is not in operation, the methane is routed to the methanator flare system. The water from the methanator is recycled to the cook water tank for re-use in the process.

DEC and others in a position to critically analyse the air quality and emissions parameters from the proposed facility will note that even if operating at a "worse case" scenario the proposed development will still fall well below DEC guidelines for air pollution and emissions maximum allowable limits.

The plant also has a water cooling tower constructed in modules that serves the various fermentation process cooling needs.

3.5.2.3 Air Emission Sources

Outlined in Table 3.0 are plant wide emissions for PM, PM_{10}, SO_2, NO_X, CO, VOC and HAP's based on a production) of 416ML ethanol per annum, utilising in excess of 1.0M tonnes of grain per year and as is identified for the emissions calculations, the production of zero dried distillers grain per annum. This reaffirms that this facility and its emissions inventory are prepared on the basis of not incorporating heat reliant dryers to dry down WDG for handling and storage on site.

This table identifies each potential emission source, individual totals for the potential pollutants and combined plant-wide totals. These figures are calculated in tonnes/year and as can be seen are on average well below the emission levels set by the DEC for the state of New South Wales.

Table 3.0: Plant Wide Emissions

Emission Sources	PM (t/y)	PM_{10} (t/y)	SO_2 (t/y)	NO_x (t/y)	CO (t/y)	VOC (t/y)	HAP (t/y)
Unload Baghouses (2 each)	14.27	14.27					
Grain Handling Fugitives	3.66	1.66					
Cooling Tower	16.44	16.44					
2 Boilers (120MMbtuh each)	7.99	7.99	0.63	94.61	88.30	5.78	1.97
1 RTO (process vents)	0.81	0.81	0.02	3.50	7.01	5.43	1.11
Fermentation (CO_2) Scrubber	0.58	0.58				49.50	5.92
Purge Scrubber	0.10	0.10				14.85	1.80
Fugitive Components (LDAR)						8.84	1.54
Methanator Flare				0.15	0.63	0.09	
Plant Haul Roads (wheel dust)	15.23	2.97					
Etoh Loadout w/Flare (truck/rail)				0.69	3.57	5.17	2.07
Liquid Storage tanks						2.70	0.09
Emergency Fire Water Pump	0.002	0.002	0.010	0.090	0.005	0.002	
Wet Cake Pad	0.024	0.005				3.79	0.66
Uncontrolled Process Vents						0.65	
Totals, Plant Wide	59.07	44.81	0.66	99.05	99.51	96.80	15.16

Contained within Annexure 16.0 is a further breakdown of the preceding table into its individual emissions source parameters and points of emission from the proposed facility and these are provided an ID number which is able to be cross-referenced against the schematic diagram contained within Annexure 17.0 that also includes the process description. The detail provided in the schematic coupled with the information summarised in the table preceding should provide adequate detail to perform an assessment on the potential "worst case" scenario for a facility almost a quarter the size again of that proposed and still meet DEC guidelines for air pollution and emission control.

3.5.2.4 Air Pollution Control Equipment

It is proposed as part of on-going air quality emissions and pollution management that specific infrastructure be installed within the ethanol manufacturing facility to control potential air pollutants and plant-wide emissions. The equipment proposed to be installed will be operated as per manufacturer's specifications and maintained at all times. The key plant and equipment proposed to be installed to manage air quality and emissions are:

- One Regenerative Thermal Oxidizer (RTO) – the regenerative thermal oxidizer is fired with natural gas and designed for a maximum heat input rate of 8MM Btu/hr (operates at approximately 4.3 MM btuh). The exhaust emissions from the cook water tank, process mixer vent, slurry tanks, concentrate tank, yeast tanks, 190 and 200 proof condensers and CIP screen are to be directed to the thermal oxidizer whenever the ethanol plant is operating. The RTO will minimise potential for nuisance odour from the process vents.
- One Hammermilling Fabric Filter Baghouse for the purpose of controlling particulate emissions from operation of the hammermills. The unit is designed for a 28,000 cubic foot per minute (2,570m^3/minute) flow rate while operating at ambient temperature.

- One Grain Unloading Fabric Filter Baghouse for the purpose of controlling particulate matter from grain unloading truck and rail pits, transfer and the day bin. The unit is designed for a 48,000 cubic foot per minute (4,400m^3/minute) flow rate while operating at ambient temperature.
- One flare for the purpose of controlling methane emissions from the biomethanator. The biomethanator natural gas is directed to the boiler(s) whenever the plant is operational. The flare will only operate when the boiler(s) is down.
- One flare for the purpose of controlling VOC emissions from truck loadout.
- One Fermentation CO_2 Scrubber for the purpose of removing VOC's from the carbon dioxide by-product stream. The packed bed water scrubber is designed to eliminate HAP's and VOC's from the CO_2 stream.
- Two 120MMbtuh package boilers to be equipped with standard burners.

We refer readers to SOC commitment 264.

3.5.2.5 Limiting Air Emissions

The infrastructure proposed to be installed on-site for the proposed development is expected to limit air emissions as follows:

- Visible emissions are expected to be less than 20% for all emission units, expect for the flares which are used to control emissions from the methanator or truck loadout. The flares are expected to operate at 0% opacity. Based upon experience in the USA and Canada, all emission units are expected to operate in compliance with applicable rules.
- The flares used to control emissions from the biomethanator and truck loadout will be designed and properly operated to emit no visible emissions. These specifications have been established in accordance with the *US EPA Designed Standards No. 40 CFR 60.18*.
- The thermal oxidizer is anticipated to reduce VOC/HAP's by at least 98% on average.
- NO_x from the two package boilers is expected to be emitted at less than the manufacturer's guaranteed rate of 0.09lb/MMbtu. CO emissions from the two package boilers are anticipated to be no more than 0.084lb/MMbtu.
- PM/PM_{10} emissions from bag houses for control of the grain unloading transfer processing and hammermilling will not exceed emission rates presented within the Table 3.0 in Section 3.5.2.3. Compliance may be determined by measuring the PM/PM_{10} emissions averaged over the period specified in performance test protocols to be approved before testing.
- Exhaust emissions from fermentations CO_2 Scrubber will not exceed emission rates presented in Table 3.0. Compliance may be determined by measuring the VOC/HAP emissions averaged over the period specified in the performance test protocol to be submitted for approval prior to testing. The fermentation scrubber is expected to reduce VOC emissions from the fermentors by at least 98% on average.

On-going emissions testing will be undertaken as part of the daily management and operation of the proposed ethanol facility. Annexure 18.0 contains detailed information on testing protocols for the proposed facility and outlines key testing methodologies as established by the US EPA and will involve both pre-performance testing and on-going testing and management during the operation of

the facility. This documentation also provides provision for the record keeping requirements to ensure that the emissions, both potential and realised from the proposed facility are clearly and unambiguously represented for referencing across any time period of operation.

ICM Inc has also outlined key parameters to monitor to be able to demonstrate and maintain the emissions compliance limits outlined in this section of the Preferred Project Report (PPR). Examples of which are:

- A maximum amount of grain processed by the ethanol facility to not exceed set limits during each consecutive 12 month period; and
- The maximum production rate of the ethanol will not exceed 110M Gallons (416ML) of product grade denatured ethanol during each consecutive 12 month period.

The fermentation scrubber will be operational while fermenting. The scrubber water flow will be no lower than 50GPM (200L/minute) during the normal operation:

- The regenerative thermal oxidizer bed temperature shall be no less than 1500˚F (815˚C) annual average based on emission testing;
- Visible emissions (stacks and fugitives sources) shall be less than 20% opacity;
- The maximum amount of WDG produced by the ethanol plant will not exceed 914,349 tonnes during each consecutive 12 month period;
- Air pollution control equipment maintenance will be based on manufacturer's written requirements;
- Leak detection and repair (valves, pumps, flanges) program will be based on the US EPA Requirements No. 40 CFR 60.48 (sub-part Kb);
- Maintenance will be performed for all equipment used to control PM/PM_{10}, VOC, NO_x and CO emissions within 180 days of start up of the plant; and
- Maintenance will be performed on all plant roads as necessary to ensure that the structural integrity of the paved roads is preserved.

We refer readers to SOC commitments 265.

3.5.3 Odour Emanating from Manure Stockpiles

Firstly, there are no "wet pens" at "Tubbo" and this is a proofing oversight in the EA as there has never been any intention to include any facility which could be termed as "wet pens".

The partially drained manure from the sedimentation basins will be moved from the project site to "Tubbo Irrigation" on a daily basis, given that the sedimentation basins will be cleaned regularly.

We refer readers to SOC commitment 266.

Gravelling of the road into "Tubbo Irrigation" was and is intended as the means of ensuring daily transport to "Tubbo". Any short term storage at "Tubbo" will be on a bunded 600mm minimum compacted clay pad to ensure deep percolation rates less than 1 x 10^{-9}m/sec (31mm/year).

We refer readers to SOC commitments 267and 268.

The presence of suitable clays at "Tubbo" has been documented in the investigations for the now established and operating large earthen water storage at "Tubbo" irrigation (Annexure 19.0 and Annexure 20.0).

The irrigation of "Tubbo" is remote from any housing and public roads. Manure stored for short periods will be over 3km from any potential receptors. Spreading on to the irrigation will be as regular as practical with the "normal" field availability and access issues permitting. The agricultural soils analyses of Annexure 15.0b affirm the suitability of the irrigation area at "Tubbo" for receival of the manure.

Any contingent short term stored manure will be submitted to a composting process even if such process is not completed prior to spreading.

We refer readers to SOC commitment 269.

3.5.4 Odour From Sedimentation Basins and Storm Surges

The Hutchins submission on behalf of the Wiseman family suggests that inadequate time was available to fully read, assess, integrate and prepare the submission within the limited timeframe. The potential issues he reasonably raises are responded to as follows:

- The sedimentation basins were designed to cope with at least 7.2ML/day from the freestall flushing operations plus 1.0ML/day from the cow and milking barn wash downs;
- It was taken into account that rain event run-off from the loafing and dry lot pens are additional and erratic according to event timings and quantums;
- The sedimentation basins were purposely over-designed to optimise the settling process and to alternate basins for maximising cleaning operations and minimizing the risk of anaerobic conditions developing;
- The surge storage was designed to be emptied within 24 hours of a 150mm rain event over the entire containment area; and
- The locations of the original ponds were to maximise the use of predominant winds and distances from receptors.

The above criteria were addressed and described in detail in the EA as displayed and will continue to be applicable in the new proposed enhanced waste water management system.

With the benefit of more recent research, the waste water management strategies for this project were reviewed and have been detailed in later sections herein.

This process revealed the opportunity for the anaerobic/aerobic ponds to be entirely removed and the new preferred system is to be based on:

- Small Category 3 recycle ponds downstream of the sedimentation basins;
- Removing 90+% of all manure before it even enters the Category 3 recycle ponds by:
  - Skid-steer scraping of the freestall flush lanes prior to each flush event and separate removal of the manure to "Tubbo";
  - Monthly scraping and removal of manure to "Tubbo";
  - Optimising sedimentation basin design to remove 60+% of that manure which reaches the basins.
- The recycle ponds would only hold water for relatively short periods and be aerated to prevent anaerobic and/or anoxic conditions developing.

The proposed new enhanced waste water management strategies are described in detail in Section 5.4. The net outcome is that the risk of odours emanating from the waste water management facilities has been reduced even further. Despite the intention to appropriately minimise the risks of odour, no claim was made or could ever be made that odours would be eliminated – minimised to very low and acceptable levels yes, but eliminated, no.

3.5.5 Managing Odour From Distillers Grain Through Secure Product Sales

Following the formal display of the EA, respondents raised legitimate concerns regarding the constant and speedy removal of WDG from the project site. Their concerns centred on the potential escalation of odour emissions, flies and the creation of other OH&S issues.

Immediately following notification of the proposed Four Arrows Ethanol Pty Ltd project, Booth Associates were approached by regional beef feedlots seeking priority access to the distillers grain. Because contracts could not be formally exchanged until project approval had been received and facility construction was imminent, the interested feedlots were required to provide written affirmation of their needs. The written offers covered the projected total distillers grain output and the preference was for partially wet (50% - 60% moisture) product.

For the purposes of the EA itself the written offers were relied upon but for Commercial-in-Confidence reasons and the general antagonism of the feedlot industry to ethanol plants, the names of the interested feedlots were not publicly declared.

Notwithstanding the written offers, the project team have continued to be aware that:

- There is an increasing interest in the construction of a number of ethanol plants, all with the same problem of managing their distillers grain;
- Assuming successful development approval, the national and state biofuels policies will encourage the construction of ethanol plants; and
- Given the synergies between ethanol plants and their distillers grain by-products with intensive animal industries, the antagonism of the beef feedlot industry may be replaced by feedlotters building their own ethanol plants.

In recognising the above, it is clear formal arrangements and even some contracts can not always be relied upon. Furthermore, there is the risk of excessive price competitiveness which can adversely impact viability. Whilst the integrated dairy will consume a significant portion of the distillers grain, the other Four Arrows enterprises will also be major WDG clients at their existing and substantial Riverina properties.

In view of likely project demands and that from existing and potential future intensive livestock industries there is likely to be sustained demand for distillers grain. In fact, since the EA display there have been a number of new requests for the product which is further expanding the potential opportunities for regular (daily) deliveries.

The next commercial question is therefore *"How may the distillers grain market be expanded without excessive commercial costs of complete drying, without exacerbating a potential product over-supply scenario, and without the risk of exposure to the loss of client/s for whatever reason"?* The solution is in having multiple outlets, spatially separated and which avoids complete product drying and/or freight of excessively WDG.

The first primary outlet is to the project dairy and to the other supplementary animal feeding operations on the Four Arrows Group holdings. These outlets would be supported by the contracted sale to other Riverina and even northern Victoria intensive animal industries, some of which have already sought a substantial regular supply from the Four Arrows' project.

The second credible option is to supply the emerging demand in New Zealand initially, and subsequently expanding into Asia. Attached hereto Annexure 21.0 are copies of letters from Strategic Bovine Services and SunRice which complement each other. The relevance of these letters is:

- Strategic Bovine Services (SBS) has a range of dairy and specialist beef clients in Australia. The company is also part of an affiliated network of similar businesses in New Zealand, Asia, USA and Europe;
- SBS and its network has identified and quantified the benefits of dairy and beef rations based on distillers grain;
- The New Zealand affiliates are seeking regular and reliable access to distillers grain based feed pellets in substantial quantities with a foreseeable target demand of 200,000 tonne to 300,000 tonne per annum;
- SunRice essentially represents the whole of the Australian rice industry;
- As a consequence of climate change, changing water policies and changing "market" policies, Sunrice is driven to both diversify and expand the productivity of existing subsidiaries. A longstanding subsidiary is CopRice which manufactures specialist animal food products; and
- SunRice is keen to be the contracted producer of distillers grain based feed pellets for SBS through the CopRice mills in the Riverina. In fact, SunRice will actively consider expanding the capacity of CopRice if necessary.

Therefore, whilst the EA relied on the written intentions of regional beef feedlots the practical and commercial reality was that the distillers grain would be on-sold to a range of end users.

The fact that virtually all end users preferred partially WDG was and is a bonus in that the costs of drying escalate at an exponential rate as more moisture is extracted. Not only is drying a financial cost, it is also an energy cost.

The haulage distances and estimated travel times for cartage of partially dried distillers grain (belt pressed to between 35% and 50% moisture) by sealed road are:

- Project site to the CopRice Leeton Mill = 75Km or 1.75 hours including some waiting time and weighing/sampling; and
- Project site to the CopRice, Echuca Mill = 250Km or 4.0 hours including waiting, weighing and sampling time.

The haulage distances and times to another large scale intensive animal industry business with two major sites seeking partially dried distillers grain are:

- Project site to Client Site 1 = 200Km or 4.0 hours with waiting, weighing, sampling time, etc; and
- Project site to Client Site 2 = 210Km with waiting, weighing, sample time, etc.

The contingency option is to spread unsaleable distillers grain on initially "Tubbo" Station and then onto other holdings of the Four Arrows Group. The "Tubbo" Station aggregation (including some CICL farms) includes some 7,500ha of broadacre irrigation lands plus 1,250ha of irrigated horticulture. In addition there is 2,000+ha at Hay.

Not all the distillers grain would need to be spread under contingency option as a high proportion of output would be sold through companies such as CopRice, and/or consumed by Company livestock.

The markets for distillers grain are diverse and pre-existing to ensure satisfactory risk management.

We refer readers to SOC commitment 270.

The ethanol manufacturing process utilises the starch component of grains leaving all the beneficial nutrients in the distillers grain.

In the worst case scenario the distillers grain is a costly fertiliser to replace artificial fertilisers on agricultural lands.

We refer readers to SOC commitment 271.

3.5.6 Odour and Flies and Cattle Sheds

Mr Hutchins on behalf of the Wiseman Family appears to have not had time to become familiar with the structure and management of freestall dairy systems and be able to respond to the EA display within the available timeframes. Accordingly, he has reasonably raised potential issues and seeks a response.

The proposed enterprise design and intended operations assumes that freestall dairies are a specialised dairy production system which have been well research for optimal:

- Cow health and production;
- Environmental performance; and
- OH & S compliance.

This detail is embedded in the design and management of the freestall system and presented in the EA referenced report *Dairy Feedpad Guidelines for the Goulburn Broken CMA*, 2002 prepared by Wrigley-Dillon.

The net outcome is that odour and flies have been of very low incidence within existing and appropriately managed freestall facilities elsewhere in NSW and Victoria. This claim by freestall operators has been specifically noted in the field at an established freestall facility by the project team as a practical point of verification.

3.6 Fly Management Plan

To reiterate, it is considered that strategies for the management of *Diptera* species were a component of best management practice strategies developed for the project site in regards to:

- Animal health and well being;
- OH&S policy including staff amenity; and
- Odour management.

The health and well being of livestock and enhanced condition is directly related to the management of pests and the spread of disease. This includes fly species that have the potential to deteriorate food quality and water sources, act as vectors for pathogens and affect the comfort of livestock.

A commitment to provide employees and contract personnel the security of a safe and comfortable working environment requires the management of fly populations.

Other relevant commitments include the management of odour, the issue of which has been comprehensively researched and mitigation measures presented within both the EA and this PPR.

To further substantiate the preceding claim, a fly management plan is detailed below that will be similarly implemented to the proposed dairy development. This will assure reduced fly incidence and the affect that elevated numbers may have on neighbouring properties.

We refer readers to SOC commitment 272, 273, 274, 275, 276, 277 and 278.

The Queensland Department of Primary Industries and Fisheries Manual contributed to the information contained in the following sub-sections www.dpi.qld.gov.au.

3.6.1 Manure and Feed Management

Decaying organic matter such as manures and rotting feed are found to be suitable sources for attracting female flies. This organic matter satisfies the requirements for protein-rich feed prior to egg laying, as well as providing an ideal environment for the maturation of larvae; ideal breeding sites being those that are not heavily trampled.

A reduction in the number of these suitable fly breeding sites will substantially diminish opportunities to establish populations. The implementation of waste management strategies to control suitable breeding situations is a primary activity in combating the establishment of fly populations. The regular cleaning of cattle areas and removal of potential breeding stimulants and habitats, with particular attention being paid to areas where waste accumulates but which are not trampled, will be a focus and includes:

- Manure accumulation within yards;
- Spilt feed and accumulated manure around troughs and feeders;
- Manure in drains and areas surrounding sedimentation devices;
- Decaying feed in mill areas;
- Manure in hospital yards and dry pens;
- Manure storage areas; and
- Brewers grain storage areas.

3.6.2 Moisture Content

Fly numbers will also be controlled via strategies that manage moisture content present within areas around the dairy, with particular attention being given to dry pens and loafing yards. It has been identified that organic material with moisture content between 75% and 80% to be suitable for egg laying and the survival and development of larvae. Fresh manure is slightly above this range so the following initiatives will be undertaken to keep conditions below these percentages and include:

- The construction of well drained sites that allows the surface to dry quickly after wet weather;
- The continuous slope of the yards will be maintained and required repairs attended to;
- Leakages from troughs and piping will be immediately repaired upon detection;
- Yards will be regularly cleaned as required pursuant to stocking density; and
- Stocking densities to be kept above the minimum standard of 10m^2/head.

3.6.3 Chemical Control

To ensure an integrated and effective fly management plan, Four Arrows Ethanol Pty Ltd commits to the:

- Installation and regular maintenance of fly traps; and
- Implementation of knock-down strategies as required. To control transient populations of *Diptera* species and those that survives the implementation of breeding cycle management.

Chemical management includes the placement of baits; fly traps, targeted aerosol and residual sprays. Other initiatives will involve the use of electrical equipment that attract and destroy flies upon contact.

Manure management and other such aspects that affect fly numbers is discussed throughout this document particularly in Section 5.4: *Revised Waste Water Management Strategy*.

Fly Management specifically will not be commented upon within further sections of this report.

3.7 Waste Streams

3.7.1 Waste Water

3.7.1.1 Agricultural Soils Analyses

The agricultural soil samples were obtained from the A horizon of the soils across the area for what had been to a preferred new enhanced waste water irrigation systems. That irrigation area was to replace the originally proposed anaerobic/aerobic pond system within the EA as displayed. The analysis of the agricultural soil samples was undertaken by Incitec Pivot in their NATA accredited laboratory and a copy of the results is attached as Annexure 15.0a.

Subsequent to the preferred concept of an appropriate irrigation system, the clarification and affirmation of State policies has necessitated the proposed irrigation be replaced with an evaporation basin system. Notwithstanding, the collected and analysed soil data has been included herein for reference.

The outcome of the analyses was that the soils on the southern section of the project site are typical of those soils encountered over the majority of the central to eastern sections of the Riverine Plains. A detailed discussion of the analyses has been provided in Section 3.4, a summary is provided below:

- Soil pH – sub optimal to optimal range for most agriculture;
- Low concentrations – organic matter, phosphorus;
- Satisfactory levels – K, Ca, Mg, Na, Cl;
- High concentrations – Nil elements in this category; and
- Calculations – Ca:Mg ratio is low.

The structure and productivity of the soils will benefit from the addition of especially Ca as gypsum and/or lime, organic matter and phosphorus.

> *The agricultural soils laboratory analyses has affirmed the Wrigley-Dillon earlier assessment of the suitability of the soils for the growing of agricultural crops under waste water irrigation.*

3.7.1.2 Extra Waste Water Quality Data

Implicit but not stated in the DNR submission to the EA as displayed are:

- Where will the project waste water and manure quality criteria be in relation to industry benchmarks? and
- How will the criteria increase or decrease the quantum nature of groundwater pollution risks?

The major driver of waste water and manure quality criteria is the nutrition of the cattle. The next major drivers are the management of dry lot and loafing pen manure, management of the flushing lane manure and the design and management of the sedimentation basins.

For the EA as displayed a detailed ration was provided which optimised the use of distillers grain for milk production and animal health. That ration was driven by a detailed and industry proven computer model.

For this response to the EA submissions, project team members were requested to provide:

- Project specific data for mass balancing the key elements in the dairy cattle rations and matching that to the sinks of those elements in milk, meat, excreta, etc; and
- Details on the optimisation of operational efficiencies in best practice sedimentation systems with particular reference to freestall dairy waste management systems.

To optimise the available time and to seek broader access to the latest information, contact was made with the School of Veterinary Science at Melbourne University, NSW DPI and Meat and Livestock Australia (MLA). The net outcome of the additional inquiries was:

- Dr Lean is widely recognised as having developed one of the best dairy cattle nutrition models available and it was best to rely on that model;
- Melbourne University provided matching data to Dr Lean; and
- MLA provided a complete but not yet published report for beef feedlots (FLOT.328) which affirmed the primary status of cattle nutrition, pen maintenance and sedimentation management in reducing and best managing salt and nutrient loads in intensive animal industries.

The above investigations are discussed in more detail in Sections 5.3 and 5.4 of this response document.

When all the above was entered into a revised mass balance structure for waste and waste water management for the proposed ethanol and dairy project, the net outcome was that the quality of the recycled waste water entering the Category 3 recycle ponds is significantly higher than the quality of the pre-existing groundwater. This difference in water quality is depicted in the following table with the supporting water and salt/nutrient mass balances in Annexure 22.0a and Annexure 22b, and Annexure 23.0 respectively.

Table 4.0: Comparison of Waste Water Quality with that of Groundwater

Element	Waste Water 113.4ML		Groundwater (Annexure 13)
	t	mg/L	mg/L
		a	b
Nitrogen	9.1	73.2	1.0
Phosphorous	2.0	15.9	0.10
Potassium	6.1	53.8	7.0
Calcium	17.5	143.7	100.0
Magnesium	14.3	126.1	63.0
Sodium	8.2	53.9	350.0
Ratios			
Ca/Mg	1.23		1.59
SAR (c)	0.35		6.80

Notes: (a) Calculated quality of water exiting sedimentation basins and entering re-cycle ponds
Based on Na mg/L x 0.0435 = meq/L Na, Ca mg/L x 0.0500 = meq/L Ca, Mg mg/L x 0.0833 =
(c) meq/L where the conversion factors for mg/L to meq/L are sourced from EPA Victoria Publication No. 168

The above data affirms that, even on a significant risk margin to counter inherent accuracy limits associated with any predictive modelling, the expected waste water quality will be substantially better than the existing groundwater quality.

We refer readers to SOC commitment 279.

3.7.2 Disposal of Mortality Products

The EA as displayed proposed that dead cattle be transported to "Tubbo" Station and disposed of by burial in a series of slot trenches which met stated criteria for location and management (Sections 4.11.2.2 and 5.5.2.17 at Pages 4-89 and 5-27 respectively). There was no intention, inference or statement that mortality products would be disposed of at the ethanol/dairy project site.

At the time of preparing and displaying the EA for the "Tubbo" option for disposal of mortality products was the only assured disposal option and hence was relied upon. Since the display of the EA, the "Barnawartha" (Vic) biodiesel plant has been approved and construction commenced. The "Barnawartha" facility will render animal carcasses as part of their biodiesel manufacturing processes (*pers. comm.* R Wrigley as chair, community consultation group) and should an agreement be reached then sale to "Barnawartha" would be preferred over burial at "Tubbo".

We refer readers to SOC commitment 280.

Notwithstanding the potential and preferred “Barnawartha” or similar option, the current Four Arrows Ethanol Pty Ltd proposal will need to rely on the “Tubbo” option until mutuality with “Barnawartha” or similarcan be achieved and as a Plan B should any agreement with “Barnawartha” happen to fail.

It would seem from the nature of their submission that DEC is not fully aware of the geomorphology of the Riverine Plains and that a number of suitable sites would be reliably found on “Tubbo” Station. The prime reason for having a number of sites over selected and appropriate sections of the aggregated 30,000ha holding is that any, albeit minimal, risk may be spread over time and that mortality “loadings” may be wisely dispersed. That is, a particular site may be used for only a few years (1 – 5 years) before moving to a new and suitable site. Whilst the original site may be suitable for many years of burials, a new and equally suitable site may be employed as a risk management strategy.

We refer readers SOC commitment 281 and 282.

Attached as Annexure 19.0 is a copy of a series of soil profiles assessed for a since approved irrigation water storage facility on “Tubbo” which is located to the NE of “Tubbo” irrigation.

The profiles and map are annexures to a report titled *Results of Site Investigations for a Proposed Irrigation Water Storage of Tubbo Station for Tubbo Farming, Coleambally NSW* by RJ Wrigley. Relevant comments by the author for the disposal of mortality products on “Tubbo” are:

- An EM31 geophysical survey and rice bore investigations had preceded the geotechnical investigations and were made available to the author;
- For all the profiles inspected, the presence of gypsum deposits, calcareous layers and mangans is testament to the very limited leaching in a soil of low hydraulic conductivity;
- The soil profile descriptions appended to the above report are consistent with the pedological classifications provided in *Stannard* (1970) and *van Dijk* & *Talsma* (1964) for the “Tubbo site;
- The available information on groundwater conditions in the vicinity of the storage indicated existing piezometer levels are depressed. Groundwater monitoring had been in practice for 15 years and the latest readings were 17.59m below NSL for the nearest piezometer. Fluctuations over the previous 15 years had been a little over 0.5m;
- References to the above report included:
    - *Langford Smith & Rutherford,* 1966;
    - *Lawson,* 1996;
    - *Butler*, 1950, 1956 and 1958;
    - *Butler & Hubble,* 1975; and
    - *Butler et.al.,* 1973.

The geomorphological findings in the above report were consistent with the prior soils reports and therefore provide confidence that the existing mapping is soundly based. The geotechnical findings also provide confidence on the suitability of the soils proposed for mortality disposal at “Tubbo”.

Also of note is the consistency of the findings of Wrigley-Dillon at the main ethanol and dairy project site with the prior soil investigations undertaken by *Stannard* and others.

Attached as Annexure 20.0a, b and c are:

- A copy of a soils association map (No. 2) attached to a report titled *Soils of Portion of the Coleambally Irrigation Area, NSW*, 1964 by *DC van Dijk and T Talsma*;
- A copy of a geology map (No. 2) attached to a report titled *Environmental Studies of the Coleambally Irrigation Area and Surrounding Districts*, 1968 being WC&IC Bulletin No. 2 of the Land Use Series"; and
- Copies of selected soil profile descriptors taken from a report titled *Morphological Descriptons of Soils Occurring in the Coleambally Irrigation Area*, *1970* by *ME Stannard.* The selected soils are known as Willbriggie, Wunnamurra and Yooroobla clays to clay loams.

On the abovementioned maps have been marked the boundaries of "Tubbo" Station itself, the "Tubbo" irrigation, the "Tubbo" water storage, the proposed ethanol/dairy project and the main Eulo and Morundah Roads. Also included on the maps are the preferred landscapes where mortality products will be managed.

The key issues to arise out of the abovementioned data are:

- The above soils reports and soil profile descriptors are widely respected, still relevant in 2007 and the soil "types" remain the basis for describing regional soils;
- The Willbriggie, Wunnamurra and Yooroobla clays and clay loams are considered as good "rice" soils because of their high clay content to >3.0m and low permeability;
- The areas marked for preferred mortality products disposal are dominated by these soil types within the landscapes known as the "Morundah Plain" and the "Gidgell Plain";
- The deep soil profile assessment for the nearby "Tubbo" water storage was in the soil type known as a Willbriggie, the same as at the main proposed project site for the ethanol plant and, whilst well suited as a soil type, is still exceeded by the even better characteristics of the Wunnamurra and Yooroobla soil types; and
- The proposed disposal areas are remote from odour receptors and are not a groundwater hazard area.

Additional soil investigations could have been conducted at "Tubbo" for this preferred project report. However, the use of such findings to locate and then dig future slot trenches could lead to future problems. That is, in the opening of such trenches by a contractor it is possible that problem sections with say, shoe-string sands, sandy lens or other localised permeable strata could be exposed and used for burials without a full comprehension of the consequences.

Since such problematic zones may only be found by building each of the trenches themselves, it would be best to use an independent and experienced professional who must be present and affirm or otherwise each trench before commissioning same.

As proposed in the EA as displayed, each slot trench for mortality disposals would be specifically assessed by the project geotechnical/environmental engineer who would document each trench for optimum site and situation specific engineering, management and performance monitoring standards.

We refer readers to SOC commitment 283.

3.7.3 Truck Wash

The EA as displayed states that any rain run-off from the truck wash will be directed to essentially the Category 3 water treatment system (EA Section 4.8.7 at Page 4-82). That intention assumed that a major proportion of wash "material" would contain a significant proportion of manure from trucks moving cattle and manure itself. Notwithstanding, many trucks will be moving grain and other products with lesser impact from such sources as dust on wheels. Trucks carting damp distillers grain off-site will be washed elsewhere before returning to the site.

Not specifically stated in the EA as displayed but definitely intended, was the capture of as much of the truck wash material as possible (95%) and cart direct to "Tubbo" on a regular basis for spreading on the irrigation and/or other suitable agricultural lands. The "wash" capture would include:

- Manure – to prevent it entering the sedimentation system and allow disposal direct to "Tubbo". This will reduce the loadings on the basins, recycle ponds and the irrigation cells;
- Soils – a mix of soil off truck wheels etc. Direct capture and regular disposal by broadcasting at "Tubbo" irrigation and on other agricultural lands will be of benefit to "Tubbo" as most of the soil is more likely to be A horizon material than any other soils. This soil could also be used as top-dress on the irrigation cells;
- Organic – organic dust and plant material would be grain or grain related. This material would be adding to and beneficial for the "Tubbo" irrigation lands which are inherently low in organic matter. If appropriate this soil could also be used as top-dress on the irrigation cells;
- Chemical – should not be an issue as trucks will only be moving chemicals in sealed containers which would then be returned for re-fill after treatment by the supplier; and
- Other – oils and other materials of limited volume will be disposed of at registered disposal stations.

We refer readers to SOC commitment 284 and 285.

The net result of this query in the DEC submission has been the refinement of the original strategy.

3.7.4 Administrative Waste

The EA as displayed stated that a pre-packaged and fully contained effluent treatment system would be installed and following suitable treatment and subject to the then ruling Environmental Protection Agency (EPA) policy the reclaimed water would be used for (limited) irrigation of landscaped areas (EA Section 4.8.5 at Page 4-82).

Whilst it was not openly stated, the intention was to separate grey and black water since the former may contain compounds which could reduce the efficacy of the black water system. An example is the risk of detergents, bactericides, etc affecting the efficacy of sewerage treatment. Separation further optimises the ability to manage the differing products with differing environmental and social impacts. That is, grey water is normally more environmentally friendly for use with less treatment. black water may require more treatment in reducing organism loadings and other health related products.

We refer readers to SOC commitment 286.

The original proposal therefore remains which is to use approved and fully packaged treatment plants which will meet DEC/EPA requirements for this project. These packaged systems are already in use in a range of situations within NSW such as:

- Caravan parks;
- Hotels/motels;
- Mines;
- Tourism facilities;
- Remote work sites;
- Special industrial projects; and
- Small towns.

Off-the-shelf systems are available which may manage either or both the black and grey water for at least 500 people and also incorporate the capacity to manage nutrients, sewage, salinity, BOD and organisms, etc. These proprietary systems may be installed to a turn-key standard and be independently serviced, monitored and maintained to the required DEC/EPA operational standards.

There are a number of commercially recognised brands which may be assessed prior to purchase and installation.

3.8 Salinity

Mr Hutchins, on behalf of the Wiseman family within his response to the public display, has quoted typical sodium concentrations in feedlot aerobic ponds of 100mg/L to 200mg/L. The project team concurs with Mr Hutchins in broad principle assuming:

- The project is a beef feedlot which it is not; and
- The proposed cattle rations have elevated salt (sodium) levels, which it doesn't.

Major points of difference between beef feedlots and freestall dairies are the volumes of waste water to manage, the regularity of flow of waste water and the differing nutritional needs of the production goals for milk rather than beef. It is noted that there are some similarities between the proposed heifer dry lot pens and a beef feedlot, but again the nutritional needs of the heifers and the overriding waste water volumes and its regularity from the freestall sheds completely dominate the dry lot pen run-off criteria.

It is also noted that previously adopted "typical" salinity and nutrient concentration data for beef feedlot waste water is becoming inappropriate as beef feedlot managers become more responsive to the links between animal nutrition, newer feedlot management standards/procedures, improved effluent quality and effluent disposal practices and the combined environmental/social/commercial impacts arising from these scientific and managerial advances. Accordingly the better beef feedlot managers have substantially reduced salt and nutrient loadings from their operational improvements which have been most recently documented in the *Meat and Livestock Australia Report FLOT.328* which is on the point of publishing and was made available by MLA for this response document.

In the EA as displayed, the salinity issue was addressed by a low salt diet as originally recommended and detailed in that document and by the then proposed major dilution strategies in the aerobic pond/s with the regular addition of CICL water.

In the review of other options for best managing salts, nutrients and waste water itself as described in Section 3.7.1.2 herein, some new and more detailed salt and nutrient mass balances were prepared.

These new mass balances are attached hereto as Annexure 23.0 and are summarised as follows:

Table 5.0: Summary of Dairy Component (Category 3) Salt and Nutrient Mass Balances in Tonnes per Year

	Dairy Component – Net Balances									
	Imports				Exports					
	Cattle Rations	CICL Water Normal Operations	CICL Cat 3 Augment	Total Imports	Milk	Sales	Mortalities	Manure	Total Exports	Net Balance
			a	b						
Nitrogen	2,155.7	0.3	0.1	2,156.1	423.3	4.4	0.6	1,601.2	2,029.5	126.7
Phosphorus	288.8	0.0	0.0	288.9	76.0	1.2	0.1	200.2	277.5	11.4
Potassium	190.2	1.3	6.1	197.6	98.8	5.0	0.6	75.1	179.4	18.1
Calcium	362.2	8.5	1.6	362.3	80.6	1.5	0.2	215.2	297.4	65.0
Magnesium	197.3	5.7	1.1	204.1	8.4	0.7	0.1	175.1	184.3	19.8
Sodium	133.9	13.4	2.6	149.9	30.4	4.1	0.5	100.1	135.1	14.8
Ratios Ca:Mg	1.79		N/A	N/A	9.54	N/A				N/A
SAR	N/A		N/A	N/A	N/A	N/A				N/A
Notes: a = water used in daily operations b = water used to top up recycle pond/s										

The generation of the above data has relied on a number of sources as detailed in Annexure 23.0. The model has been as being reviewed and critiqued by the project team as being as close to the expected project outcomes as could be reasonably projected.

Items of particular note in Table 5.0 above are:

- The ration nutrient and salt contents may be accurately controlled and dominate the other imports;
- The exports of salts and nutrients in milk, sales and mortalities are well documented in literature and supported by the Lean model; and
- Exports in manure will be driven by manure management and the documented evidence is that with best practice manure management the above projection are realistic.

We refer readers to SOC commitment 287.

3.9 Greenhouse Gas Emissions

3.9.1 Agency Responses Regarding Greenhouse Gas Emissions

The DEC has raised concerns that the original EA has not fully addressed the request contained within the Director General's requirements for a full assessment of the impact of Greenhouse Gases from the proposed development. DEC currently believe that the information provided is lacking in sufficient detail to make a valid assessment of CO_2 emissions and other greenhouse gas impacts. Consequently they have requested that an accurate account of full life cycle GHG emissions be undertaken and further requested a demonstration of how greenhouse gas emissions will be minimised over the life cycle.

DEC has further qualified this request by outlining that the life cycle assessment must include all emissions generated by:

- Growing grains used to produce ethanol (i.e. on the farm);
- All activity and processing on site (including the activities associated with ethanol such as the intensive agriculture operation); and
- Transporting all material to and from the site (e.g. from the farm to the plant and from the plant to the ethanol distributor and other receivers of product).

The GHG assessment must also include details of the capture efficiency of the originally proposed CO_2 scrubbers, numbers and size of CO_2 storage tanks identified and users and consumers of CO_2 if captured, also any other proposed measures to offset GHG emissions from the facility.

To address the requirements of the DEC further, investigations and analysis was undertaken, as detailed in the following sub-sections.

3.9.2 CSIRO Greenhouse Gas Abatement Calculator

Concerns raised by direct correspondence (both verbal and written) with DEC is that the models used for the calculation of Greenhouse Gas GHG emissions in the original EA did not contain information for inputs or outputs beyond the ethanol production facility itself. This is not considered to be an accurate account of the information supplied.

Attached as Annexure 24.0 are the CSIRO GHG abatement calculator models prepared for the consumption of both wheat and sweet sorghum in the production of ethanol. For each feedstock, two pages of information are provided:

- The first is a broad summary of total quantity of ethanol produced with the subsequent GHG emissions and GHG savings made by the replacement of existing fossil fuel consumption; and
- The second page provides information on the generation of the summation figures on page 1 of each of the two prepared models.

Page 2 of each model clearly outlines the GHG emissions generated by the inputs for growing feedstock including the use of phosphate fertilisers, urea, pesticides, tractor fuel in diesel filters etc through to transport of feedstock to the ethanol process facility, the energy inputs and subsequent CO_2 equivalent impacts in the fermentation and distillation process, and ultimately transport and energy associated with movement of product to end users, consumers and ethanol distributors.

It is clearly evident from the attached annexure that the CSIRO model does incorporate all CO_2 equivalent gases emitted in the production of ethanol from production of raw feedstock through to the transportation of final product to the end user. The comprehensive nature of the CSIRO models is also supported by Mr Bill Slattery and Mrs Victoria Crappa of the AGO in verbal communication during the preparation of further investigations.

The outcome from these two runs of the CSIRO models are vastly different in that production of ethanol from 100% wheat feedstock results in net GHG emission saving of 74.85Kt of CO_2 equivalent per annum and a 100% utilisation of corn as feedstock for ethanol production results in a net saving of some 200.49Kt of CO_2 equivalent per annum.

Depending on how these two outcomes are utilised, the figures bear great sway in the overall debit or credit for the proposed project in general terms as discussed in subsequent sub section.

3.9.3 Total Project GHG Emissions

Having undertaken a more detailed investigation into the CSIRO models used for the calculation of CO_2 equivalent emissions from ethanol production, it is necessary then to re-apply these figures by way of addition to the dairy herd methane calculations for CO_2 equivalent emissions from the intensive agricultural component of the proposed development. A recalculated spreadsheet is presented in Annexure 25.0.

In calculating total GHG emissions it has been decided to initially prepare the emissions inventory on a worst case scenario, based on an adverse impact and the highest requirements for mitigation measures. This has been done to ensure an over-calculation of offsets rather than the alternative of undervaluing CO_2 eg emissions, and potentially not offsetting the total CO_2 footprint.

As can be seen from herd methane calculations the intensive agricultural development proposed generates in the order of 172Kt of CO_2 equivalent per annum. With no CO_2 capture proposed, and if sorghum is used as a feedstock for ethanol production 100% of the time, at 200.49Kt credit/annum the obvious potential arises for the total proposed development to be in credit in the order of 28Kt/pa. This however is a best case scenario, and it is unreasonable to assume that sorghum can provide 100% of feedstock for the ethanol production facility at all times.

Consequently, a 70:30 split has been applied to feedstock inputs for the ethanol plant with wheat being the lower of the creditable feedstock options incorporated as 70% of ethanol feedstock and the sorghum option being the better creditable option for ethanol production, only being considered as 30% of feedstock for the proposed development. In effect, by utilising these percentages of feedstock input we see in Annexure 25.0 a net credit from the ethanol facility utilising zero CO_2 capture for on-selling of 111.54Kt per annum CO_2 equivalent credit.

In marrying this tally to the 172Kt of CO_2 equivalent debit resulting from the intensive animal enterprise the project in its entirety presents a net debit of 53.56Kt of CO_2 equivalent per annum requiring mitigation and offset.

The estimated requirements for mitigation offsets has been based on what is considered reasonable, likely and conservative and not based on best case scenarios. Notwithstanding an on-going review of specific CO_2 management options will remain as viable options and economic drivers post approval and commissioning of this project. Examples of such are that the 53.56Kt CO_2 equivalent debit as calculated is under the provision that:

- No CO_2 capture for on-sell of by-product will be undertaken; and
- There will be no effort or endeavour made towards the generation of electricity through methane capture and bio generation of energy onsite.

To summarise the project total outputs, we have modeled conservatively that a total of 53.57Kt of CO_2 equivalent will be discharged into the atmosphere per annum and when extrapolated to an anticipated project life of 25 years the full GHG emission from the proposed development is 1,339.25Kt or 1.34Mt of CO_2 equivalent.

3.9.4 Project Mitigation of GHG Emissions

Having calculated a full GHG emission inventory for the proposed development for an anticipated operational life span of 25 years, it is not feasible to manage a mitigation offset or carbon sequestration program onsite. As a result, organisations within the private sector have been approached to prepare an offset and carbon sequestration strategy to manage the GHG emissions from the project on behalf of Four Arrows Ethanol Pty Ltd if required.

Proposals have been received by Booth Associates to manage the full emissions as calculated.

The detail and specifics of the accredited organisations and nature of agreements reached cannot be divulged at this time due to confidentiality agreements and market sensitivity in regards to market position and initial capital expenditure. Suffice to say that the full emissions as outlined have been proposed to be managed and will be activated upon granting of approval of the proposed development.

We refer readers to Section4.2: Greenhouse Gas Assessment.

We refer readers to SOC commitment 288.

3.9.5 Project GHG Emissions Management Options Post Approval

Whilst GHG emissions in this instance have been calculated on a worst case scenario, utilising zero CO_2 capture and no capture of gaseous emissions that can be utilised for energy production, these factors can be viably managed should Four Arrows Ethanol Pty Ltd decide to pursue such management options once the project is approved.

These include two possible strategies that can be pursued at a later stage during site development and following project stabilisation.

The ***first*** option being the capture of CO_2 from the ethanol production process by way of providing facility to both scrub CO_2 for removal of VOC's as a purity and management control system and ultimately incorporate capture technology, proven in the USA and capable of capturing 340Kt of CO_2 per annum.

In effect, if this technology is implemented then the proposed development would be in carbon credit in the order of 286Kt of CO_2 equivalent per annum. This technology has not been utilised in the calculation of project offset for one specific reason.

Whilst this new technology will be incorporated as part of the infrastructure proposed for the ethanol facility, at this stage accurate data and information on the markets available for CO_2 capture and supply are not robust enough for us to consider viable management options at this stage of the project development.

Verbal information and ongoing discussions have been held between Booth Associates and various private sector interested parties that a market is available and willing to accept quantities of CO_2 captured as discussed. That having been said, no firm commercial relationships can be established or markets quantified. Consequently it is not within the major project assessment process in NSW to base an approval on a speculative market arrangement.

The ***second*** option available to in managing GHG emissions for the duration and life cycle of the proposed development is to minimise active release of methane from the intensive agricultural waste management systems.

Whilst the ethanol facility places the proposed development in credit the intensive dairy operation places a higher value of CO_2 emission into a debit scenario, and consequently the project in total results in a net debit emission. The 172Kt/annum CO_2 equivalent from the dairy component is predominantly released via methane as a by-product of manure production and waste water storage management.

The technology is available to completely enclose the waste management storage facilities so that 98% of all methane produced from the waste management facilities can be captured and used for generation of electricity through combustive technology. Again this is not a strategy that has been proposed in the preparation of this PPR but can and will remain a possible viable option for future management to the Four Arrows Ethanol group post approval of this EA.

The two systems outlined above if utilised will place the development in significant carbon credit as opposed to simply managing a debit arising from managing a carbon sequestration and offset to cope with the worst case scenario as outlined above.

We refer readers to SOC commitment 289.

Implemented, the above systems will limit the emission of CO_2 equivalent GHG into the atmosphere. The difference between the carbon being sequested and the carbon no longer being emitted will result in Four Arrows Ethanol Pty Ltd having a tradable commodity in the form of carbon sequestration credits for utilisation by other alternative developments. This in effect provides the company with a marketable and tradable commodity by committing to sequest carbon at current market prices, and recognising the market mechanism potentially raising the value of carbon sequested in the future.

There is the potential for the carbon sequestration project component that may not be needed to be utilised by Four Arrows Ethanol Pty Ltd to be openly and equitably traded on the open market, whether nationally or internationally, just as any other agricultural or commercial product or service may be traded.

In Australia these systems are in their infancy, however there are classic examples of movements towards trading in carbon emission and sequestration projects becoming the norm rather than the exception. One such example is the Chicago Climate Exchange (CCX) which operates under the premise that an internet accessible market place is used to execute trades among various registered account holders within the CCX. The CCX has recently been the subject of a World Bank study that affirms the market for carbon credit trading has in the absence of any regulatory framework, already traded a dollar volume surpassing US$100.0M. *The "Economist"* magazine of behalf of the World Bank predicts an annual volume of trading ranging from US$60.0 billion to US$1.0 Trillion in the future.

These systems will be at the disposal of Four Arrows Ethanol Pty Ltd as an accessible market for a viable commodity in the form of unutilised carbon sequested under the assumption that the systems of CO_2 capture or methane utilisation for energy generation outlined above are undertaken.

3.10 Project Water Reliability

The Murrumbidgee Catchment Management Authority (MCMA) submission appears to conclude that the EA has superficially or inadequately addressed the issues of water supply quantity and reliability. This is not so.

Accordingly, significant points are:

- A $100M business will not be put at risk by inadequate planning and inadequate risk assessments;
- Fallback positions for a wide range of seasonal, water supply, policy, climatic and management scenarios have been evolving;
- The Four Arrows Group already has ownership of substantial volumes of high security water and bore water entitlements as its primary fall back position, and could permanently purchase additional entitlements. Such water is available on the open market;
- Near-by bore irrigators have offered to supply water to the project at prices and volumes to be determined at each specific time of negotiation. Suffice to say, the proposed ethanol and dairy facility could and would pay significantly more for annual temporary transfer water than the irrigators could generate from agricultural and horticultural crops; and
- Other commercially sensitive options are being assessed and others are already agreed in principle subject to project approval.

Presenters at the 2007 Ethanol Conference in Melbourne noted that the technology is now available (at cost) to capture and re-cycle almost all water other than that in Dry Distillers Grain (DDG) exiting the site. The issue of water requirements and adequacy of supply is not limited by current seasonal (severe drought) circumstances.

We refer MCMA to SOC commitment 290.

3.10.1 The 2006-07 Water Availability Benchmark

It is recognised that if the combined ethanol and dairy business was to be established on a worst case scenario of only receiving that water available in a generally reputed 1:1,000 year drought such as suggested for the 2006-07 water year then the business would not be established at all.

If a water dependent business were to be stopped on the basis of a 1:1,000 year event possibly occurring regularly then no business would consider investing, for example in high technology irrigation systems nor high value forms of agricultural production because the assets could be too easily stranded.

In this scenario it would be commercially more prudent to keep technology and capital inputs at a low level to avoid stranding assets and seek only opportunistic revenue streams. The suggested

MCMA benchmark of 2006/07 would undermine any confidence in the future for any water dependent business.

The MCMA comment on the 2006-07 water availability benchmark is noted.

3.10.2 Integrated Water Management Plan

The MCMA recommendation for the establishment of an integrated Water Management Plan is noted and reflects the pathway down which the project has already progressed. The following observations and responses to the MCMA submission are made:

- The Board, senior management and staff of Coleambally Irrigation Co-operative Limited (CICL) have been actively involved at all stages of the project with Four Arrows' Ethanol Pty Ltd senior management and with the project team;
- The project water management strategies, issues and perspectives have all evolved with CICL consultation and are consistent with the aims and intent of the CIA LWMP;
- All component parts of the proposed project water operations as delineated in the EA already form the basis of the integrated water management system for the project; and
- The proposed overall project water management system in the EA has been integrated with the wider hydrological and hydrogeological systems to minimise adverse impacts and enhance overall net outcomes.

It would thus appear that the MCMA may not have fully grasped the detail and complexity of the proposed project water management plan. This outcome may be a result of:

- A possible lack of clarity in the EA as displayed;
- A lack of time for the MCMA to read and comprehend the detail; and
- The desire of MCMA to see a separate document titled an "Integrated Water Management Plan".

It is the project team's intention to prepare a detailed Environmental Management System (EMS) following project approval. That EMS will incorporate and integrate a water plan in context with the project itself and its context with the wider landscape.

The MCMA could be involved in the preparation and performance monitoring of the EMS following project approval or at a scoping level prior to approval.

If the MCMA requires additional detail for this response then direct contact could be made to the project team for mutual clarification of outstanding issues.

We refer MCMA to SOC commitment 291.

3.11 Hazard Assessment

Queries have been received in regards to the Hazard Assessment contained with the EA document prepared. The respondent notes that the traffic has been modelled on a 365 working day schedule, whilst the Hazard Assessment is modelled on a 360 day scenario. Whilst this is clearly of concern as an oversight, it is not unreasonable to suggest that this does not materially affect the outcome of the Hazard Assessment prepared. The Hazard Assessment has been prepared in accordance with the requirements of the DoP and specifically the State Environmental Planning Policy (SEPP 33) *Hazardous and Offensive Development.*

The preliminary hazard analysis clearly states that this proposed development is potentially hazardous and as such, analysis of any and all off-site consequences was undertaken utilising the *IAE 1993 Manual for Classification and Prioritisation of Risks due to Major Accidents in Process Unrelated Industries.* This analysis did indicate the potential of off-site risks including the probability of those risks occurring. The risks were detailed in the EA and re-affirmed here are the identified two key findings being:

- Whilst ethanol is the product stored in the largest quantity, it is the storage of petrol that presents a larger potential off-site risk; and
- That the frequency of incidents for both ethanol and petrol were largely based on the transport activities.

In reviewing the 360 days modelled in the Hazard Assessment versus the 365 days modelled in the transport modelling section of the EA, an increase in the five days represents <1.5% in the modelled period for risk. In assuming this <1.5% impact on timeframes discussed and identified in the Hazard Assessment it does not alter the conclusion of the Hazard Assessment that the off-site risk of the proposed facilities will be negligible and still remains with a Level 1 qualitative assessment meeting DEC guidelines, assuming implementation of a traffic management policy, and design and operation of the facility to appropriate Australian standards.

A concern was raised about whether the modelling was completed on ethanol or de-natured ethanol. Given that petrol storage, handling and incorporation within the proposed development has been modelled as individual components of the Hazard Assessment, it is clear that modelling has been undertaken on de-natured ethanol, incorporating the use of the more potentially explosive petrol component of the petrol/ethanol de-natured product.

This respondent also outlines that a comprehensive list of chemicals has not been provided or consideration given to the affects of:

- Spillage of sulphuric acid or urea and/or combined with an ethanol/petrol fire; and
- Clean-In-Place (CIP) or other toxic chemicals and what effect a 30t truck spillage would have upon hazard mitigation and the environment.

As per SEPP 33 and the report prepared by Moore Consulting & Engineering, such a detailed list is not required to be investigated at this preliminary project stage. For any facility of this nature to operate it must meet stringent Australian standards for licensing. Incorporated within the conditions of licensing and operating procedures is the requirement to meet HazMat standards for chemical handling, spill management and mitigation, and explosive risk management. This process is supported by the outline within the Statement of Commitments (SOC) of the EA displayed to ensure that all chemical handling areas and storage facilities be bunded to contain all spill events on-site for appropriate management restoration.

Notwithstanding, It is apparent that such containment strategies cannot be applied to the movement of potential containment and chemical products onto and off site. In this instance, it is proposed that standard best management practice and operating procedures be implemented as part of a working policy document to ensure that appropriate HazMat and HazChem standards will be applied to all transport of product onto and off site where appropriate.

We refer readers to SOC commitment 292.

3.12 Traffic Movements

A respondent to the Traffic Impact Study (TIS) has commented that there is some exclusion of truck vehicle numbers and variations to volume numbers was required to be considered. This request has been acknowledged and alterations have been included and are represented in Spreadsheet Annexure 26.0. The original spreadsheet from the EA has also been presented for comparison.

The modifications required the inclusion of:

- An additional 500 truck movements on to and off the site each year for denaturing purposes with no backloads being applied to these vehicles even though most of these movements will be involved in backloads;
- Operational periods to be discounted to 360 days rather than the original 365 days. It must be noted that plant will in reality not cease operations for public holidays and the dairy facility will be required to operate at all times);
- Varied feedstock volumes, according to bulk density figures supplied by the respondent, within submissions received from the public display period;
- The downgrading of silage transport vehicles from 38 tonne to a 20 tonne capacity;
- Recalculated manure outputs;
- The downgrading of manure transport from 40 tonne to 25 tonne capacity;
- 180 return trips for the removal of dead carcasses; and
- Two visiting vehicles per day.

Even with these inclusions, truck movements have only increased by one vehicle per hour.

Other comments are included below in response to queries received from the public display period in relation to vehicle movements:

- Trucks transporting CO_2 have not been included in backload calculations at any time;
- Backloaded trucks are derived from those carrying feedstock only onto the site;
- It is noted that within Annexure 4.1.1 of the original EA that a 40 tonne value has been utilised to calculate truck movement numbers.

  This was given as an indication of truck volumes for readers concerned with that section. The actual TIS has used a more accurate and conservative truck carrying capacity of 38 tonnes in most instances for volume calculations. These being the figures that have been submitted to the RTA for assessment, and have acquired conditional approval;

- The respondent's query focuses upon the scenario that there will be variations to truck vehicle movements during harvest, as local producers will be supplying grain and there will be some variations in the amount of trucks available for backload as well as delivery operating hours being dependent upon available labour, etc.

  These assumptions are inconsistent as ethanol production requires a constant guaranteed supply of feedstock and this will be transported from grain storage facilities, as well as being sourced from local producers. It is not envisaged that purchases will increase due to seasonal variations. Local purchases will be made on the basis of a preferred commitment to supporting regional enterprises provided relative prices are not excessive. Therefore movements will be consistent with those presented on the spreadsheet and not reliant upon seasonal variations;

- It has been noted that the Willbriggie/Junee rail is presently closed and will require substantial funding to upgrade it to a level suitable for the transportation of the required feedstock.

  Negotiations are currently underway between all levels of government, including regional and state planning authorities, to have this line reinstated. Negotiations have been positive and it is anticipated that the Willbriggie/Junee line will receive funding and be upgraded to the benefit of not only this facility, but many local producers within the region;

We refer readers to SOC commitment 293.

- Heavy vehicle calculations have been altered to reflect the fact that Eulo Road bridges, at this point in time, are not suitable to support B-Double traffic. However, there have been negotiations with CICL concerning their upgrade. This is for the benefit of many producers within the regional as well as the proposed facility.

We refer readers to SOC commitment 294.

Having considered all within the EA, concerns regarding traffic vehicle movements, and the inclusions of updated information into the spreadsheet, it has been concluded that increases above the traffic movements originally predicted within the EA will not reflect appreciative increases to noise, traffic congestion or safety.

4.0 ADDITIONAL INFORMATION REQUIRED RESULTING FROM AGENCY REVIEW OF PPR REPORT

Further discussions with Department of Planning (DoP) and other agencies regarding the draft Proposed Project Report (PPR) revealed the need for a number of additions and qualifications to be included within this final document to clarify air quality emissions, Greenhouse Gas (GHG) assessment and waste water disposal systems. A copy of this request is presented in Annexure 2.0b with questions repeated below followed by the appropriate response to satisfy these queries.

4.1 Air Quality

Holmes Air Sciences have provided a further report addressing the questions raised relevant to air quality. This is presented as Annexure 27.0. These findings are detailed below:

> *Whilst the data provided in Section 3.1.2.3, Annexure 5.0 and Annexure 6.0 do provide much more detailed information on the air emissions from the proposed plant, in its current form the data cannot be compared to Department of Environment and Climate Change (DECC) guidelines. Specifically the data provided by the US manufacturer are primarily presented in units of tonnes/year which as outlined below is inconsistent with DECC regulations and guidelines.*

Conversions have been completed by Holmes Air Sciences as outlined within the main table provided in Annexure 27.0 being those converted values used to generate model outcomes within the original EA.

> *In the first instance the data needs to demonstrate that the general air emission standards outlined in the POEO (Clean Air) Regulation 2002 will be met. These standards relate to schedule premises (activity and plant) and are presented in units of mg/m^3.*

General air emission standards outlined in the POEO (Clean Air) Regulation 2002 will be met. Refer to comments within Annexure 27.0. Holmes Air Sciences state in Annexure 27.0 at the last paragraph "*These values are all well below the POEO limits*."

> *Secondly, the data needs to be used to determine that the relevant assessment criteria (as outlined in the "Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales") will be met. These criteria are typically stated in units of mg/m^3 or mg/m^3.*

The relevant assessment criteria (as outlined in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales) will be met. Refer to Holmes Air Sciences comments within Annexure 27.0.

> *The original Holmes Air Science report defined the relevant assessment criteria for the project and undertook modelling to demonstrate that these criteria were met. The original modelling undertaken is now redundant as more accurate emissions data is available from the manufacturer. Revised modelling should be undertaken using the new data, however this may not be required if it can be clearly demonstrated that the new emission data is lower than those used in the original model. The DECC expects that this comparison and determination be undertaken by a qualified air scientist.*

Holmes Air Sciences have calculated that air emissions data provided by ICM for a 416ML plant which, as demonstrated in Annexure 27.0, when scaled down to a 300ML plant provide values lower than those used for the original EA modelling.

Not able to be reliably quantified in any of these emission estimates are the quantum and rapid advances ethanol technology and associated reductions in environmental impacts as well as the improvements in operational efficiencies. The net effect of these advances is that by the time of eventual construction the emissions on the high balance of probabilities will be significantly less than those assed herein.

> *It is also noted that the data provided by the US manufacturer is based on a corn based ethanol plant with a CO_2 recovery plant. The draft PPR needs to justify that these data are representative of the proposed grain based ethanol plant with no CO_2 recovery plant proposed.*

Thus it is not considered that further modelling is required in light of the data provided by ICM. Refer to comments within Annexure 27.0.

Holmes Air Sciences also state in Annexure 27.0 "*The issue of scaling was one of the uncertainties in the emission estimates, however emission rates from a 60ML and 416ML plant show reasonable correspondence when emissions are scaled to a 300ML plant with the scaling up process appearing more conservative. Therefore, it appears that this aspect of the emission estimates is reasonably robust*."

Comparative analysis between those results provided within the original EA and the emissions data put forward by ICM reveals a system void of CO_2 capture will still have no significant impact upon air quality to the surrounding areas. Refer to the Holmes Air Services comments within Annexure 27.0.

> *Whilst the draft PPR has identified additional market for the WDG, no information has been provided regarding the location of the end markets and in particular the practicalities of storing and transporting this product within acceptable timeframes to reduce potential odour issues. This outstanding issue needs to be addressed.*

A large part of the identified market for WDG will be to regional intensive livestock industries. The project dairy being the primary consumer whilst Four Arrows' other livestock enterprises wish to secure a large volume of product with a substantial portion also to be on-sold to other similar intensive operations throughout the region. It is not intended that the brewers grain in a wetted form will be transported further as a demand has been secured for the balance.

Localised stockfeed processors have also expressed an interest in obtaining WDG and transforming it into an innate pelletised form. The result being a product that has effectively no odour characteristics and is suitable for long term storage in silos and bunker areas.

A national demand for the product currently exists with other export markets exhibiting strong interest in the high protein pelletised form. These being potentially being New Zealand initially and then to Asia, USA and Europe.

Further relevant detail is presented within Section 3.5.5.

4.2 Greenhouse Gas Assessment

> *"For all ethanol plant proposals the DoP requires Scope 1, 2 and 3 emissions calculated in accordance with the AGO Factors and Methods Workbook (2006). It appears that this has been done, however, could you please provide a summary table in the PPR identifying and quantifying Scope 1, Scope 2 and Scope 3 emissions."*

The *AGO Factors and Methods Workbook (2005)* categorises emission sources by grouping specific activities to provide a consistent set of emission factors for a variety of purposes. These present as Scope 1, 2 and 3 activities and described within the Workbook as:

- Scope 1 covers direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes;
- Scope 2 covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate the electricity, steam or heat and do not include emissions associated with the production of fuel; and
- Scope 3 includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation.

The following table identifies and quantifies those emissions as presented in Annexure 24.0 being the CSIRO Gas Abatement Calculator. The table represents outputs from wheat feedstock being the worst case scenario GHG emissions produced by the proposed ethanol plant.

Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope.

Table 6.0: Breakdown of Scope 1, 2 and 3 Emissions from Ethanol Facility and Ancillary Off-Site Activities

Scope 1, 2 and 3 Emissions Calculations						
Emissions Source	**CSIRO Model Reference No.**	**Quantification**		**Scope**		
		g CO_2 eq/kg feedstock	**kT CO_2 eq/ 300ML/annum**	**1**	**2**	**3**
Details of Wheat Feedstock						
Production of wheat feedstock (per kg)	W1 + W2 + W3 + W4	240.2	170.7	-	-	✓
Replacement Ratio	W5	1.7	1.2	-	-	✓
TOTAL	Sum A (W1:W6)	259.1	184.3			
Transport						
Transport of Feedstock to Ethanol Facility	W6	17.3	12.4			✓
Transport of Fuel to Market	W10	54.6	16.5			✓
Details of Fermentation and Distillation						
Feedstock impacts per Litre of Ethanol (2.37kg/L)	W7 (2.37*Sum A)	614.2	184.2	✓	-	-
Heat/Steam impacts per Litre of Ethanol (9MJ*W12a)	W8	804.2	241.2		✓	
Electricity impacts per Litre of Ethanol (0.1kWh*W12b)	W9 (n/a = only applicable for Anhydrous Ethanol Production)	-	-	-	-	-
TOTAL	**Sum B (W7:W10)**	**1472.9**	**441.9**	**-**	**-**	**-**
TOTAL/Scope kTCO_2eq/annum				**184.2**	**241.2**	**16.5**
Note: TOTAL/Scope figures are a product of differentiation between known total tallies of Scope 1 and 2 emissions on site, and not a direct summation of each scope column. This is the inherent difficulty in quantification of scope emissions as Scope 3 emissions are derived for Impact per kg/feedstock and are subsequently utilised in calculations of Impacts per MJ energy, and per Litre of ethanol produced. There is no uniformity in the nature of unit measurement that can clearly delineate between quantity of CO_2 output and scope emission point. The only known and unambiguous figure provided in the table above is the 441.9KTCO_2 eq/annnum known to be the total GHG Impact from a combination of Scope 1, 2 and 3 emission sources. This is the figure accepted by the proponent as the total emissions requiring offset for the production of ethanol from the proposed development						
Definitions						
W12a = 89.35g CO_2 eq					√	
W12b = 280.2g CO_2 eq				-	-	-
Sum A = Component of Sum B						√
Sum B = total of all Scope 1, 2 and 3				√	√	√

In response to the questions raised for clarification by the Department of Conservation (DEC), the above table serves to differentiate between Scope 1, 2 and 3 GHG impacts from the proposed ethanol development. The table originally presented in the draft PPR incorrectly separated the quantities of emissions from various stages in the ethanol production process. The table identified Scope 2 and 3 emissions as being in addition to the Scope 1 emissions outlined. This was not correct, as the Scope 2 and 3 emissions form part of the total emissions attributed to the Scope 1 column in the earlier table.

It is not possible to fully define Scope 1 as different to Scopes 2 and 3 with absolute confidence on the basis of the formulas built into the CSIRO Biofuels Calculator. The formulas within the biofuels calculator are hidden within the model, and are not readily accessible. Based on this difficulty, it is necessary to rely on the application of basic mathematical analysis to the calculated figures as presented in the model with no reference available to the linkages between specific generated emissions. The figures generated in the production of feedstock (Scope 3), do not neatly separate from the figures attributable to Scope 1 emissions (those emissions are driven solely by activities on site), as the Scope 1 tally is built upon calculations relying on hidden variances and applications of the Scope 3 emissions (or sum A from the preceding table).

That notwithstanding, it is fair to assert that the most important component for differentiation would be the separation of Scope 2 emissions, to ensure that two or more organisations do not report on the same emissions, resulting in a misrepresentation (increase) in actual emissions in the broader context. Based on this assertion, the model does differentiate between scope 1 + 3 and Scope 2 emissions with reasonable confidence.

As a conclusive statement, it is evident that regardless of attribution of specific scopes to the emissions as calculated by the (CSIRO) model, the total emission per annum is no greater than that calculated at 441.9 kT CO_2 eq, less the displaced fuel reductions, resulting in a "*nett saving*" of 74.85 kT CO_2 eq/annum.

If was consider that Scope 2 emissions were those reported by another organisation (in this instance the production of energy/fuel for consumption by the ethanol facility), then the GHG emissions footprint for the proposed development would be reduced by 241.2kT CO_2eq/annum, and would represent a much larger "*nett saving*" than that currently being expressed. This assumption though is not strictly valid as there is no quantifiable reference to support it, and as such, the proponent will consider the "*nett saving*" as tallied (441.9 kT CO_2eq/annum).

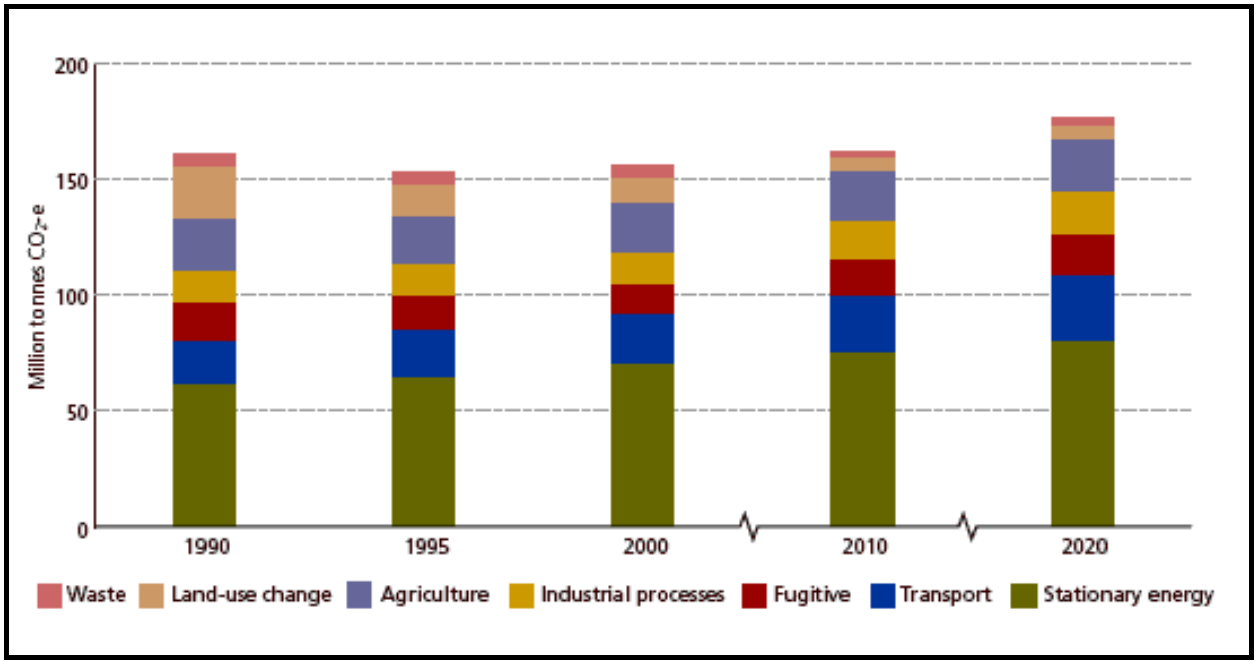
> *There appears to be a large difference between the data presented in the original EA and that in the PPR even though the same model has been used. In the EA the model results were a total of 275kt/annum of CO_2 for the project with no CO_2 capture and 98kt/annum if CO_2 capture was used. The PPR now states the project will have a net debit of 54kt/annum of CO_2 (with no CO_2 capture associated with the plant). Can you please clarify the reasons for these differences?*

In the original EA, the models prepared by the CSIRO were utilised incorrectly because of the lack of supportive documentation. Within the original EA, no credence was paid to the full offsite (indirect) impacts of production of feedstock, transport of feedstock and product, waste management, and ultimately fossil fuel replacement credit etc. This was an error on the part of Booth Associates, and the altered outcomes from the modelling undertaken for the PPR reflect the more accurate utilisation of the same model and the extra support provided by the AGO in the operation of that model.

Emissions from the project should be reported against NSW total annual GHG emissions and emissions for similar industries.

At this stage, no data on the current state of CO_2 equivalent emissions is readily available for 2005, 2006 or the elapsed portion of 2007. Consequently, predictive modelling has become a commonly accepted practice for quantification of potential emission rates and annual totals.
Figure 1.0 shows the past estimated and future predicted CO_2 total annual emissions from a range of industries in NSW.

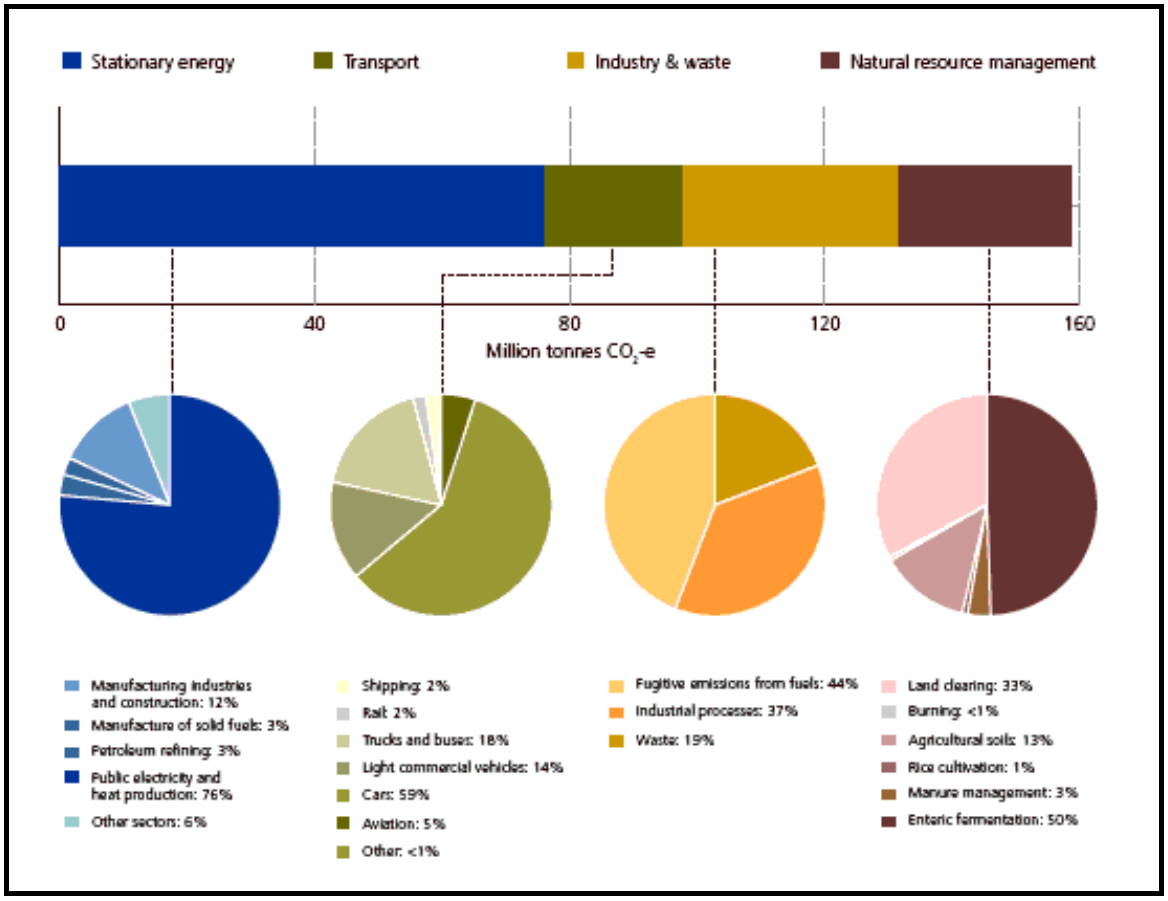
Figure 1.0: Actual and Projected Greenhouse Gas Emissions under "Business-as-Usual Scenario for NSW (million tonnes CO_2-e)



Source: AGO 2006

The most recent information available from the DEC website page *New South Wales State of the Environment 2006* indicates that in 2004, total NSW emissions were 158.7 million tonnes (Mt) CO_2 equivalents. Figure 2 illustrates the distribution of state emissions by sector. The annual emissions from the proposed development expressed as Mt CO_2 equivalents is 0.05357 million tonnes (Mt). As a percentage, this equates to 0.0337% of total NSW emissions per annum.

Figure 2.0: NSW Greenhouse Gas Emissions for 2004 and Emission Sources by Sector (million tonnes CO_2-e)



Source: AGO 2006a, AGO 2006b

It must be noted that this figure assumes no CO_2 capture technology is employed, and full emissions are proposed to be offset utilising carbon sequestration via establishment of tree plantations.

At this stage, there are no similar industries available with which to compare the proposed development. Previous comparison was made between the proposed development and pre-existing ethanol production facilities of a much smaller scale for various aspects of the EA, and Booth Associates were heavily criticised for having undertaken such comparison.

The request to apply such a comparison in this instance is in direct contradiction to the response by state department representatives to Booth Associates having utilised the tried and tested methodology of comparison to pre-existing developments applied to aspects of the proposed development previously.

Bearing the above in mind, and given the distinct lack of numbers of such facilities within Australia to provide a comparison base exhibiting a reasonable degree of uniformity and scientific or statistical rigour, Booth Associates will not compare the predicted emissions data to similar industries.

> *From the models provided in Annexure 8.0, it appears that you have specified that the energy source would be 80% from coal derived energy and 20% as natural gas. However, the EA states that natural gas is not currently available at the site, and while the extension of the pipeline from Griffith is a potential option (as detailed in Annexure 3.3.1), no commitments have been made regarding the construction of the pipeline to the site. Therefore, the use of the 80/20 split should be justified.*

It is proposed that a pipeline to be constructed for the transport of natural gas to the site will be investigated for completion pursuant to cost sharing potentials between other end-users and stakeholders. Such partnerships will be sought with the likes of the Coleambally Chamber of Commerce, Shire councils and other potential industrial development bodies. Various options are available to the Four Arrows Group for funding initiatives and incentive schemes, and these will be further developed pending successful project development approvals. It is premature to make statements in the form of a 'Statement of Commitments' at this stage of the proposed development, and such commitments will be considered pending the outcome of the planning application process.

In the interim, a cap has been set on natural gas consumption of 20% of total project energy needs. This cap is set on the basis of the economic and physical viability of transport of natural gas onsite through standard industrial retail relationships with supply networks and mobile supply.

> *The PPR details that options such as CO_2 capture and methane capture will be investigate. However, additionally technology/infrastructure would only be installed should it prove economically viable. Should it be decided that it is not viable the only measure proposed to minimise GHG is through the preparation and implementation of a carbon offset and sequestration strategy. Details of what would be included in this strategy should be provided. Is it the intention that this strategy will include offsets for all the GHG emissions generated by the project?*

The strategy proposed for offset of GHG in the PPR is subject to Commercial-In-Confidence at this stage; hence the specific details cannot be disclosed. What can be outlined is that the system to be employed for sequestration involves the establishment of large-scale tree plantations and the scale of operation of the sequestration project will capture all GHG emissions generated by the proposed development (including GHG emissions from all production of feedstock for the plant, transport of feedstocks, transport of final product to markets and waste management).

The proposed sequestration project will affect approximately 1.61 million tonnes over a project life of 25 years. Details of this proposal have been forwarded to the proponent for approval by CO2 Australia Limited recognised as a legitimate project management company overseeing established sequestration programs.

We refer readers to SOC commitment 288 and 289.

4.3 Waste Water Disposal

All comments that have been presented by the agencies for further explanation/investigation regarding waste water disposal are now redundant due to the Revised Waste Water Strategy as detailed within Section 5.0: *Preferred Project*.

5.0 PREFERRED PROJECT

5.1 Project Changes

The only essential changes of note to the project as described and assessed in the EA as displayed are:

- The Category 3 waste water management systems;
- Refinements of the remainder of the project and response to:
  - Submissions made during the EA display period;
  - On-going comments made by reviewing agencies; and
  - Evolving policies provided by the appropriate agencies.

The primary examples of refinements are the sole strategies for management of distillers grain and the strategy for managing CO_2 emissions which have since been proved to not have the available markets as was previously advised. These two and other refinements have been addressed in prior sections of this PPR.

The major change to the project has been the complete revision of the Category 3 waste water management system. This change is detailed in the following sections.

5.2 Approach in Environmental Assessment as Displayed

When the Environmental Assessment (EA) was displayed it both recognised and incorporated appropriate responses to the following key issues:

- The potential risks to groundwater including potential contamination and rising groundwater levels;
- Acknowledgment of the intrinsic differences in waste water management between beef cattle feedlots and intensive freestall dairies viz:
  - The much higher and daily water flows for washing down in the milking barn and in the freestall sheds;
  - The reliance on rains generating waste flows in beef feedlots results in a significant increased concentration of salts and nutrients between rain events;
  - The nutrition of dairy cattle requires substantially less salt in their diet;
  - The regular and substantial export of salts and nutrients in milk.
- CSIRO Griffith had undertaken a relatively recent (2000) and comprehensive assessment of regional groundwater flows, movements and elevations for the CIA LWMP. The identified issues and perspectives for groundwater were related to causes and effects of changing land management practices and to climate variations;
- The need to use statistically based data with respect to rain, temperature, evaporation, etc;
- To purposely over-size waste management facilities to ensure a significant buffer capacity was available to shock-absorb against unforeseeable events;

- To be able to manage all waste water on-site in all but the most extreme of years. To this extent a decision was made to segregate water into three categories of water quality viz:
  - Category 1 being potable water for use in the ethanol plant and office infrastructure after simple treatment;
  - Category 2 water which was near potable water and with limited additional treatment could be made potable;
  - Category 3 water of relatively low quality and which was to be totally segregated and retained on-site under all foreseeable circumstances;
- To be able to manage all Category 3 water in a decile extreme year this, at 1,000mm of rain in total, is approximately 40% greater than the wettest recorded year. This decile extreme year also allowed for effective management of extreme "one off" storm events;
- Only Category 1 and 2 excess water could be directed to the DC400 drain and then only when flow in that drain was running at extreme levels and even then only with CICL prior approval;
- To move all waste products (manure, mortality, etc) off-site as soon as possible to mitigate problems with flies, odour, etc;
- To ensure sedimentation basins were substantially over-sized and appropriately designed so that:
  - Above "normal" time was available to settle any manure;
  - Excess water could drain through a narrow spacing between drop boards;
  - To actively minimise the opportunity for through movement of nutrients and salts into the dedicated waste water management systems for the Category 3 water.

Reaction from the EA display period indicates that the approach to addressing some of the above issues was not fully appreciated by the respondents. Therefore, a fresh approach to the presentation of the adopted strategies has had to be considered.

5.3 Options to Address Concerns Raised

5.3.1 Status Quo

The initial response to the questions raised in submissions was to continue with the original strategy of large anaerobic and aerobic ponds to:

- Best manage the large volumes of water recycled throughout the freestall dairy sheds;
- Concurrently manage the drainage from the dry lot pens; and
- Provide a very large additional air space for ensuring capture of run-off from a large storm event in a year of rainfalls well above that ever recorded.

It is believed that the integrity of the site for the original waste water management system has been strongly supported by the geotechnical, geomorphic and agricultural soils investigations untaken by Wrigley-Dillon.

From the EA display submissions a continuance with the principles of the original proposal required additional and substantial:

- geotechnical, soils and groundwater investigations; and
- almost full design level drawings including details of under storage leakage capture systems;

to satisfy the various commenting and concurring agencies.

The scale of the originally proposed Category 3 waste water management system also gave concern to the commenting agencies about the ability of the proposed large scale facilities to retain their integrity spatially and over time.

Given the above, the project team decided to investigate alternative strategies for waste product and waste water management. In the process a scientifically sound and practical strategy was needed to further enhance operational performance, and to provide additional scientific and operational comfort to the agencies.

5.3.2 Stated Policy

The verbal advice of the NSW Department of Water and Energy (DWE) is that the current policy on groundwater protection is essentially as follows:

- For (existing) agricultural businesses – to promote those land and natural resource practices which reduce accessions of salts, nutrients and even water to existing groundwater;
- For non-agricultural business – the tolerance for accessions is zero. That is there can be no accessions even if those accessions could beneficially enhance existing groundwater of relatively low quality;
- For changes from agricultural to non-agricultural – the policy relating to non-agricultural businesses will prevail and there will be no consideration given to net benefits. That is even though the proposed non-agricultural business may generate less salts and nutrients in total than the current agricultural business; this fact should not over-ride the stated policy for non-agricultural businesses;
- If at any time there is to be a proposed disposal of waste water by way of irrigation, the quality of that waste water must not exceed the quality parameters of the then available water being supplied by the authority which in this instance is CICL; and
- Where there is likely to be a potential cause for concern, the proponent must propose a well engineered solution to the problems, with risk management strategies including the capacity to identify, capture and best manage possible facility leakages so that the existing groundwater is not affected.

Given the well documented impacts of the on-going drought/s on water supplies and especially for urban and rural domestic/stock water, there has been a re-focus on groundwater protection by communities and governments. In essence, Government is now viewing groundwater as the possible, even probable, primary water source for high security needs and is thus moving to protect that resource/s.

Notwithstanding the intentions of the stated policy, there are some constructive observations on the implications of the policy. As it stands, the policy could result in:

- The retention of land use practices with a more elevated hydraulic, salt and/or nutrient loading than a proposed alternative non-agricultural project; and
- A reduced/lost opportunity to even enhance the quality of existing groundwater with a proposed non-agricultural project should undesired accessions still occur.

The constraints of the stated policy are noted and will be conformed to when evaluating the risks and outcomes associated with the proposed new project waste water management system.

5.3.3 Minimising Waste Products

The primary and best practices strategy for minimising waste products is to minimise the mass of products of concern brought onto the project site.

The quality of the Category 3 waste water is primarily driven by the mass of salts and nutrients within the rations being fed to the cattle. The project dairy specialist was instructed to review the ration presented in the EA as displayed. The outcome of that review was:

- Potassium – K levels were below the optimum for best cattle nutrition. The K levels are normally raised by increasing K fertilisation of pastures and/or forage crops used in the overall feed source. In this instance K fertilisation of contracted silage crops will optimise K levels in the rations and minimise K levels in the faeces and urine;
- Sodium – Technically Na levels may be reduced to 0.109% by reducing the salt added to the ration. However, at this low level cattle well-being and performance will be compromised. An achievable concentration in practical nutrition is 0.19% which is well below the 0.28% found in the EA as displayed; and
- Other – all other salts and nutrients in the original ration were at or near optimal concentrations and would be best managed through performance monitoring strategies.

In essence, there is significant scope to minimise the introduction of those salts, nutrients and solids of potential environmental concern, through careful attention to the minimisation of these elements in the cattle rations.

The next and still a primary strategy are to minimise the mass of introduced salts and nutrients able to enter the waste water management system. The main tactics available are:

- Freestall flush lanes – scrape the flush lanes before each flushing event. Normally this is done with a half tractor tyre or other rubberised fitting on the front of a skid-steer equipment. The scraped manure is stacked aside for daily removal to “Tubbo”;
- Loafing pens – to scrape, stack and remove, for spreading at “Tubbo”, excess manure on a monthly basis. The best practice procedure is well documented in existing management guidelines and accepted by the dairy sector; and
- Drylot pens – to scrape, stack and remove, for spreading at “Tubbo”, excess manure on a monthly basis. The best practice procedure is well documented in existing management guidelines and accepted by the drylot dairy sector.

Once the remainder of salts, nutrients and solids have entered the waste stream the options to remove such matter are:

- Sedimentation basin best practice which has a recorded capacity to settle up to 70% of solids but 60% is a more budgetable level. Settled solids also contain significant amounts of the less soluble elements. The settled material with attached elements and some dissolved elements in the included moisture is removed to "Tubbo" on a daily basis;
- Rotary drum screening or other appropriate methods as a means of removing a high proportion of residual solids after sedimentation and before those solids enter the re-cycle ponds is a future consideration. Only scant data is available on the efficacy of screening and hence more investigation is required before such an option can be included;
- Aeration 1 re-cycle ponds will also facilitate solids breakdown and re-cycling of residual solids for a second sedimentation opportunity. This strategy will also minimise solids loading in the evaporation basins;
- Filtering is a future consideration and distinct from screening for waste water pumped from re-cycle ponds to the evaporation basins. A "filter" could also be a much finer rotary driven screen. Lesser soluble salts and nutrients will be removed with the solids and this will result in reduced loadings in the evaporation basins. Data on this option is scant and thus cannot be relied upon for this PPR; and
- Aeration 2 evaporation basins will facilitate accelerated evaporation and the breakdown of solids.

All solids removed at the above stages would be suitable for spreading on "Tubbo" irrigation, as a higher proportion of the more soluble elements (especially Na) would remain in solution and thus enter the evaporation basins.

5.3.4 Dairy Industry Review

In 2006 Mr Wrigley (Project Environmental Engineer) had been engaged by Dairy Australia to review all strategies, issues and perspectives surrounding waste and waste water management from dairy farms and intensive dairy businesses. As a consequence of the findings of his latest industry specific investigations a number of points were noted:

- Nutrition in beef cattle is generally different to that in dairy cattle, with meat being the primary objective in the former enterprise and the production of quality milk in the latter;
- Beef feedlots generate waste water through rain and storm events, and as such the volumes of water are relatively limited, generally more "event" driven and are generally more concentrated;
- Freestall dairies require substantial volumes of water on a daily basis to flush the freestall lanes. This water does not necessarily have to be fresh water, but can be recycled waste water after significant sedimentation has been allowed to occur;
- Export of salts and nutrients in milk is significant in dairies and non-existent in beef feedlots; and
- Significant fresh water is required to wash down the dairy cows before milking and to clean down the dairy barn itself. This water is directed to the Category 3 waste stream.

For the proposed integrated ethanol/dairy project, the freestall sheds will require 7.2ML/day for the flushing of the freestall lanes alone. Additional water will also be generated daily from the cow and barn wash down in the milking shed.

5.3.5 An Urban Experience

In a team project with reclaimed urban waste water, the project involved a community which had as its primary water source a regional groundwater system with elevated salinity. Following movement of this salinised water throughout the town and treated in a sewerage treatment plant, the resultant waste water was even more salinised. After treatment the reclaimed water had to be applied to agricultural lands situated over a sensitive and extensive regional groundwater system supplying a number of other communities and a number of regional food businesses dependent on that groundwater.

After substantial investigations, the saline reclaimed waste water (salinity levels upwards of 2,800EC's) was to be applied to the agricultural land in such a way as to "park" any saline material below the agricultural root zone and above the regionally extensive and sensitive groundwater system. The groundwater levels varied from 9m below NSL to approximately 18m below NSL.

To meet the needs of responsible resources stewardship and state agency concerns, the use of the internationally accepted management procedures as recorded in the *FAO* Irrigation and Drainage Paper No. 47 *Waste water Treatment and Use in Agriculture (FAO No. 47)* had to be addressed.

5.3.6 The FAO Strategy

The following points are noted and essentially replicated from the FAO No. 47 paper, in particular pages 67 – 75 inclusive viz:

- To leach during the cooler seasons to increase efficiency and ease of leaching;
- To use more salt tolerant crops which require a lower leaching fraction;
- To use tillage (and/or other cultural practices) to slow overland water flow and reduce the number of soil surface cracks which foster by-pass flow and decrease leaching efficiency;
- To use sprinkler irrigation at application rates below the soil infiltration rate to favour unsaturated flow within the soils;
- To use alternate ponding and drying instead of continuous ponding to enhance irrigation and leaching efficiency and to use less total water;
- Where possible to schedule leachings at periods of low crop water use or postpone leachings until after the cropping season;
- To avoid fallow periods, particularly during hot summers when rapid secondary soil salinisation from high water tables (and/or rising capillary action) could occur;
- If soil infiltration rates are low to consider pre-planting irrigations and/or off-season leachings to avoid excess "in crop" water applications; and
- To use one irrigation before the start of the rainy season if total rainfall is normally expected to be insufficient to complete leaching.

The FAO No. 47 document specifically notes that rainfall is the most efficient leaching and salt "parking" medium because it provides high quality water at relatively low rates of application.

5.3.7 MLA Report FLOT.328

As the representative agency for the red meat industries, Meat & Livestock Australia (MLA) has commissioned a range of studies to provide currently credible data on the impacts and sustainability of these industries. The primary sustainability studies are designated COMP.094 and focus on the Life Cycle Analysis (LCA) for use by the broader red meat supply chain.

FLOT.328 is a related project for assessing and benchmarking the environmental sustainability of the feedlot industry against domestic and international competitors. The component of the broader FLOT.328 studies relevant to this EA response document is FLOT.328 Final Report Part C – *Nutrient Cycling at Australian Feedlots.* As at the date of preparation of this response document FLOT.328 Part C had been accepted in its final form but had not been formally published. MLA provided a pre-release copy for this response document on the basis of:

- The source was formally identified;
- The data therein was correctly used; and
- The desire of MLA and the red meat industry to continually improve sustainability was noted.

A copy of the executive summary and conclusions found in FLOT.328 are attached hereto as Annexure 28.0.

The key elements assessed under FLOT.328 were nitrogen (N), phosphorus (P) and potassium (K). Salt *per se* was not studied but it is reasonable to expect the same principles will be encountered.

The key findings of the FLOT.328 Part C project are:

- Cattle nutrition is the primary driver of the nutrient content in manure (urine and faeces) and in the amount of greenhouse gases generated through belching and flatulence;
- Pen maintenance determines the nature and location of nutrient losses eg N to atmosphere, P and K to sedimentation and to irrigation etc; and
- Sedimentation management/capacity drives the quality of waste water for irrigation and the dispersal/usage of manure on (agricultural) lands.

With respect to the overall FLOT.328 Part C project the following is a succinct summary of the study findings for the key elements being considered.

- Nitrogen:
  - If dietary protein is limited to only that needed by the animal then NH_3 emissions may be reduced by as much as 70%;
  - Monthly pen cleaning as against at the end of each 166 day feeding period reduced N losses from the feed pad by 66%; and
  - Between 50% and 60% of incoming N ended up in manure with over 90% of manure N lost through volatilisation and the balance exported in run-off and scraped manure.

- Phosphorus:
  - P in feed ranged from 47% to 80% of total P into the surveyed feedlots with incoming cattle being the source of the remainder of the P import sources;
  - P levels in manure ranged from 0.017 to 0.089Kg/Kg Hot Score Carcase Weight (HSCW) gain in 2002 and 0.048 to 0.068Kg/Kg in 2004 with long-fed cattle having the higher P levels;
  - Scraped manure contained 94% to 99% of total manure P with the remainder exported from pens in run-off to the holding ponds;
  - P is a relatively immobile element with pen management determining how much P in total is exported in waste run-off; and
  - Monthly scraping was optimal for minimising P run-off.
- Potassium:
  - The biggest variation in K inputs was in the variations found within incoming feed;
  - K retained in scraped manure ranged from 65% to 99% in 2002 and 35% to 96% in 2004;
  - Remaining K is exported in pen run-off; and
  - Monthly scraping of dry lot pens and daily scraping of slush lanes substantially reduce K exported in pen run-off.

From a commercial perspective the regular (monthly) scraping of dry lot pens, daily pre-cleaning of flush lanes, regular maintenance of sedimentation basins and manure removal to "Tubbo" will optimise both the capture and usage of nitrogen before it is largely lost by volatilisation. Optimisation of N capture and incorporation into the "Tubbo" irrigation soils will also contribute to a reduction in the demand for artificial N, P and K fertilisers.

5.3.8 Options Review

Whilst the waste management system proposed within the EA as displayed has significant merit, the additional benefits accruing from amalgamating the appropriate components of the:

- the latest stated policy of DWE on groundwater protection;
- latest review of the dairy industry waste management strategies;
- FAO No. 47 recommended strategies for agricultural irrigation with waste water; and
- MLA report FLOT.328 project which affirms the primary importance of animal nutrition and regular pen maintenance.

have driven a need to review the Category 3 waste water management strategy with a resultant ongoing improvement in net environmental outcomes.

Of particular note is the latest stated policy of DWE of "zero tolerance" for groundwater accessions and the indicated preference for engineered evaporation basins. These policies as they now stand preclude any consideration of sustainable irrigation strategies as proposed in the Draft PPR.

Given the over-arching need to satisfy the stated policy, the reviewed Category 3 waste water management system must focus on:

- Minimising the potential loadings of solids, salts and nutrients able to enter the waste water system and especially those able to enter the required evaporation ponds; and
- Engineering the evaporation basins to that level which will meet the needs of the stated policy.

Section 5.4 of this response document will detail the integration of those strategies and tactics which will optimise the performance of the revised Category 3 waste water system.

5.4 Revised Waste Water Management Strategy

5.4.1 Proposed Strategy Overview

To meet stated DWE policy requirements, the final repository for Category 3 waste water must be evaporation basins. These basins must be fully engineered, have geo-membrane liners and incorporate an underlying drainage capture system as a form of risk protection for unexpected basin leakages.

Upstream of the evaporation basin will be the Category 3 re-cycle ponds to hold the waste water emanating from the sedimentations system until it is required for freestall flushing and/or surplus waste water is directed to the evaporation basins. The recycle ponds will need to be fully engineered and incorporate an underlying drainage capture system for risk management. If required a geo-membrane liner will be incorporated.

Of particular note is:

- Removal of the anaerobic ponds which are now not required following the 2006 investigations for Dairy Australia by the project dairy waste specialist; and
- Removal of the then proposed large aerobic pond which has become redundant with the new recycling ponds and evaporation basins.

The remainder of the Category 3 waste water infrastructure remains essentially as presented in the EA as displayed. That is, all the freestall and drylot drainage system is directed to an engineered series of sedimentation basins. As a back-up to the sedimentation basins is a short term buffer storage to capture all Category 3 water generated by excess storm run-off from the designated containment area. The pump capacity on the buffer storage will remove all water within 24 hours even in extreme circumstances.

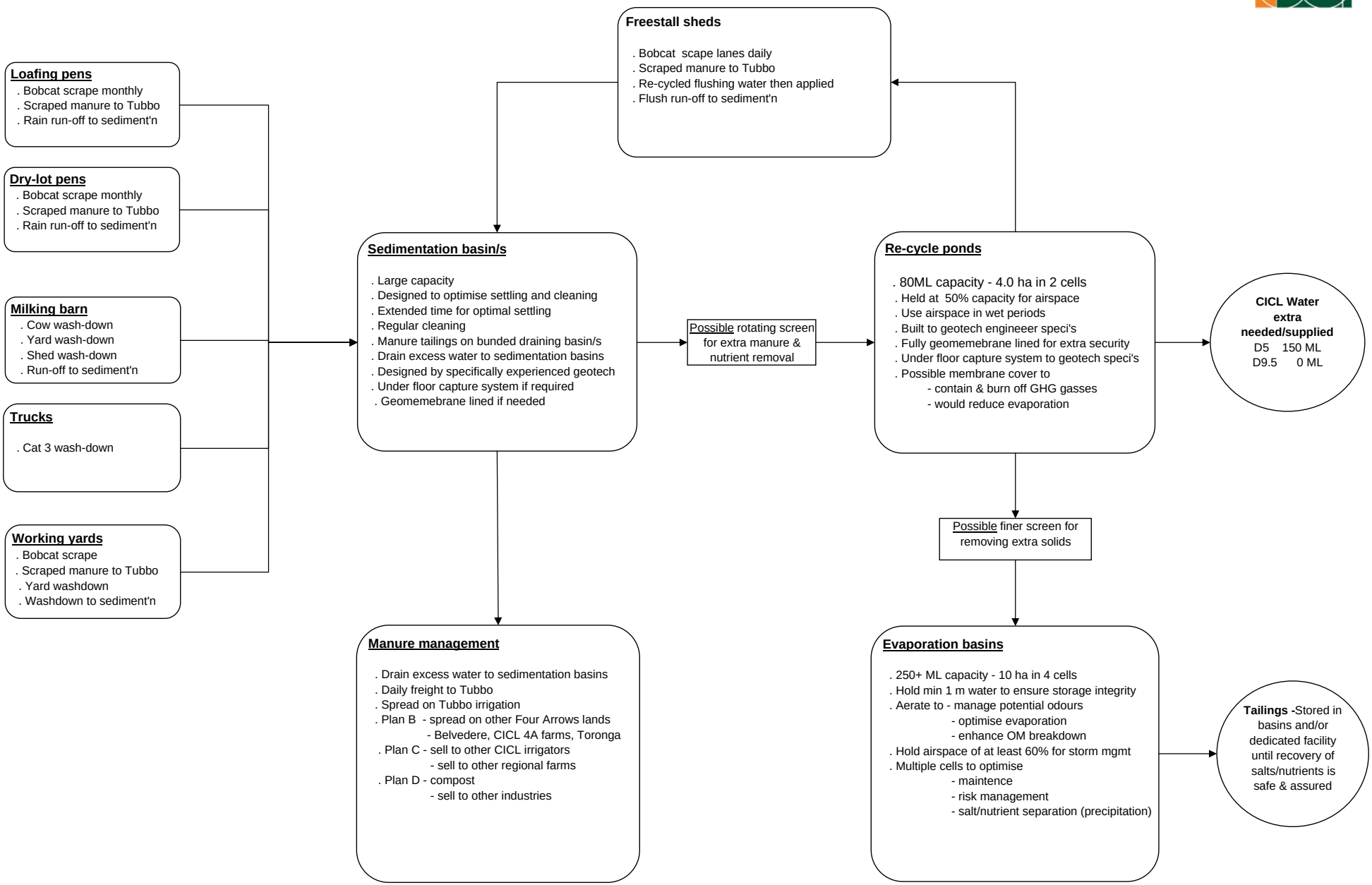
5.4.2 The System Components

Included over page is a flow chart depicting the revised flow of Category 3 waste water and manure under the revised waste water management plan. The components of the enhanced strategy are broadly described as follows with more detail being provided in subsequent sub-sections of this report. The starting point is the run-off from the project activities in the left hand and top sections of the flow chart:

- Run-off water is generated from the dry lot pens, the cattle working yards, milking barn truck and workshop wash-down, freestall sheds, loafing pens and any other Category 3 generated water within the containment area;
- Dry lot and loafing pens will be regularly scraped (no less than monthly) and manure removed to minimise transmission to the sedimentation basins;
- Flush lanes will be scraped daily with a bobcat before each flush event;
- All scraped manure (dry to semi-dry) and basin sediments will be removed daily to "Tubbo" for spreading on the irrigation;
- All drainage water from the above are directed to the sedimentation basins which allow extended time and minimal velocity rates for optimum solids settling;
- Manure management is the same as has been previously described. The manure is removed from the sedimentation basins on a daily basis, drained of excess water on a draining pad and then freighted to "Tubbo" for spreading on the irrigation. As an alternative plan the manure may be spread beyond "Tubbo" irrigation to other Four Arrow properties within the "Tubbo" aggregation;
- Drainage water from the sedimentation basins is pumped to the recycle ponds of at least 40ML each. These ponds are operated at no greater than 50% of capacity to provide a buffer storage for storm events;
- Subject to additional investigations it may be possible to remove additional solids and attached nutrients by operating a rotary drum screen between the sedimentation basins and the recycle ponds;
- Category 3 water is held for minimum time in the recycle ponds and directed back to the freestall sheds for use as flushing water. Category 3 water shall not be allowed to become anaerobic nor anoxic and this will be achieved by installing aerators;
- On a regular basis Category 3 water will be pumped from the recycle ponds to the evaporation basins to ensure the recycle ponds do not become saline. Subject to further investigation of scant data the pumped water could be put through a finer rotary screen to remove some additional solids;
- Water pumped and evaporated from the Category 3 recycle ponds will be replenished with fresh CICL channel water;
- The evaporation ponds will accumulate residual solids, salts and nutrients (tailings) for future removal, de-watering and best practice management; and
- The evaporation ponds need only be 200ML capacity over 10ha to manage both the evaporation needs and storm run-off. Additional bank height to contain say >250ML will provide further buffer capacity for exceptional storm events.

Each of the above components will be discussed in greater detail in the following sub-sections.

FOUR ARROWS ETHANOL PTY LTD : *Waste water management strategy for Category 3 water with evaporation basins*



5.4.3 Groundwater

CSIRO Griffith conducted a detailed study of groundwater levels and flows throughout the whole Coleambally Irrigation Area. The CSIRO findings were reported in their detailed report titled *Groundwater Dynamic in the Coleambally Irrigation Area (November 2000)* which was prepared for the Coleambally LWMP. The CSIRO report is the most recent and comprehensive report available. This report reviewed all relevant previous reports and is highly relevant at the date of this EA, and was summarised in detail within the original EA.

The following points of note are reaffirmed:

- Groundwater levels within and surrounding the Coleambally Irrigation Area (CIA) are declining in response to improving land management practices, a run of droughts since early 1990's and the benefit of the CIA LWMP;
- Groundwater flow around and within the project site is to the north and north-west. The main driving force is the hydraulic/piezometric head created and maintained by the predominance of substantial production bore irrigation properties to the immediate north and north-west of Coleambally;
- Not mentioned in the CSIRO report but a patent conclusion, is that the only potential localised variation to the main trends in groundwater flows between 2000 and 2007 and even the foreseeable future, could be the installation of a nearby and substantial production bore which could change the direction of localised flows in or around the project site. There is no evidence to indicate that a new production bore/s have been or are likely to be installed; and
- Groundwater levels around the project site are approximately 9m to 10m below NSL as documented by CICL for the CICL piezometers in and surrounding the project site and the project piezometer itself.

There is little evidence on the historical and current quality of groundwater within the project area. In December 2006 a piezometer was installed at the western side of the project site. A log of this piezometer is attached as Annexure 13.0 which depicts 8.0m of clay over sand with groundwater at 10m below NSL.

The piezometer on the project site was subsequently and substantially bailed to remove any trace of drilling materials and consequences of the installation process and a water sample then taken and sent for analysis. A copy of the NATA accredited laboratory results on the groundwater sample is attached as Annexure 8.0. The issues of note with respect to the groundwater analyses are:

- Sodium – at 350mg/L of sodium the level is high;
- Calcium – at 100mg/L of calcium the level is high with potential impacts on water hardness although the elevated Ca will reduce potential soil sodicity hazards if the groundwater were to be used for irrigation purposes;
- Total dissolved ions – at 2,000mg/L the water is of high salinity;
- Sodium adsorption ratio – at 6.8 the groundwater has an elevated but still satisfactory SAR; and
- Chlorides – at 710mg/L the chloride level is high.

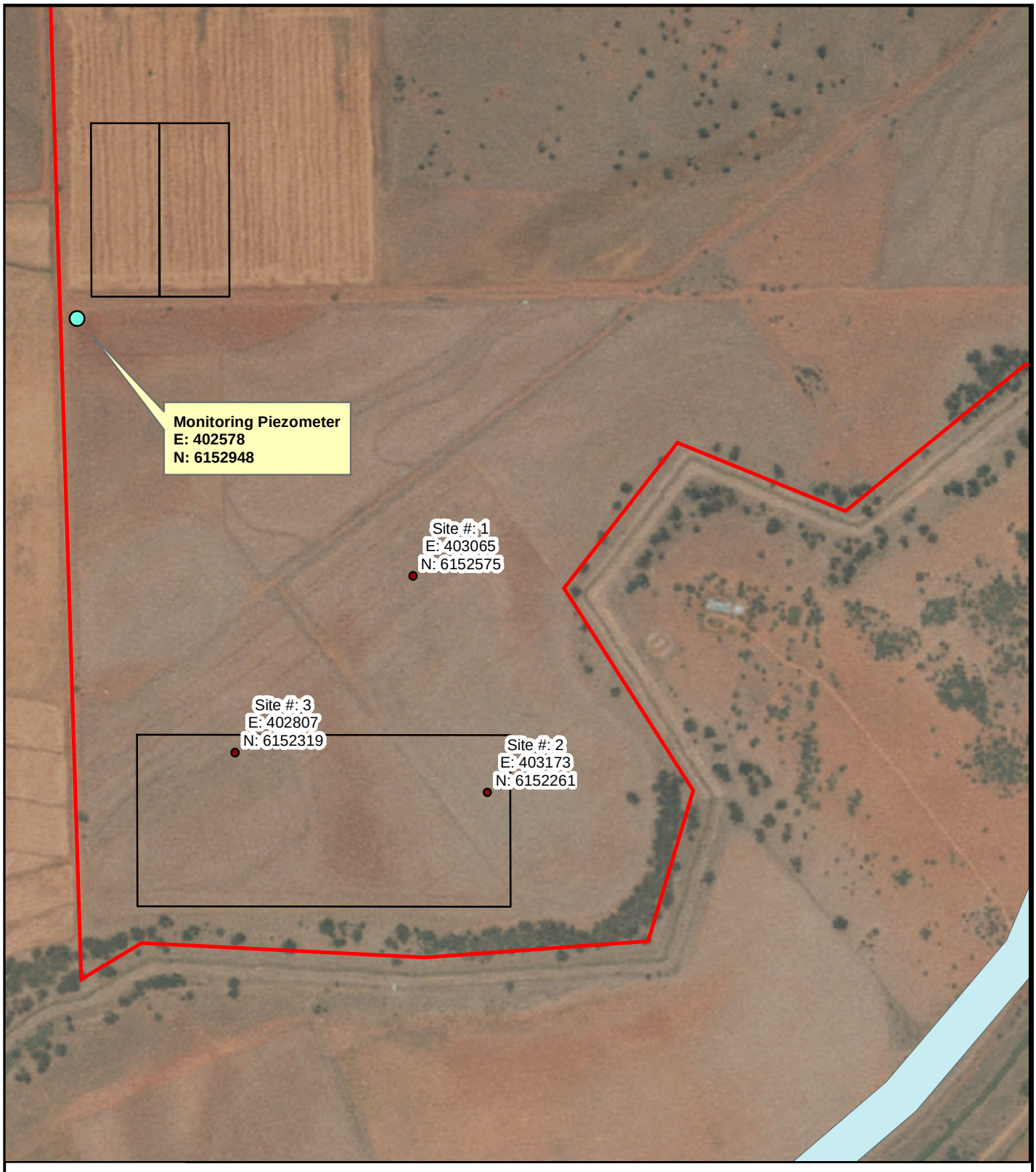
Overall the quality of the pre-existing groundwater at the site is of standard to give reason for significant concern if this water were to be used for general irrigation purposes.

The direct mixing of the waste water and groundwater would result in an admixed water of significantly lower salinity than the existing groundwater itself.

Monitoring Piezometer Location & Surface Soil Samples

Creation Date: 10/09/2007
File path :D:\Clients-Mappin\4Arrows\Coleambally/Response Document/WGB maps/PPR_piezo_100907
Created by : Christelle Borella, GIS Administrator, Booth Associates
Project : Four Arrows Ethanol Pty Ltd Ethanol Plant & Intensive Dairy Environmental Assessment

Booth Associates



5.4.4 Deeper Soil Profiles

Attached as Annexure 29.0 are the soil profile logs for a series of auger holes drilled to assess site suitability for the proposed evaporation basins and recycling ponds. Also recorded for each hole was the depth to groundwater below NSL for each hole drilled. The location of each hole was recorded by GPS and is depicted on the map inserted on the previous page.

The net outcome of the deeper soil profile assessments are summarised below:

- Clay and/or clay dominated soils to between 3.0m and 4.0+m with profiles closer to the central sandy rise evincing shallower clay layers;
- Sandy layers below the clay; and
- Groundwater at between 8.5m and 10.0m below NSL.

The project geotechnical experts have responded to a combination of the above investigations as well as the soils investigations by Wrigley-Dillon, the rice approval investigations supplied by CICL and the geotechnical laboratory analyses when preparing the concept plans for the Category 3 recycling ponds and the evaporation basins. These concept plans are discussed in Section 5.4.16.

5.4.5 Geotechnical Assessments

Attached hereto as Annexure 14.0 are the results of the laboratory analyses for geotechnical soil samples obtained from the LanePiper (NATA accredited) Laboratories in Melbourne.

The assessed soil permeability rates were determined by using elevated electrolyte levels in the test water to affirm that soil stability is able to be retained in the recycle pond and evaporation basin liners and embankments. The resultant permeability rates were between 65% and 85% less than the minimum standard of 1 x 10^{-9} meters/second required under current policies. In the fourth sample the permeability was 2.4 times the minimum required rate but the project geotechnical expert advises that the extent of suitable soils at the project site and the ability to further reduce permeability by the appropriate mixing of soils during construction will negate the perceived negative impacts indicated by the assessed higher rate in the fourth soil sample.

The outcomes of the geotechnical laboratory analyses may be summarised as follows:

- The concentration of the testing water of 700mg/L (approximately 1,200EC) assures the maintenance of a flocculated soil structure so that the magnitudes of soil permeability rates as tested are most likely to be the worst case scenario;
- The samples represent the soils at the respective sampling sites and this earthen/soils material can be appropriately employed for liner construction in the proposed water storages;
- As these soils also range in particle sizes in the clay, silt and sand fractions the resultant mix of materials will enable the problems normally encountered with cracking in heavy clay liners to be avoided;
- Rather than employ geo-synthetic liners as a matter of course, the geotechnical expert has recommended that the employment of *in situ* material will be appropriate for the construction of earthen liners at 600^{+}mm thickness; and
- If deemed appropriate after further detailed project design level investigations, the compacted earthen liner thickness could be increased and this will be preferable to employing a bentonite or geo-synthetic liner.

For the proposed Category 3 recycling ponds and evaporation basins the inclusion of a geo-synthetic liner and an under storage drainage capture system will be considered as an additional security to the compacted clay liner to provide agencies with the required feeling of security.

The geotechnical laboratory results affirm the original Wrigley-Dillon investigations which concluded that the soils on site are well suited for the then proposed larger Category 3 anaerobic/aerobic ponds and the newly proposed small Category 3 recycling water ponds.

The original soils investigations also affirm that there are sufficient soils of appropriate material to enable full construction of the proposed storages by employing on-site materials only. The spreadsheets provided as Annexure 10.0 and Annexure 11.0 affirm this conclusion. Therefore, there is no need to import materials for construction of the water storages and associated other earthen facilities.

5.4.6 Agricultural Soil Tests

5.4.6.1 "Tubbo" Irrigation

"Tubbo" irrigation is the proposed application area to receive the collected manure.

Annexure 15.0b contains a summary of typical agricultural soil analysis from a number of the irrigation blocks on "Tubbo" Station. The agricultural soils analyses were conducted by the Incitec Fertiliser laboratories which are NATA accredited.

The soils analyses results depict typical soils of the Riverina plains and particularly those soils to be found in the eastern sections. The following points are noted:

- Soil pH ($CaCl_2$) – these vary from a pH4.6 in the "Magna Clump" paddock to pH7.8 in sample 21. Typically the analyses are in the range of pH6.3 – pH7.0 at "Tubbo" which is as would be expected;
- Phosphorus – at levels varying between 5mm/mg and 25mg/kg, the total P is low to very low and typical of that expected throughout the Riverina. The area known as "Two Woods" has the highest level of P and would be considered acceptable with adequate application levels of P fertilisers. The remainder of the soils on the "Tubbo" irrigation would require significant applications of fertiliser P;
- Ca/Mg ratio – the ratios of 1.1 to 1.3 are low and the soils would benefit from applications of gypsum and/or lime; and
- Sodium (ESP) – varying between 2.0 and 7.5 of exchangeable sodium percent. These soil samples indicate ESP levels which are greater than optimum and the soils would benefit from applications of gypsum and/or lime.

The soil samples from "Tubbo" irrigation indicate that care would be required in the application of manure and adequate additions of gypsum and/or lime would be required to assist in the management of soil sodium levels. Notwithstanding the above, the soils are no different from that which would be expected throughout the Riverina and from past and current experiences are substantially better than those which would be found further west as the soils there become increasingly sodic in the western direction.

5.4.6.2 Project Site

No irrigation is planned for the project site itself whilst the stated policy on groundwater protection remains. However, the captured data is provided herein for general reference.

Attached as Annexure 15.0a is an agricultural soils analysis from samples collected in and around the area proposed for the recycle ponds and evaporation basins. The samples were collected under recommended soil sampling procedures and forwarded to the NATA accredited Incitec Fertiliser's laboratories for analysis. Comments on the analysis of the soil samples are as follows:

- Soil pH ($CaCl_2$) – varies from 4.3 to 5.6 and are in the sub-optimal to optimal range;
- Organic carbon – range from 1.1% to 1.3% which is low and soils would benefit from organic matter (manure) applications;
- Phosphorus – Colwell P ranges from 16 to 31mg/Kg which is generally low. The P buffer index of 120 to 130 is generally satisfactory;
- Potassium – varies between 0.78 to 1.3mg/100gm and is generally satisfactory;
- Calcium – range 4.8 to 12.0mg/100gm and is generally satisfactory;
- Magnesium – range 3.1 to 6.3mg/100gm and is generally satisfactory;
- Sodium – range 0.22 to 0.44mg/100gm and is generally satisfactory;
- Chloride – range 31 to 85mg/Kg and is generally satisfactory;
- Sodium ESP – range 1.1% to 3.5% and is generally satisfactory;
- Ca/Mg ratio – range 1.5 to 1.9 and is low. The soils would benefit from gypsum and/or lime application;
- Cation Exchange Capacity – range 9.65 to 20.1mg/100gm; and
- Textures – light to medium clays.

The above analyses indicate site suitability for irrigation of a diverse range of summer and winter crops and forages. Not untypically, the soils would benefit from application of gypsum and manure to enhance soil structure and increase soil organic matter.

5.4.7 Cattle Nutrition

The quality and quantity of waste products passed by the cattle and entering the sedimentation basins will be driven by the nutrition of the cattle. The as yet unpublished MLA report FLOT.328 highlights this issue and reflects the sound logic of a well considered mass balance analysis.

The project dairy cattle specialist was requested to provide details of the nitrogen, phosphorus, potassium, calcium, magnesium and sodium contents of the recommended diet presented in the original EA. He was then requested to provide an assessment of the cattle "sinks" for each of the above elements to enable a realistic mass balance to be generated of what was consumed by the cattle and then ultimately retained and/or exported as milk and/or body mass and/or excreted by the cattle.

When the initial mass balances were undertaken it was noted that the majority of the elements resulted in elemental concentrations within the manure at the relatively low end of the accepted scale found in beef cattle feedlot guidelines. The exception being potassium where it was found that the recommended ration was low in potassium, and that the incoming silage would need to be grown with elevated levels of potassium fertiliser to raise (K) levels in the diet to acceptable levels.

To gain a wider understanding of the mass balance implications; additional investigation were made at the School of Veterinary Sciences at the University of Melbourne, the NSW Agriculture specialists at Orange and the Meat and Livestock Corporation (MLA) offices in Sydney. Contacts with Dairy Australia could not provide any further information other than a reference back to Dr Ian Lean which was also affirmed by the NSW Agriculture specialist. The MLA staff provided a copy of a finalised report (FLOT.328) and authorised the appropriate quotation.

The independent mass balances and the more recently documented evidence of the impact of cattle nutrition on ultimate animal waste products firmly supported the project dairy specialist's approach of "what the animals are fed will determine what the components of the waste products will be".

The original ration presented in the original EA has been shown to be well balanced and will minimise both the concentration and total quantums of adverse elements within the waste products generated by the cattle.

We refer readers to SOC commitment 287.

5.4.8 Manure Interceptions

Most of the excreta generated by the cattle in the freestalls are deposited in the flush lanes. It is intended to scrape the flush lanes with a rubberized blade on the front of skid-steer equipment prior to each flush event. The scraping will take place while the cows are being milked. The scraped manure will be stacked to the side for loading on a truck and daily delivery to "Tubbo" irrigation. Approximately 85% of the freestall manure will be removed in this process and before it even enters the waste water system. The manure captured reducing this method results in +45% of the total mass of manure produced on the project site.

By scraping the loafing and drylot pens on a monthly basis, the well documented evidence is that 60% of the manure deposited in these areas will be removed before it enters the waste water system. Therefore, a further +25% of the total project excreta will be removed to "Tubbo" irrigation before it enters the waste water system.

We refer readers to SOC commitment 295.

Approximately +30% of the excreta deposited in the loafing and drylot pens will be lost as dust and biological degradation. This equates to +10% of the total project excreta.

Of the remaining excreta reaching the sedimentation basins, 60% (+15% of the excreted total) may be expected to be settled, retrieved and removed to "Tubbo".

Therefore a total of only 1,500t to 1,600t of manure or 5% ex 30,750t in total excreted by the cattle is calculated to enter the recycle ponds. A possible but not necessarily probable option to further reduce the 1,500+t entering the recycle system is to pass the output from the sedimentation basins through a rotating drum screen before the waste water enters the recycle ponds. The available data is scant on the efficacy of this strategy and hence it has not been included in the calculations.

In summary, with appropriate attention to planning and reinforcing with best management practice, it is expected that over 90% and even over 95% of all excreta may be intercepted before it enters the waste water recycling ponds. Furthermore, with possible (not necessarily probable) screening of the waste water directed to the evaporation basins, further and significant interception and removal to "Tubbo" could be achieved. The mass balances will be addressed in other sub-sections.

5.4.9 Sedimentation System

In 2006 Dairy Australia commissioned a full review of dairy waste management systems and the development of best practice guidelines for dairy waste management. The project geotechnical and environmental engineer was the person engaged to undertake the work. In his investigations he found substantial differences between the types, design and operation of a range of sedimentation systems and their relative performance. At best the sedimentation systems could intercept 70% of the manure solids being generated from best practice freestall sheds and associated dry lot areas. System performances as low as 40% sedimentation were also found.

From the 2006 Dairy Australia research 55% settlement of solids in a well managed sedimentation basin is budgetable and 60% is realistically achievable. Any project with sedimentation estimates above 60% is only budgetable upon proven performance.

Of particular note is that the project geotechnical engineers claim it is not necessary for sedimentation basins to be concrete lined as basin integrity is maintained and even enhanced when:

- They are cleaned with a long reach excavator regularly; and
- An appropriate lining of manure is left in the bottom of the basins.

The preferred option is to concrete line the basins the basins so that the project skid-steer equipment to be used in at least the freestall sheds may be used for cleaning and loading of trucks.

5.4.10 Manure Management

The suitability of the soils at "Tubbo" irrigation for receiving the manure has already been determined and discussed in sub-section 5.4.6.1. The area of available land at "Tubbo" irrigation is 2,500ha and is further supported by the availability of some 4,000ha to 5,000ha of additional irrigation lands owned by the Four Arrows Group and operated in conjunction with "Tubbo".

Manure carted to "Tubbo" will be spread on the irrigation at sustainable rates (10t/ha/year) which is within agreed policy guidelines. The soil organic matter, salts and nutrient status shall be monitored regularly through a system of scientific sampling procedures and sample analyses at a NATA accredited laboratory. The monitoring program will form part of the documented project EMS.

From time to time it will be necessary to sequentially drain the Category 3 water ponds and remove the accumulation of settled material on the bottom of the ponds. In doing so care will be required to ensure the integrity and operational performance of those ponds is not compromised.

The back-up options for manure disposal are:

- Spreading on other Four Arrows' Group lands beyond the EA nominated 2,500ha and within the "Tubbo" aggregation viz:
  - "Belvedere" irrigation – (1,000ha);

- Coleambally Irrigation Area farms owned by the Four Arrows Group and which are integrated with "Tubbo" operations – (5,000ha);

- Spreading on the Four Arrows Irrigation at "Tooronga" Hay – (3,000+ha);
- Sell surplus manure to other CICL irrigators and to other regional farms especially in the Murrumbidgee Irrigation Area; and
- Compost the manure and sell to other industries regionally and beyond. This is a lesser preferred option because history has demonstrated such strategies do not service an assured market into which the product can be reliably sold.

Every effort will be made to adhere to the plan for sustainable disposal on "Tubbo". The strategy will be subjected to an on-going monitoring and review as part of the documented project EMS.

We refer readers to SOC commitment 296.

5.4.11 Category 3 Recycling Ponds

The purpose of the recycling ponds is to receive and store the outflow from the sedimentation basins, to provide a facultative condition for partial breakdown of organic matter, and to provide an acceptable water source for flushing the freestall sheds. An additional capability will be to provide airspace for managing storm event run-off from the containment area.

The location of the recycle ponds and drill log sites are depicted on the map inserted over page. The ponds will be constructed in accordance with the concept plans provided by LanePiper (refer Section 5.4.15). The concept plans reflect the following:

- A full response to the DWE stated policy of preventing accession to groundwater by using fully engineered basins, facility liners and an under storage leakage capture system;
- In two cells of 40+ML capacity each to facilitate maintenance and spread risk;
- A concept design response to soil and situation specific profile logs to at least the current groundwater level. A copy of each drill log is attached as Annexure 29.0; and
- The need to performance monitor for potential leakage and to ensure the under storage capture system is able to be maintained in optimal condition.

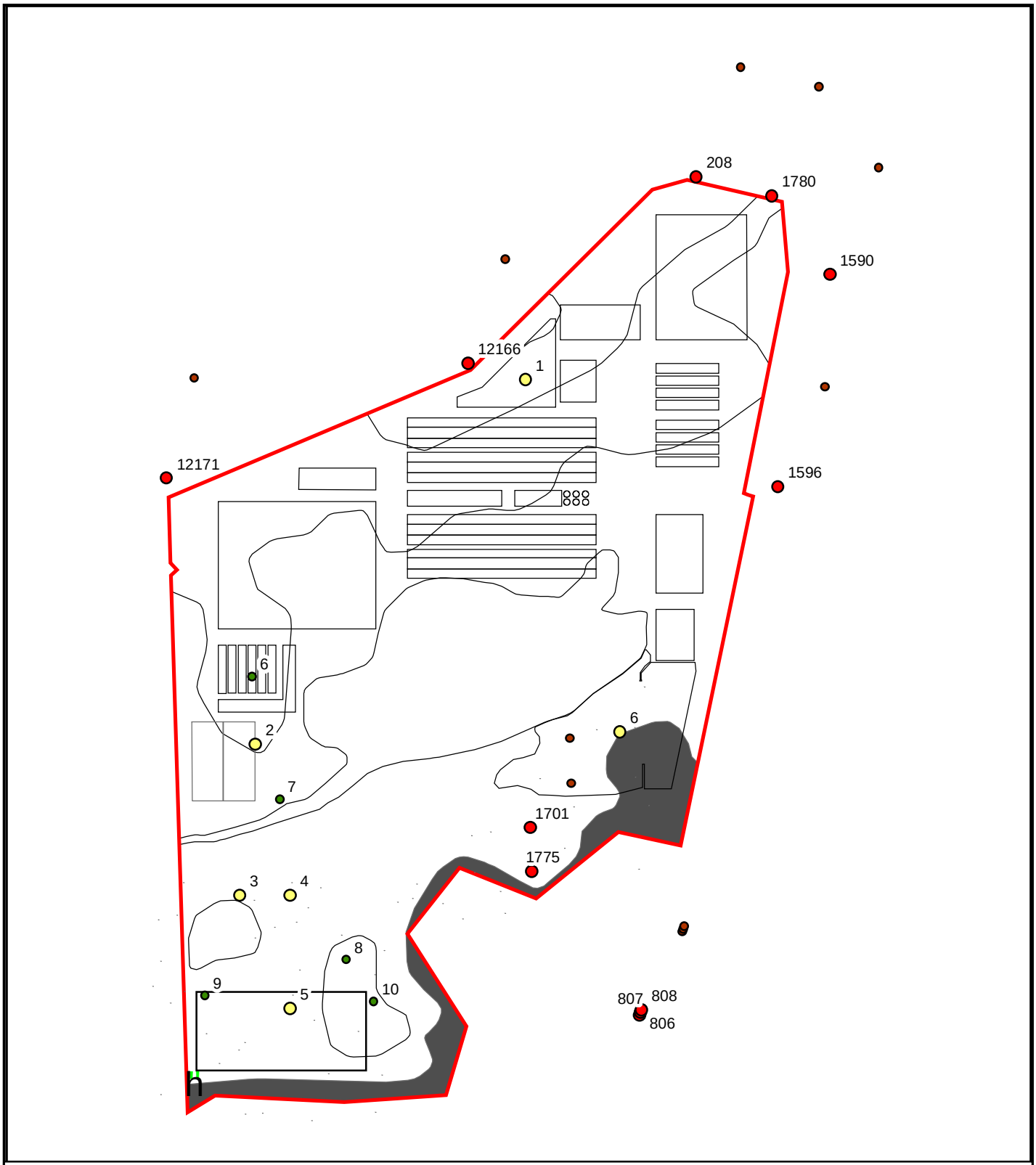
Operational criteria for the Category 3 recycle ponds shall be as follows:

- Sizing has been determined by the water balance models included in Annexure 22.0a and Annexure 22.0b;
- Normal operating capacity will be at 40ML for provision of a 40ML to 50ML air space for storm event capture;
- Inclusion of an aeration system to prevent anaerobic and/or anoxic conditions developing and to accelerate organic matter breakdown;
- To retain low salinity levels by pumping approximately 100ML to 125ML per year to the evaporation basins; and
- To receive approximately 125ML to 150ML per year of fresh water from the CICL channels to cover evaporation losses, and that water pumped to the evaporation basins.

Piezometer and Groundwater Test Bore Sites for Category 3 Waste Water

Creation Date: 29/08/2007
File path : T:\4Arrows\PPR_test_bores_290807
Created by : Christelle Borella, GIS Administrator, Booth Associates
Project : Four Arrows Ethanol Pty Ltd Ethanol Plant & Intensive Dairy Environmental Assessment Preferred Project Report

Booth Associates



Proposed Site V2
CICL Piezometers
Sand
bore 230707
Groundwater Test Bores 050706
Evaporation Bassins 300807
Skeleton of Proposed Infrastructure
f25adrillpoints.dxf MultiPatch
Recycled Ponds 300807

Kilometers
0 0.25 0.5 1 1.5 2

É

Of particular note in the revised water models is the use of decile rainfall and evaporation supplied by CSIRO Griffith for the still relevant data generated at the Griffith research laboratories and field station. The primary reason for the change in data is that the specialised Kc values for evaporation basins will match the researched values at Griffith. The other supporting reasons include:

- The decile 9.5 rainfall year at Griffith equates to 1,015mm/year which is above the highest ever recorded annual rainfall at Coleambally of 700mm approximately;
- The decile 5.0 rainfall year at Griffith is less than the average at Coleambally but is not an issue given the need the design for the extreme wet year; and
- The matching decile 5.0 and 9.5 reference evaporation (ETo) data is conservative whilst allowing the water models to align with CSIRO derived Kc values.

Maintenance of the recycle ponds will be enhanced by constructing parallel long and narrow ponds. This will enable cleaning of sludge with a long reach excavator guided by laser equipment to minimise the risk of compromising liner integrity. A future option may be removal of tailings with a sludge pump to de-watering geo-tubes on a bunded concrete base.

With managed cattle nutrition and removal of over 90% of solids prior to the sedimentation basins the removed tailings/sludge will be of quality suitable for spreading on irrigation lands outside the CIA at low rates of application. Microbial activity and general bio-solids chemistry will further breakdown organic matter within the solids and consume nutrients (especially nitrogen) in the operation of the recycle ponds.

5.4.12 Evaporation Basins

The evaporation basins have been incorporated into the project to manage surplus water and residual solids, salts and nutrients. The evaporation basins also act as a buffer storage for the capture, containment and eventual evaporation of storm water containing Category 3 water.

Whilst strictly and correctly titled evaporation basins, the proposed basins for the integrated ethanol and dairy project have unique operational characteristics which distinguish them from “normal” evaporation basins. In a simple sense, the so-called distinction is described as follows:

- For “normal” evaporation basins:
  - Take salty water and deliver it to an evaporation basin/s;
  - Evaporate the water to concentrate and then harvest the salts; and
- For the proposed project:
  - Every effort has been made to initially and substantially reduce the mass of salt, solids and nutrients entering the Category 3 waste water system;
  - Once in the waste water stream, every effort has been made to optimise the removal and sustainable disposal of salts, solids and nutrients;
  - By effectively renewing the recycle pond water annually there should be a steady state and relatively low level of salts, solids and nutrients therein;
  - Thus the quality of Category 3 waste water entering the evaporation basins is relatively low in salts, solids and nutrients; and
  - There is the potential to further enhance Category 3 water quality by screening as was suggested in sub-section 5.3.3 and depicted in the flow chart found in Section 5.4.2.

The net result is that the quality of the tailings or sludge in the evaporation basins should have a responsible and sustainable value when managed correctly.

It is therefore not being argued that the tailings in this situation must receive favoured consideration, but more that such an option warrants future re-assessment. Therefore, care is needed in not eliminating some future options.

The proposed location of the evaporation basins and the actual location of the investigative soil drilling logs are depicted on the map in Section 5.4.11. It is intended to construct four long and narrow ponds in accordance with the concept plans provided by LanePiper (refer Section 5.4.15).

The concept plans reflect the following:

- A full response to the DWE stated policy of preventing accessions to groundwater by using fully engineered basins, facility liners and an under storage leakage capture system;
- A concept design response to situation specific soil profile logs down to at least the current groundwater level. A copy of each drill log is attached as Annexure 29.0;
- In four cells to facilitate maintenance, spread risk and to separate water of differing concentrations so that salt and nutrient segregation may be achieved via differing precipitation criteria; and
- The need to performance monitor for potential leakage problems and to ensure the under storage capture system is able to be maintained in optimal condition.

The water balances in Annexure 22.0 Indicates that the maximum required capacity is 200ML with a surface area of 10ha. From a practical perspective the wall height could be increased by 0.75m to enable a total capacity of approximately 275ML for further risk management if needed.

Unpublished data on planning for evaporation basins has been provided by the project geotechnical engineer. The initial sizing of basins is determined by the formula $Ha = Q_T \div E_N \times K$ where:

- Ha is the required surface area;
- Q_T is the annual volume to be evaporated in ML;
- E_N is the annual net evaporation in mm; and
- K is the unit conversion factor equal to 100.

When the above formula is applied to the project evaporation basins and assuming the average input is 120ML (high) and the net evaporation is 1,500mm (low) the desired basin size calculates at 8ha. Therefore, the modelled 200ML over 10ha is considered conservative and the suggested 250+ML is sound.

Operational criteria for the evaporation basins shall be as follows:

- Sizing of the basins has been determined by the water balance models included in Annexure 22.0. Normal operating capacity will be 100ML to protect the liners and to make provision for a 150ML to 175ML air space for storm event management;
- Inclusion of an aeration system to prevent anaerobic and/or anoxic conditions developing and to facilitate further organic matter breakdown; and
- The aeration system shall further increase the rate of evaporation.

As discussed in sub-section 5.4.11 the climatic data for the revised water models has been altered to align Kc values for evaporation basins with CSIRO Griffith prior research. The net affect has been to marginally reduce the calculated area and capacity of the evaporation basins. To introduce a practical margin for operational safety in extreme wet years, the capacity of the basins could be increased by:

- Increasing the wall height (each 0.10m wall increase equals an extra 10ML capacity); and
- Reducing the normal freeboard of 1.0m to 0.5m which would increase short term capacity by 50ML to facilitate extreme storm event management.

Maintenance of the evaporation basins will be enhanced by their long and narrow configuration and the use of a long reach excavator. That excavator would have accurate laser guidance of the bucket to minimise the risk of compromising liner integrity. A future option may be the removal of tailings with a sludge pump to de-watering geotubes on a bunded concrete base.

With the proposed:

- careful management of cattle nutrition;
- removal of over 90% of solids with associated salts and nutrients prior to the sedimentation basins; and
- the possible addition of prudent screening processes.

the removal tailings/sludge should be of a quality suitable for very light spreading on acceptable irrigation lands outside the CIA. Such practices would only be employed with future approvals against specific proposals. Microbial activity will also enhance organic matter breakdown and consume nutrients (especially nitrogen) in the operation of the evaporation basins.

Sludge tailings removal will be infrequent 4 – 10 years) because of the planned upstream strategies for the removal of solids, salts and nutrients. If need be a new basin could be added and an existing basin decommissioned as a basin *per se* and then be converted to a lined and engineered facility for the storage of tailings.

Every effort will be made to seek sustainable solutions to the re-use with and/or without the extraction of non-beneficial components.

We refer readers to SOC commitment 297.

5.4.13 Water Mass Balances

5.4.13.1 Meteorological Data

Attached as Annexure 22.0 are revised water mass balances for a decile 5 (D5) and decile 9.5 (D9.5) year. A D5 year is the statistical median year when there are an equal number of years when rainfall and evaporation are higher and lesser than the stated amounts. A D9.5 year is that year when 5% of total annual rainfalls are higher than the stated rainfall amount and 5% of the total annual evaporation is lower or alternatively a “very high rainfall year” set against very low evaporation. The statistical data has been provided by CSIRO Griffith for the data generated at the CSIRO laboratories on the outskirts of Griffith (Annexure 22.0c).

The change from the meteorological data presented in the EA as displayed has been made for the following reasons:

- CSIRO Griffith research reports into evaporation basins developed Kc values against Griffith generated reference crop evapotranspiration (ETo) data;
- Kc values for evaporation basins are not always consistent across the literature and hence the use of regional research is appropriate;
- The D9.5 rainfalls for Griffith are very close to the decile extreme (DX) totals used in the EA but the ETo values are higher and it could be said that the net outcome is less representative;
- The D5 rainfalls are lower and the ETo values higher and again it could be said that the net outcome are les representative; and
- When both values were run in their original models the net outcomes were within ±5% of the original estimates.

Given the intricacies of estimating and defending Kc values for evaporation panels the decision was made to utilise local research data and to then add a practical 10+% increase in the deemed capacity of both the re-cycle ponds and evaporation basins. This simple approach covers the worst case scenarios.

5.4.13.2 Mass Balances

The original format as presented in the original EA has been modified as follows:

- The water demand sheet and the two water run-off sheets remain essentially unchanged. The only changes made are corrections of small syntax issues. The net impact of these corrections has been to refine the overall water balances;
- The consolidated water budget sheet has been expanded from a one page summary to two pages of summary viz:
  - Page 1 – limited to meteorological data and the water balances in the Category 1 and Category 2 water storages; and
  - Page 2 – water balances in the new Category 3 water recycle ponds and the evaporation basins.

The water balances for the Category 1 and Category 2 storages are essentially the same as in the original EA.

Within the two Category 3 water recycle ponds, the water is assumed to be pumped into these ponds on an aggregated basis with water being directed on an operational basis to one or both ponds at any point in time. The operating decisions will be driven by the need to keep each of these ponds somewhere near 50% of their total capacity to ensure air space is available to manage storm events. These ponds will also be aerated on an “as needed” basis to effectively manage the oxygen and potential odour status of the water and to promote organic matter breakdown.

A total of 150ML of additional CICL channel water will be required to replenish the evaporation losses which occur during the operation of the uncovered ponds and in the flushing of the freestall flush lanes and also the 120ML to 130ML per year diverted to the evaporation basins. Additional water will be received from wash down of the cows pre-milking, washing of the milking barn and cattle working yards as well as any run-off water from the loafing yards and dry lot pens

Approximately 80ML to 100ML of water will be retained in the evaporation basins to protect the geo-membrane liner and ensure sufficient airspace for storm events. The basin will also be aerated to prevent anaerobic and anoxic conditions developing, promote organic matter breakdown and enhance evaporative losses.

The outcomes of the water mass balances will then be used to assess the sources and sinks, issues and perspectives arising through the nutrient and salt mass balances in the following sub-section.

5.4.14 Nutrient and Salt Mass Balances

Attached as Annexure 23.0 is a detailed analysis of the mass balances of the key nutrients and salts. Individual mass balances are provided for the following elements:

- Nitrogen;
- Phosphorus;
- Potassium;
- Calcium;
- Magnesium; and
- Sodium.

Each element is subjected to five separate analyses as follows:

- The mass balance for the proposed total project of ethanol plant, dairy and heifer enterprises;
- The mass balance for what is a typical farming system based upon a standardised rice rotation. With an assumed 75% averaged annual allocation as indicated in the *Murrumbidgee Regulated Stream Water Sharing Plan* a total of 1,077ML would be available to the "farm" given an assumed 4ML allocated per benefited hectare across the site. With the above crop rotation a total of almost 170ha of crop could be grown in 4 x 42ha lots, producing some 900 tonnes of grain per year;
- A comparison of the incremental changes in the total loading of the proposed project compared to the current averaged loading;
- The mass balance for the combined dairy and heifer raising enterprise only (ie Category 3 section of the project); and
- Distributions of the manure and each assessed element within the overall project.

All the nutrition information for the cattle was provided by the project dairy specialist. He developed the cattle rations for the original EA and from his computer model was able to generate accurate data as to the fate of each of the assessed elements into and through the cattle. The analysis data for the water being delivered through CICL system was provided by Mr G Schultz Department of Natural Resources – samples obtained at the Gogeldrie Weir (Station 410082).

Further supporting information was provided by the Bread Research Institute (*pers comm*), the *Australian Soils Fertility Manual and Meat and Livestock Australia (MLA)* in providing their recently completed project FLOT.328.

The project environmental engineer has provided the information on the relative performance of sedimentation basins which have been further supported by data provided through MLA FLOT.328.

Annexure 23.0 is a summary of the salt and nutrient mass balances for each of the assessed elements. From an agricultural perspective N, P, K, Ca and even Mg and Na are nutrients in the correct combination and total amounts. For the purposes of this review and simplicity, Na and Mg will be considered salts and the remainder as nutrients required for optimal agricultural production.

From the attached mass balances the following observations are made about the fate of the above elements in the evaporation basins:

- Nutrients:
  - Nitrogen: 9.1t/year enters the basins. Largely consumed by microbes and eventually lost to the atmosphere;
  - Phosphorus: 2.0t/year enters the basins and most will be absorbed/adsorbed in the tailings;
  - Potassium: 6.1t/yr enters the basins and will be largely in solution;
  - Calcium: 17.5t/year enters the basins and will be in a mix of soluble and bound forms;
  - Total: 34.8t/year contained in the basins and be unavailable for productive use.
- Salts:
  - Magnesium: 14.3t enters the basins;
  - Sodium: 8.2t;
  - Total 22.5t/year not entering the environment.

There will also be other beneficial, non beneficial and even adverse elements entering the ponds each year but these are not able to be realistically quantified.

5.4.15 Concept Design of Category 3 Storages

LanePiper of Melbourne was engaged to prepare site and situation specific concept plans for the proposed recycling ponds and evaporation basins. LanePiper was chosen because of their longstanding specialist geotechnical, hydrogeological and environmental skills which encompasses detailed investigations into waste water management including the design, construction and performance monitoring of storage ponds and evaporation basins. LanePiper also have a history of working with the project geotechnical engineer and the firm had undertaken the project geotechnical soil testing in their NATA accredited laboratory.

LanePiper were provided with copies of the drilling logs supplied to the proponent's EA team by:

- CICL – all rice drill logs and associated EM31 SURVEY MAPS;
- L Angove – deep drill logs to 10m or thereabouts and the piezometer drill log; and
- Wrigley-Dillon – soil profiles and project soil report.

LanePiper had direct access to R Wrigley before and during the concept design process as well as their records of the project geotechnical laboratory analyses.

Inserted over page are the graphical representations of the drilling logs under both the proposed recycle ponds and the evaporation basins. These and other surrounding rice logs were provided to LanePiper and the Wrigley-Dillon report from the EA as displayed, along with the direct comments of the project geotechnical engineer provided the technical basis for preparing the concept design.

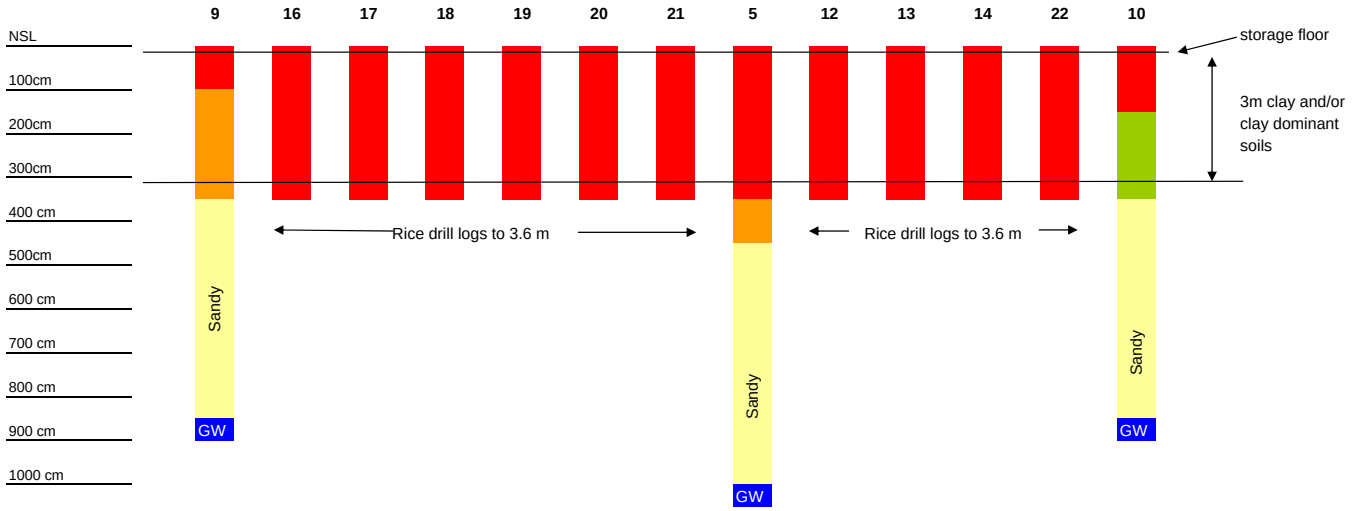
Based on the above data LanePiper prepared the concept designs and these are inserted on two separate pages inserted overleaf and behind the graphical representations.

The concept designs are self-explanatory, are thus site and situation specific to the Four Arrows' project and are reinforced by the experience of LanePiper in already having designed, supervised construction for and then performance monitored fully engineered waste water storage ponds and evaporation basins in arguably equally and/or more sensitive sites.

Detailed design may then be undertaken before undertaking any construction and any subsequent testing usage and then commissioning.

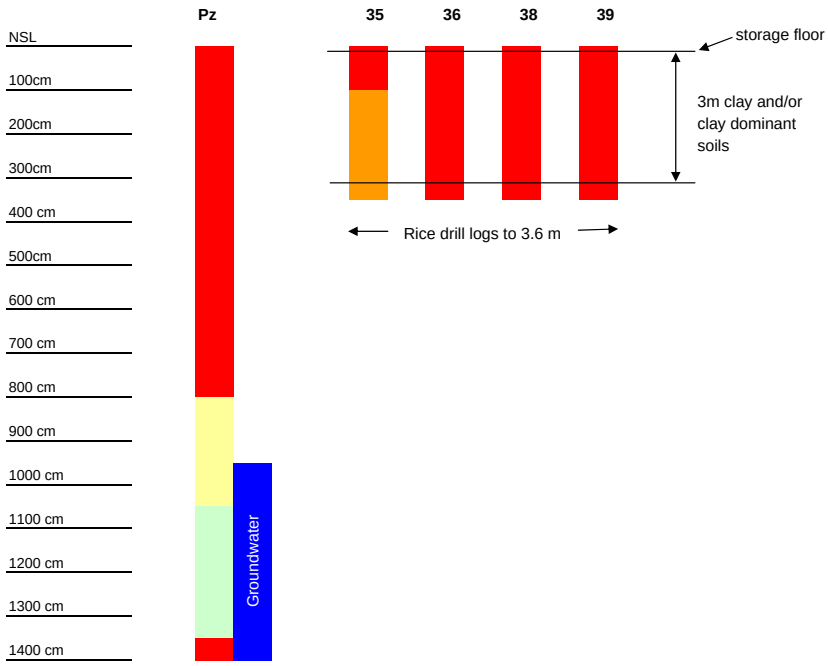
EVAPORATION BASINS

Reference number of each logged rice drill hole supplied by CICL and three (3) deep drill holes to groundwater



RE-CYCLE PONDS

Reference number of each logged rice drill hole supplied by CICL and nearby project piezometer



Notes : Each rice drill hole is automatically stopped at 3.6m below NSL

: Original data provided to team geotechnical specialist and Lane Piper

: Basis of the drafting of concept plans prepared by Lane Piper

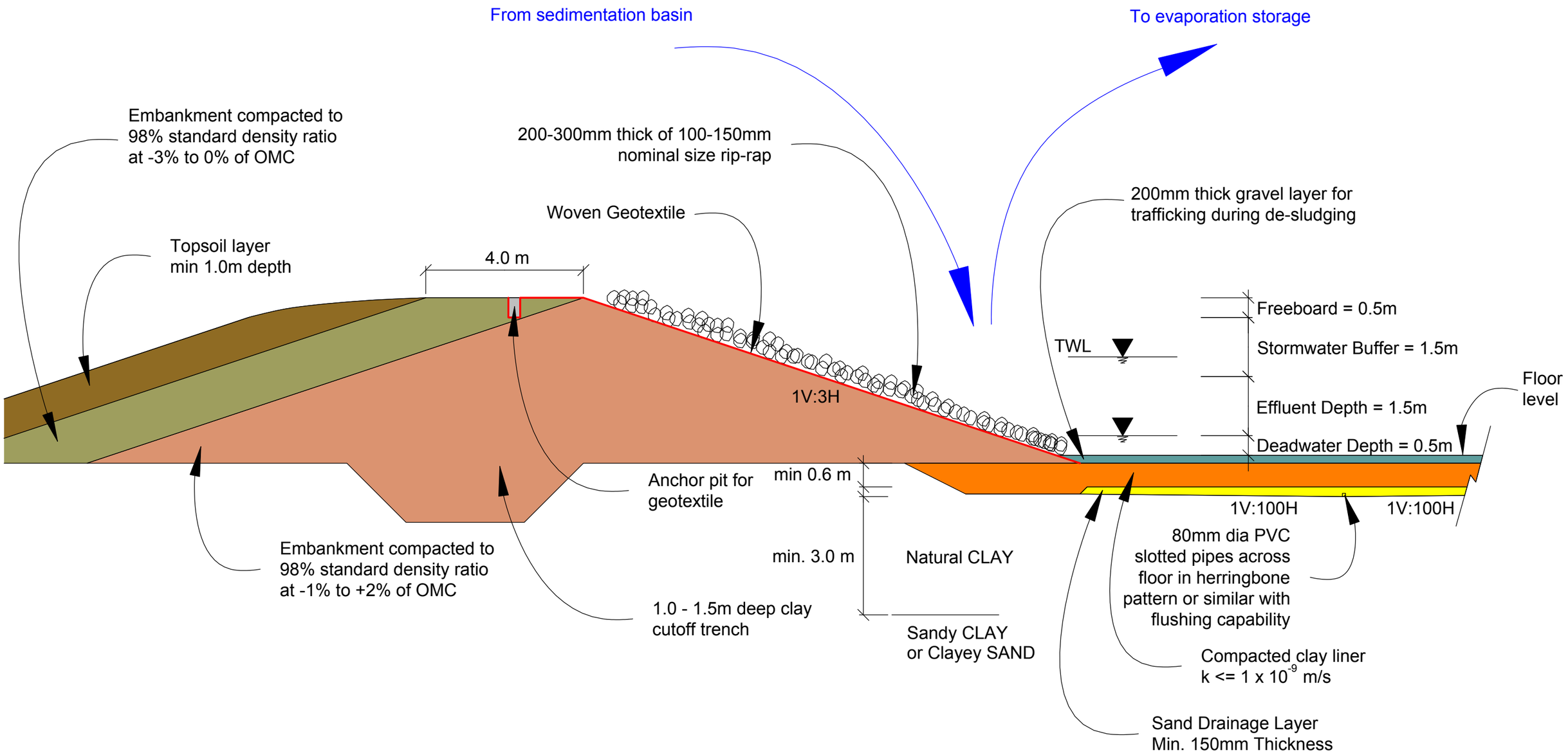
: The final design will be driven by further detailed "in field" and laboratory investigations at the detailed design phase for the project

:

Key

- Clays
- Clay with fine sand or trace fine sand
- sandy
- gravelly
- groundwater

Minimum combined storage area of
4 ha. with an effluent depth of 2.0m.
Total minimum effluent storage
capacity of 80ML

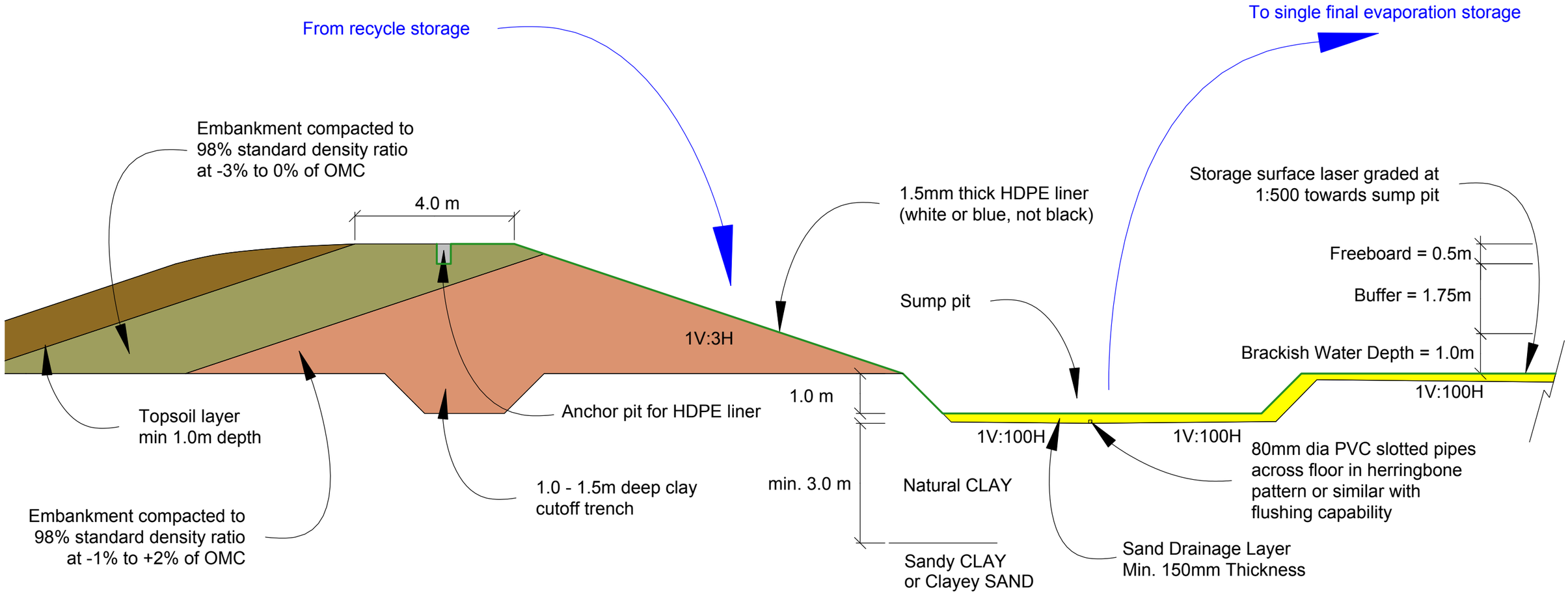


RECYCLE STORAGES

FOR COMMENT

PROJECT GI WASTEWATER TREATMENT PLANT COLEAMBALLY, NSW	LanePiper **LANE PIPER PTY LTD** A.C.N. 120 109 935 Geotechnical and Environmental Engineers Hydrogeologists and Environmental Scientists BLDG 2, 154 HIGHBURY RD, BURWOOD, VICTORIA, 3125 TELEPHONE (03) 9888 0100 FAX (03) 9808 3511	TITLE CONCEPT DRAWINGS	SCALE (A3) 1:100 DRAWN DBS	DATE 27 AUG 2007 JOB NO. 207252
		REF: 207252-Concept Drawings.tcw		REV. NO. 1 FIG. NO. 1

Minimum combined storage area of
10 ha. with brackish water depth of 1.0m
and buffer depth of 1.75m.
Total minimum storage capacity of 250ML



EVAPORATION STORAGES

FOR COMMENT

PROJECT GI WASTEWATER TREATMENT PLANT COLEAMBALLY, NSW	LANE PIPER PTY LTD A.C.N. 120 109 935 Geotechnical and Environmental Engineers Hydrogeologists and Environmental Scientists BLDG 2, 154 HIGHBURY RD, BURWOOD, VICTORIA, 3125 TELEPHONE (03) 9888 0100 FAX (03) 9808 3511	TITLE CONCEPT DRAWINGS	SCALE (A3) 1:100 DRAWN DBS	DATE 27 AUG 2007 JOB NO. 207252
		REF: 207252-Concept Drawings.tcw		REV. NO. 1 FIG. NO. 2

5.4.16 Evaporation Basin Serviceability

Assuming other cation and anions are 1.5 times the above total in Section 5.4.14 then the annual imports of all salts and nutrients to the evaporation basins would be 35 + 23 ≈ 60t x (1.0 + 1.5) = 150t/year. Add to this the 315t/year of solids the total imports would be of the order of 450 t to 500t/year say 500t.

Given that a significant proportion of the nitrogen (say 70%) will be lost by volatilisation and the loss of around 70% of organic matter by similar processes, the net annual accumulation of the known elements is calculated in Table 7.0.

Table 7.0: Tonnes of Salts, Nutrients and Residual Manure Entering and Ultimately Retained in the Evaporation Basins

	Entering Basins from Cat 3 Recycle Pond/s	Remaining after Losses in Basins	Annual Accumulation in Basins for Removal
Nutrients:			
Nitrogen	9.1	30%	2.7
Phosphorus	2.0	100%	3.0
Potassium	6.1	100%	7.1
Calcium	17.5	100%	18.5
	34.8		31.4
Salts:			
Magnesium	14.3	100%	15.3
Sodium	8.2	100%	9.2
	57.3		24.4
Add provision for remainder TDS @ 2.50 multiplier			139.7
Biosolids:			
Organic Matter	313.5	30%	94.1
Ca/Mg	1.23		
SAR	0.35		

From the above table the annual net accumulation is of the order of 250t/year which, after 10 years post commissioning some 2,500t of tailings will need to be managed.

At a bulk density of 1t/m^3 the volume utilised by the tailings would be 2,500m^3 or 25ML of apparent waste water space. Given a void space of 33% the actual volume of water displaced would be between 15ML and 20ML.

With an extra 0.5m on the embankments, this “lost” volume would be managed *in situ.*

At the end of 10 years post commissioning, many options to manage the tailings are potentially available, viz:

- Clean the basins and seek a beneficial use, for example road base has been one reported usage;
- Clean the basins and seek approval for a sustainable land application within agriculture (outside of the CIA);
- Clean the basins and extract worthy elements for a beneficial use and stockpile the remainder; and
- Decommission one evaporation basin and replace it with a new approved basin. The decommissioned basin could then be used as a receptacle for all tailings which, without any above bank space being utilised, could contain the equivalent of 70ML or 7,000t of tailings. The effective stored capacity would be 10,000t or 40 years of input.

We refer readers to SOC commitment 298.

Waste management technology is rapidly developing and the problems will be sustainably solved within the foreseeable timeframes. Progress with urban sewage management is already driving the solutions.

6.0 AMENDED STATEMENT OF COMMITMENTS

The amended Statement of Commitments below follows on from those included within the original EA submission. The purpose remains the same as stated within the original document being:

"A Statement of Commitments has been included as part of this EA as per requirements of Part 3A of the EP & A Act 1997 [Division 2, 75F (6)]. The following sections detail the proponent's intent to address those issues identified throughout the development of this Environmental Assessment (EA) including those proposed by relevant agencies and stakeholders. The process has been comprehensive to ensure that all potential issues have been identified and addressed however not restricted to those included within the Director General's (DG) specifications.

Upon approval the proponent will commission the formulation of an Environmental Management Plan (EMP) that will include a Construction Environmental Management Plan (CEMP) and an Operational Environmental Management Plan (OEMP), to achieve a state of maintained and/or improved environmental integrity initiated by the EA process. The detailed commitments described within the following sections will form the basis of these plans."

The EA commitments had been tabulated however the following are presented in a varied format appointing a specific category to each being either:

- *Reaffirmed* meaning that they are existing commitments, the details of which have been readdressed within this document.
- *Expanded* meaning this is an additional guarantee that has been made to bolster an existing commitment.
- *Inclusion* meaning an additional commitment that will be eventually integrated into one or a number of intended environmental management plans specifically developed for the enterprise mix.
- *Amended* meaning variations to the original commitment due to further investigations undertaken within this report.

Each commitment is numbered and a reference given to that section which it applies. Some commitments may relate to a number of sections although not expressed within the following. All established monitoring and review, reporting, auditing and mitigation commitments remain applicable.

NOTE: The term therein relates to the strategies referred to within the EA Statement of Commitments.

Commitment 251, Section 2.3.4., Reaffirmed Flora and Fauna Management Plan

Four Arrows reaffirms its commitment to develop a flora and fauna management plan as stated within the EA SOC (commitments 201-204). Specifically, to ***provide adequate protection for the significant remnants of vegetation*** and ***enhancing the species richness*** of the corridor to provide valuable biodiversity outcome. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 252, Section 2.3.4, Inclusion to Flora and Fauna Management Plan (design, construction, operational)

Four Arrows includes a commitment within its flora and fauna management plan as stated within the EA SOC (commitments 201-204). This is the ***appointment of a local specialist native vegetation nursery,*** which can be engaged to collect, germinate, plant out and then independently manage the landscaped areas. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 253, Section 2.3.4, Inclusion to Flora and Fauna Management Plan (design, construction, operational)

Four Arrows includes a commitment within its flora and fauna management plan as stated within the EA SOC (commitments 201-204). This is to ***involve a representative from the MCMA*** in the planning of habitat restoration works and suitable species selection and establishment. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 254, Section 2.3.4., Reaffirmed Heritage Management Plan

Four Arrows reaffirms its commitment to develop a ***heritage management plan*** as stated within the EA SOC (commitments 212-219). The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 255, Section 2.3.5, Expanded Traffic Management Plan

Four Arrows expands upon its commitment to a traffic management plan as stated within the EA SOC (commitments 53-61) to include adherence to all ***RTA conditions of development consent*** that are included once reviewed by the DoP. This augments all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 256, Section 2.3.6., Reaffirmed Air Quality Management Plan

Four Arrows reaffirms its commitment to develop an ***air quality management plan*** as stated within the EA SOC (commitments 1-18). The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 257, Section 2.3.6., Reaffirmed Air Quality Management Plan

Four Arrows reaffirms its commitment to develop an air quality management plan as stated within the EA SOC (commitment 7-12) that ***specifically targets the generation and management of dust*** throughout the site. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 258, Section 2.3.7, Inclusion to Air Quality Management Plan (operational)

Four Arrows includes a commitment within its air quality management plan as stated within the EA SOC (commitments 1-18). This is to ***use on-site weather data for modelling purposes***, once a sufficient sample has been retrieved. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 259, Section 3.3.1 and Section 3.4.1, Inclusion to Water Management Plans (pre-design)

Four Arrows includes a commitment within its water management plans as stated within the EA SOC (commitments 69-104). This is to ***supply further hydrogeotechnical data if required*** once a specific brief of needs and justification has been forwarded by the authority concerned. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 260, Section 3.4.1, Reaffirmed Soils (agricultural and geotechnical) Management Plan

Four Arrows reaffirms its commitment to a soils management plan as stated within the EA SOC (commitment 129). This includes the design, placement and construction of buildings, structures and infrastructure ***only upon suitable soil types and topography***, and the exclusion of areas deemed inappropriate for development. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 261, Section 3.4.2, Reaffirmed Soils (agricultural and geotechnical) Management Plan

Four Arrows reaffirms its commitment to a soils management plan as stated within the EA SOC (commitment 130). This includes ***further soils testing encompassing chemical and geophysical aspects*** as part of detailed design investigation. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 262, Section 3.4.4, Expanded Water Management Plans

Four Arrows expands upon its commitment to water management plans as stated within the EA SOC (commitments 105 and 106) to include the ***installation of piezometers***, at specific locations being one at each corner of the new enhanced waste water management system, one at each corner of the combined free-stall and dry lot pen areas, and a single piezometer at the north section of the ethanol plant. This augments all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 263, Section 3.4.4, Reaffirmed Water Management Plans

Four Arrows reaffirms its commitment to water management plans as stated within the EA SOC (commitment 75). This includes ***applying engineering methods and other such technologies upon areas that are to be utilised for infrastructure including waste storages, dairy free-stall sheds and heifer dry-lot pens***, to mitigate accession to groundwater. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 264, Section 3.5.2.4 & 3.5.2.5, Expanded Air Quality Management Plan

Four Arrows expands upon its commitment to an air quality management plan as stated within the EA SOC (commitments 138-157) to include the installation of ***air pollution control equipment and operational procedures*** at the ethanol facility as described. This augments all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 265, Section 3.5.2.5, Expanded Air Quality Management Plan

Four Arrows expands upon its commitment to an air quality management plan as stated within the EA SOC (commitments 138-150) to include ***key testing methodologies and record keeping requirements*** at the Ethanol facility as described. This augments all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 266, Section 3.5.3, Reaffirmed Air Quality Management Plan

Four Arrows reaffirms its commitment to an air quality management plan as stated within the EA SOC (commitment 16 and 18). This includes ***the regular removal of manures from sedimentation basins*** to "Tubbo" irrigation to minimise the drift of odours from the project site. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 267, Section 3.5.3, Inclusion to Air Quality Management Plan (construction)

Four Arrows includes a commitment within its air quality Management plan as stated within the EA SOC (commitments 1-18) .This is the ***gravelling of the road into "Tubbo" Station*** to ensure all weather daily access for the transportation of manures. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 268, Section 3.5.3, Inclusion to Water Management Plans (construction)

Four Arrows includes a commitment within its water management plans as stated within the EA SOC commitments (commitments 69-104). This is the ***construction of a bunded compacted clay pad*** for the short term storage of manures at "Tubbo". The intended plan continues to include all

applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 269, Section 3.5.3, Inclusion to Air Quality Management Plan (operational)

Four Arrows includes a commitment within its air quality management plan as stated within the EA SOC (commitments 1-18). This is the ***composting of short term stored manures prior to spreading***. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 270, Section 3.5.5, Reaffirmed Air Quality Management Plan and Waste Management Plan

Four Arrows reaffirms its commitment to an air quality management plan and waste management plan as stated within the EA SOC (commitments 3-6 and 139,144,145). This includes ***securing contracts that ensures the expeditious movement of unrequired WDG offsite*** and the development of strategies that make provision for unexpected dropouts or terminations of agreements**.** The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 271, Section 3.5.5, Expanded Air Quality Management Plan and Waste Management Plan

Four Arrows expands upon its commitment to an air quality management plan and waste management plan as stated within the EA SOC (commitments 18,100,149) to include ***the incorporation of excess WDG not consumed by general markets*** also into the soils of "Tubbo" as worst case scenario. This augments all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Inclusion to Air Quality Management Plan and Animal Welfare Management Plan (operational)

Four Arrows includes within its commitments to an air quality (commitments 1-18) and an animal welfare management plan (commitments 185-193) as stated within the EA SOC that provides a safe and hygienic workplace and a facility that is designed and operated which promotes animal welfare best practice; that directly affects fly numbers.

Commitment 272, Section 3.6, Four Arrows commits to the following specific strategies to ensure the management of fly numbers:

- The regular ***collection of manures and spilt feed*** which accumulates in areas that are rarely trampled.
- The ***reduction of moisture*** content in manures.
- The use of ***chemical knockdown methods***.
- The use of ***electrical eradication equipment***.

These methods augment all strategies applicable to air quality, animal welfare and OH&S policy described therein, accompanied by all monitoring and reviews, reporting and auditing commitments.

Commitment 273, Section 3.6, Four Arrows commits to ***appointing a fly management officer/consultant*** to monitor fly numbers and implement knockdown strategies.

Commitment 274, Section 3.6, Four Arrows commits to the ***setting of fly traps in order to monitor fly numbers*** in and around the site and production areas.

Commitment 275, Section 3.6, Four Arrows commits to providing a process where ***grievances regarding fly numbers*** can be registered and addressed in an effective and expeditious manner.

Commitment 276, Section 3.6, Four Arrows commits to ***performance reporting*** that will be utilised to assess the success of operational and knockdown strategies, by management and external agencies, which will allow for the updating of environmental management plans.

Commitment 277, Section 3.6, Four Arrows commits to allowing third parties to ***audit fly number records*** to ascertain adherence to management practices and to assist with recommendations for updated strategies.

Commitment 278, Section 3.6, Four Arrows commits to ***implementing all mitigation measures*** in relation to managing fly numbers identified throughout the EA and PPR development process.

The preceding strategies in relation to fly numbers are accompanied by all relevant monitoring and review, reporting and auditing commitments.

Commitment 279, Section 3.7.1.2, Inclusion to Water Management Plans (operational)

Four Arrows includes a commitment within its water management plans as stated within the EA SOC (commitments 69-104). This is to ***adhere to a best management waste water quality programme*** in order to maintain waste water quality above that of current groundwater conditions, to ensure that any unpredictable or unforeseen accession, will not be detrimental to existing groundwater supplies. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 280, Section 3.7.2, Inclusion to Waste Management Plans (operational)

Four Arrows includes a commitment within its waste management plans as stated within the EA SOC (commitments 138-150). This is ***to secure contracts with the "Barnawartha" biodiesel plant to accept Four Arrows deceased stock for rendering*** as opposed to burial at "Tubbo" station. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 281, Section 3.7.2, Inclusion to Waste Management Plans (operational)

Four Arrows includes a commitment within its waste management plan as stated within the EA SOC (commitments 138-150). This is ***the burial of dead stock only in suitable soils and at sites with limited life spans*** as described and approved by the appropriate agencies. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 282, Section 3.7.2, Reaffirmed Animal Welfare Management Plan

Four Arrows reaffirms its commitment to an animal welfare management plan as stated within the EA SOC (commitment 189). This includes the ***expeditious removal of dead stock to adjacent "Tubbo" Station*** where burial will be carried out in a manner that results in no impact to neighbours or the surrounding environment. This commitment will also be integrated into water management and waste management plans. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 283, Section 3.7.2, Amended Water Management Plans

Four Arrows amends its commitment to a water management plan as stated within the EA SOC (commitment 85). This includes ***the engagement of an experienced geotechnical engineer to also partake in the assessment and selection of appropriate mortality disposal sites*** of which will also be included within waste management plans. This strategy is accompanied by all relevant monitoring and review, reporting and auditing commitments.

Commitment 284, Section 3.7.3, Expanded Waste Management Plans

Four Arrows expands upon its commitment to waste management plans as stated within the EA SOC (commitments 150)) to include ***the capture as much truck wash material as possible (as described) and carted direct to "Tubbo" station*** for spreading on agricultural lands. This augments all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 285, Section 3.7.3, Reaffirmed Waste Management Plans

Four Arrows reaffirms its commitment to a waste management plan as stated within the EA SOC (commitment 150). This includes the ***capture of truck wash waste material*** that will be carted direct to "Tubbo" on a regular basis for spreading upon irrigation and/or other suitable agricultural lands. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 286, Section 3.7.4, Amended Waste Management Plans

Four Arrows amends its commitment to a waste management plan as stated within the EA SOC (commitment 148). This includes the ***segregation of grey and black water for treatment*** that is captured by the effluent management system within administration areas. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 287, Section 3.8, Inclusion to Animal Welfare Management Plan (operational)

Four Arrows includes a commitment within its animal welfare management plan that will be based upon cattle nutrition as stated within the EA SOC (commitment 185-193). This is to ***provide***

feeding rations as described to minimize the loadings of nutrients and salts within waste water repositories, thus being an aspect of an integrated waste water management plan. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 288, Section 3.9.4, Amended Greenhouse Gas Emissions Management Plan

Four Arrows amends its commitment to a GHG emissions management plan as stated within the EA SOC (commitment 229) to include that an appointed private sector company ***will implement carbon offset and sequestration strategies*** as proposed (Commercial In Confidence document), to manage total GHG emission debits produced by the combined enterprises, if a technological capture system is not adopted within the facilities design. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 289, Section 3.9.5, Inclusion to Greenhouse Gas Emissions Management Plan (design, construction, operational)

Four Arrows includes a commitment to a GHG emissions management plan as stated within the EA SOC (commitment 227-229) and amending WMP (commitment 141). This includes ***the installation of GHG capture technology should markets for CO2 and methane provide an economically viable alternative*** to the purchase of carbon offsets post approval. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 290, Section 3.10, Reaffirmed Water Management Plans

Four Arrows reaffirms its commitment to a water management plan as stated within the EA SOC (commitment 71). This includes all strategies applicable to ***secure water sources beyond existing entitlements*** to ensure adequate and consistent supplies. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 291, Section 310.2, Reaffirmed Water Management Plans

Four Arrows reaffirms its commitment to an ***integrated water management plan*** as stated within the EA SOC (commitments 69-104). This will include stormwater, drainage and all waste water treatments in consultation Coleambally Irrigation Cooperative Ltd to ensure full integration with the CIA LWMP. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 292, Section 3.11, Inclusion to Hazard and Risk Management Plan (operational)

Four Arrows includes a commitment to a hazard and risk management plan as stated within the EA SOC (commitments 113-119). This is the ***implementation of standard best management practice and operating procedures*** as part of a working policy document to ensure that

appropriate HazMat and HazChem standards will be applied to all transport of product onto and off site where appropriate. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 293, Section 3.12, Reaffirmed Traffic/Transport Management Plan

Four Arrows reaffirms its commitment to a traffic/transport management plan as stated within the EA SOC (commitment 61). This includes ***ongoing support for the upgrading and reopening of the Willbriggie railhead*** to reduce the need for long distance transportation of resources and the potential for the transportation of product. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 294, Section 3.12, Inclusion to Traffic/Transport Management Plan (post-approval)

Four Arrows includes a commitment within its traffic/transport management plan as stated within the EA SOC (commitments 53-61). This is to ***continue to negotiate with CICL for the upgrade of Eulo Road bridges to support B-Double traffic***. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 295, Section 5.4.8, Inclusion to Water Management Plans (operational)

Four Arrows includes a commitment within its water management plan as stated within the EA SOC(commitments 138-150). This is the ***cleaning/scraping of heifer pens*** no less than monthly and the ***cleaning of lanes prior to flushing***. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 296, Section 5.4.10, Reaffirmed Waste Management and Air Quality Management Plan

Four Arrows reaffirms its commitment to a waste management plan and air quality management plan as stated within the EA SOC (commitment 61 and 18). This is to ***incorporate all manure produced by the dairy into "Tubbo" soils***. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 297, Section 5.4.12, Inclusion to Water Management Plans (design, construction, operational)

Four Arrows includes a commitment within its water management plan as stated within the EA. SOC (commitments 69-104) and also affecting waste management plans. This is the ***construction of infrastructure including recycling ponds and evaporation storages plus operational procedures*** to accommodate the revised water management strategy as described. The intended

plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

Commitment 298, Section 5.4.16, Inclusion to Waste Management Plans (operational)

Four Arrows includes a commitment within its waste management plans as stated within the EA SOC (commitments 138-150). This is to ***manage tailings after a predetermined period (10 years)*** by either one or a combination of methods as described. The intended plan continues to include all applicable strategies described therein, accompanied by all monitoring and review, reporting and auditing commitments.

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