

**ANNEXURE 2.0b**

**COPY OF AGENCY RESPONSES TO DRAFT PPR**

## Comments – Preferred Project Report

### 1. Air Quality

- 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 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.
- 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 scheduled premises (activity and plant) and are presented in units of mg/m<sup>3</sup>.
- Secondly, the data need 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<sup>3</sup> or mg/m<sup>3</sup>.
- 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.
- It is also noted that the data provided by the US manufacturer is based on a corn based ethanol plant with a CO<sub>2</sub> recovery plant. The draft PPR needs to justify that these data are representative of the proposed grain based ethanol plant with no CO<sub>2</sub> recovery plant proposed.
- Whilst the draft PPR has identified additional markets for the WDG, no information had been provided regarding the location of the end markets and in particular the practicalities of storing and transporting this product within acceptable time frames to reduce potential odour issues. This outstanding issue needs to be addressed.

### 2. Greenhouse Gas Assessment

- For all ethanol plant proposals the Department 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.
- There appears to be a large differences between the data presented in the original EA and that in the PPR even through the same model has been used. In the EA the model results were a total of 275kt/annum of CO<sub>2</sub> for the project with no CO<sub>2</sub> capture and 98kt/annum if CO<sub>2</sub> capture was used. The PPR now states the project will have a net debit of 54kt/annum of CO<sub>2</sub> (with no CO<sub>2</sub> capture associated with the plant). Can you please clarify the reasons for these differences.
- Emissions from the project should be reported against NSW total annual greenhouse gas emissions and emissions for similar industries.
- From the models provided in Annexure 8, it appears that you have specified that the energy source would be 80% from coal derived energy and 20% as natural gas. However, EA states that natural gas is not currently available at the site, and while the extension of the pipeline from Griffith it 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.
- The PPR details that options such as CO<sub>2</sub> capture and methane capture will be investigated. 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 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?

### 3. Wastewater Disposal

#### 3.1. Issue

- The concern is that due to the high salt content (particularly Na as it is not likely to be absorbed by plants) and the sandy nature of the soils on site, that salts will accumulate and move downward through the soil profile, therefore there is a high risk that the irrigation of wastewater could contaminate groundwater.
- The shallow aquifer under the site (Upper Shepparton) is linked to deeper aquifers including the Calivil Formation and the Renmark Group. Discussions with Murrumbidgee Council and DWE indicate that water sourced from both of these aquifers is used for stock and domestic purposes and town water supply for Coleambally and Darlington Point.
- Under the NSW Groundwater Quality Protection Policy, contamination of town water supplies is not permitted.

#### 3.2. Wastewater Disposal Systems

- For the reasons outlined above, the change of method of wastewater disposal from evaporation to irrigation is of a concern.
- The Department, DWE and DECC consider that there are a number of options available for wastewater disposal, including:
  - Engineering solutions (eg collection system) to minimise risk of contamination (this is the preferred option).
  - Treat the wastewater.
  - Include more land for irrigation purposes with better suited soils. If this was to be done additional information would need to be included on the irrigation area particularly in regards to soil types and depth to groundwater.
  - The other alternative is to remove the dairy component of the project. Once a suitable system for wastewater disposal is developed or a more suitable site located, Four Arrows could submit a new application for the dairy facility (given the size of the facility a new application would be required).
- Should you wish to pursue an approval for the revised wastewater system the following information should be included:
  - justification of the proposed changes and a details of how this system would reduce the risk of groundwater contamination.
  - a discussion on the depth of the cut required for the recycling and evaporation ponds and the depth of "clay" under these ponds (this information was provided in the EA for the anaerobic and aerobic ponds). This should be justified with a sufficient amount of soil cores that show a minimum of 3-4 metres below where cuts are proposed.
  - Clarification of the wastewater volumes expected for the entire operation (ethanol plant and dairy).
  - a revision of the salt and nutrient balances, particularly for sodium. In table 5 (pg 64) it is stated that a total of 47 t/yr or 624 kg/ha of Na would be irrigated per year, however, these figures do not seem to correspond to any of the figures in the salt and nutrient balance sheets provided on 22 June 2007. These figures should be independently confirmed and signed off.
  - details of the capacity of the soils within the irrigation areas to accumulate salts and nutrients (ie N and P) over the life of the project. It is noted that on page 90 that details of accumulation, however, these figures are for the net annual accumulation only.
  - number of days of storage within the ponds and the an estimate of the minimum time water is held (pg 75 point 3).
  - Point 4 on pg 75 states that should water within the category 3 ponds become unacceptably saline than an amount would be drawn off to a Category 4 evaporation pond and the remaining Category 3 water diluted. Are you able to provide an approximate value of what you would consider "unacceptably saline" to be?
  - As already stated, all wastewater ponds must be certified by an appropriately qualified engineer. Given the quality of the groundwater resource, appropriate collection and monitoring systems should be designed to safeguard against pond leakage. Afterall, an impermeability of  $1 \times 10^{-9} \text{m/s}$  is the standard compaction for

wastewater ponds but even this compaction is likely to still result in some leakage. Whilst it is minimal, the long term nature of the project and quality of resource beneath it, in DWE's opinion warrants special protection through a leakage and collection system.

- The storm surge has been relocated however, it is unclear whether the sizing has changed.
- The nitrogen mass balance includes a figure of 93% which has been used to calculate the amount of nitrogen volatilised from pens, basins and ponds. This figure should be justified.
- In summary the previous proposal of an evaporation basin has less potential to contaminate than the current irrigation proposal. The reality is that this site may not have the soil types suitable for wastewater management of the volume required. If a rice approval was requested for this site, the parts of the site without a uniform 3 metres of clay underneath would not gain approval to simply grow rice with irrigation water.

**ANNEXURE 3.0**

**SUSTAINABLE WASTE WATER MANAGEMENT SYSTEM  
AS PRESENTED IN DRAFT PPR**



Considered integration of the issues and perspectives contained in the above points emphasise the prudent application of:

- Feeding the project dairy cattle adequate but not excessive salts and nutrients; and
- Regular maintenance of the dry lot pens and flush lanes to remove all removable amounts of salts and nutrients before they enter the on-site waste management system.

Integrating the above options has merit in mitigating the risk of adverse impacts occurring around and under the proposed project site.

Section 4.3 of this response details the integration of the revised investigation for the design, operations and impacts of a new and proposed enhanced waste water management strategy.

## **4.3 Enhanced Waste Water Management Strategy**

### **4.3.1 Overview**

Included over page is a flow chart depicting the revised flow of Category 3 water and manure under the enhanced waste water management plan. The Category 3 water contains some of the manure and other solids from the dairy enterprise and its immediate surrounds. 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 top left hand and central sections of the flow chart:

- Run-off water is generated from the dry lot pens, the cattle working yards, milking barn (cow yard and shed wash-down, 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 losses to the sedimentation basins;
  - Flush lanes will be scraped no less than twice daily before each flush event and whilst cows are being milked with a bobcat using a part tractor tyre.
- All drainage water from the above are directed to the sedimentation basins which allow extended time and minimal flow rates for optimum solids settling. The sedimentation basins will be regularly cleaned without undermining the integrity of the liner in the basins.
  - All scraped manure (dry to semi dry) will be removed daily to “Tubbo” for spreading on the irrigation;
- 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 carrying 30% - 40% solids will be directed to one of four recycle ponds of 20ML each which are operated at no greater than 50% holding capacity to provide a buffer storage for storm events. Each of these cells may be totally membrane lined and may also have a membrane cover to contain and burn-off greenhouse gases subject to approval under a future separate development application;
- 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 pumping from one cell to another on an “as required” basis;



- Should the water within the Category 3 ponds become unacceptably saline then an amount would be drawn off to a Category 4 evaporation pond and the remaining Category 3 water diluted with CICL water;
- Downstream of the Category 3 holding ponds shall be four irrigation cells of 15ha each and these shall be irrigated with a spray irrigation system. These irrigation cells will be used to produce silage and/or green crops for feeding to the dairy cows and/or dry lot heifers. If needed surplus forage product would be carted off-site to “Tubbo” livestock operations which is separate to the “Tubbo” irrigation;
- The irrigation cells will grow one summer crop and one winter crop each year with the exception of cell 4 which may only produce a summer crop; and
- Additional water will be required from CICL to augment the Category 3 water in both the Category 3 ponds themselves and on the irrigated crops in the irrigation cells;
- Any Category 3 water remaining after irrigating the forage crops will be used for limited watering of the landscape areas, where it is proposed that watering will not exceed  $K_c = 0.2$  in the autumn period.

Refer SOC commitment 285.

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

#### 4.3.2 Groundwater

CSIRO in Griffith conducted a detailed study of groundwater levels and flows throughout the whole Coleambally Irrigation Area. The CSIRO findings was 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. As expected 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 to the north and north-west of Coleambally in the Darlington Point/Coleambally area;
- Not mentioned in the CSIRO report, but the only potential localised variation to the main trends in groundwater flow between 2000 and 2007 and even the foreseeable future, could be the installation of a local and substantial production bore which could change the direction of localised flows. 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 in the CICL piezometers in and surrounding the project site.

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 as depicted on Annexure 23.0. A log of this piezometer is attached as Annexure 24.0.



The piezometer on the project site was subsequently and substantially bailed to remove any trace of 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 13.0. The issues of note with respect to the groundwater analyses are as follows:

- 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 as to give reason for significant concern if this water were to be used for general irrigation purposes.

**Comment:** *The direct mixing of the waste water and groundwater would result in a lower salinity outcome than the groundwater itself.*

**Comment:** *In passing through the soil profile, any project waste water may leach some salts which, on the balance of probabilities given prior irrigation leaching events are not likely to increase groundwater salinity beyond that already encountered.*

**Comment:** *E.Coli and other organisms of concern to groundwater are most likely to be killed during the irrigation events described in Section 4.3.5.*

#### 4.3.3 Geotechnical Assessments

Attached hereto as Annexure 25.0 are the results of the laboratory analyses for geotechnical soil samples obtained from the Lane Piper (NATA accredited) Laboratories in Melbourne.

The assessed soil permeability rates were determined by using elevated electrolyte levels in the test water to affirm soil stability. The resultant permeability rates were between 65% and 85% less than the minimum standard of  $1 \times 10^{-9}$  meters/second ( $\approx 31\text{mm/year}$ ) required under current policies. In the fourth sample the permeability was 2.4 times the minimum required rate but the extent of suitable soils and the ability to further reduce permeability by the appropriate mixing of soils during construction at the project site 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) would have assured the maintenance of a flocculated soil structure so that the magnitudes of soil permeability rates as tested are most likely to be a worst case scenario;
- The samples represent the soils at the respective sampling sites and this material can be 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, it is recommended that the employment of *in situ* material will be appropriate for the construction of earthen liners at 600<sup>+</sup>mm thickness; and
- If deemed appropriate with 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 new 4 x 1ha Category 3 recycling ponds the inclusion of a geo-synthetic liner would only be considered as an additional security to the compacted clay liner to provide agencies with a feeling of security rather than achieve a real gain in pond integrity.

Furthermore, consideration could be given to a membrane cover to capture greenhouse gases (methane) and the regular burning off of the accumulation of any such gases if not captured and employed for power generation on site.

In total, the geotechnical laboratory results further 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 spreadsheet provided as Annexure 21.0 and Annexure 22.0 affirms this conclusion. Therefore, there is no need to import materials for construction of the water storages and associated other earthen facilities.

#### **4.3.4 Agricultural Soil Tests**

##### **4.3.4.1 "Tubbo" Irrigation**

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

Annexure 15.0(b) 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 are typical of these seen in over 40 years of professional experience on the Riverina plains and particularly those soils to be found in the eastern sections of the Riverina plains. The following points are noted:

- Soil pH (CaCl<sub>2</sub>) – 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/kg and 25mg/kg, the total phosphorus is low to very low and typical of that which would be expected throughout the Riverina. The area known as "Two Woods" has the highest level of phosphorus and would be considered acceptable with adequate maintenance to above maintenance application levels of phosphorus fertilisers. The remainder of the soils on the "Tubbo irrigation would require significant applications of fertiliser phosphorus;
- Ca/Mg ratio – the ratios of 1.1 to 1.3 are low and the soils may 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 become increasingly sodic in the western direction.

#### **4.3.4.2 Waste Water Irrigation**

Attached as Annexure 15.0(a) is an agricultural soils analysis from samples collected in and around the area proposed for the irrigation cells. 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 ( $\text{CaCl}_2$ ) – 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 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 to be generally satisfactory;
- Magnesium – range 3.1 to 6.3mg/100gm and generally satisfactory;
- Sodium – range 0.22 to 0.44mg/100gm and 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 may benefit from gypsum and/or lime application;
- Cation Exchange Capacity – range 9.65 to 20.1mg/100gm; and
- Textures – light to medium clays.

The key elements present in the waste water of concern are:

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

Based on the soil analysis detailed above the soil levels of these elements have been described as low to satisfactory. In relation to these elements generally and the soil test analysis specifically, the following comments are made.

Phosphorus is an essential element in soils which is typically low in most Australian soils and these soils are no exception. Application of phosphorus by synthetic fertilisers has long been the remedy for this soil constraint. Phosphorus is relatively immobile in soils and especially so in clayey soils such as those found at the project site. The clay driven immobility reduces the risk of movement of phosphorus into both surface and groundwater systems.



In the case of this development the existing clayey soils with inherently low levels of phosphorus have a great capacity to absorb this element. This will be beneficial agricultural production and reduce the risk of groundwater contamination. As all the phosphorus needs of the proposed crops will be present in the irrigation water the soil will receive routine amounts of phosphorus spread over time rather than large single doses that cannot be immediately absorbed or that may “shock” the soil system.

Potassium can be another pollutant and/or resource element present in waste water. Potassium is relatively mobile in soils, however the clayey soils such as those found on the proposed site have enormous capacity to absorb and retain potassium. This is particularly the case where potassium is applied in small amounts over time in irrigation water.

Magnesium is an important element essential for both plant and animal growth and especially for lactating animals’ well-being. The soil levels of magnesium found on the proposed site are relatively low and would benefit from additional magnesium. This will be supplied in the irrigation water. The clayey soils to be irrigated have a large capacity to absorb magnesium.

Sodium can be a problem in many Australian soils. When levels exceed 5.0% soil properties can be unduly affected. These potential adverse impacts can be addressed by the addition of gypsum and/or increasing soil organic matter level. The cropping system that will be conducted on these fields in conjunction with regular access to manure (organic matter) will greatly enhance these soils’ ability to absorb sodium without impacting on soil properties. This farming system will ensure the soils can remain productive and the sodium applied remains at the soil surface rather than being moved into groundwater systems.

#### **4.3.5 Irrigation System and Procedures**

It is proposed that the new enhanced waste water management system will incorporate a spray irrigation system covering a total of 60ha in 4 x 15ha irrigation cells. Irrigation of the crop areas in the dedicated irrigation cells will be augmented by the irrigation of parts of the 10ha of project landscaped areas and the 80ha of buffer and native plantings.

The landscaped areas will be the outer landscaped areas surrounding the administration area of 5ha and the 5ha of landscaped area around the ethanol plant. In addition, there is consideration for including the irrigation of the landscaped areas around the dairy barn, cattle working yard facilities, each of the dairy freestall sheds and the dry lot pens. These landscaped areas in and around the livestock facilities will further enhance animal wellbeing. The native species plantings are to be watered on a limited supplementary basis to ensure the plantings:

- Do not dry out to the extent that they die;
- Maintaining sufficiently active vigor in the plantings without encouraging excess growth; and
- Do not denigrate the nature and intent of the native plantings themselves.

Accordingly, it is intended to provide only limited irrigations to the areas of landscaping and buffer plantings which will be watered to no more than a Kc value of 0.2 and preferably only in the autumn period. This limited water supply will ensure there remains the ability of these areas to absorb winter rainfalls and that tree and shrub growth is such that they will actively explore the soil profile to optimise rainfall and nutrient uptake. Furthermore, it is expected that only 20ha or 25% of buffer/native planting, will need to be watered in the majority of years with a different 20ha each year. This strategy enables a greater area to be watered in the wetter years.

Refer SOC commitment 286.



The irrigation system within the dedicated irrigation cells will:

- Most likely be a solid set sprinkler system designed to apply the Category 3 water at a rate not exceeding the infiltration rates of the soil;
- Apply water in those amounts such that readily available water (RAW) will not reach an upper level which is greater than 50% of the difference between field capacity and wilting point and thereby allow absorption of substantial rain events (see diagram insert over page); and
- Soil moisture status will be regularly monitored to constantly record RAW and to ensure that irrigation water to no more than 50% of RAW is applied to the soil.

These procedures ensure the soil profile is always able to best manage any unexpected/unintended salt movement in accordance with world best practice as depicted by the *FAO Irrigation and Drainage Paper No. 47* document – see comment box at end of Section 4.2.4.

Each of the irrigation cells will be planted to a summer forage crop (eg: forage sorghum and/or forage maize) for ensiling and/or green chopping and subsequent feeding to the dairy cattle. In winter a forage crop of oats and/or other acceptable cereal forage crop will be grown for the same purpose.

Refer SOC commitment 287.

The irrigation cells will be rotated in their order of sequence with Cell A becoming:

- Cell 1 in Year 1;
- Cell 2 in Year 2;
- Cell 3 in Year 3; and
- Cell 4 in Year 4.

This sequential strategy ensures full rotation of any issues and impacts over all the cells.

Surrounding each of the irrigation cells will be a 2m high embankment to enable capture and containment of water in storm events and in very wet years.

There are variations to the theme of storm capture and of sacrificing growing crops such smaller internal “rice” style embankments to ensure that only parts of cells are flooded out in small rain events. This strategy of sequential and minimum impact flooding of a cell is discussed in further detail within other sub-sections of this report.

The volume of water to be managed and the quantum of nutrients and/or salts within the Category 3 waste water are calculated within Sections 3.11.1.2 and 3.13 of this report.

#### **4.3.6 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 thus 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 each of the sinks for the above elements to provide realistic mass balance of what was consumed by the cattle and ultimately 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 the beef cattle feedlot guidelines criteria. 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 was made of the School of Veterinary School 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) yet to be published and which had been completed under an independent consultancy. MLA authorised the appropriate quotation of the FLOT.328 report.

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 quantum of adverse elements within the waste products generated by the cattle. The exception on the quantum of elements is that additional attention will need to be given to increasing dietary potassium by the supplementary fertilisation of the silage crops being contractually grown and ensiled throughout Coleambally for delivery to the project site. The project dairy specialist advises that he normally achieves improved adequacy of nutritional potassium by recommending increasing potassium fertilisation of pastures to his dairy clients.

#### **4.3.7 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, which include the loafing pens around the freestall sheds. 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% achievable. Any project with sedimentation estimates above 60% is only budgetable upon proven performance.

Therefore a well designed and managed sedimentation system at the proposed project site should reliably intercept 55% solids. Therefore the sedimentation system proposed in the original EA should achieve at least the budgeted 55% settlement of solids.

Of particular note is that 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
- A lining of manure is left in the bottom of the basins.



The performance criteria of the proposed sedimentation system will determine the amount of manure or solids collected from the sedimentation basins and carted to “Tubbo” station for spreading on irrigation. The sedimentation system will also determine the amount of solids moving forward into the Category 3 water ponds.

The overall efficiency of solids management will be enhanced if intercepted before they get to the sedimentation basins. The primary strategies are:

- No less than monthly scraping of manure in the pens, particularly the dry lot and loafing pens; and
- Scraping of the flush lanes in the freestall sheds with a part tractor tyre acting as a “squeegee” on the front of a bobcat. The scraping to be undertaken as soon as the cows leave the shed for milking and before the lanes are flushed.

It is documented in the Beef Feedlot Guidelines and MLA final report FLOT.328 that regular scraping of the dry lot pens and removal of manure will reduce not only the loading of manure into the sedimentation basins, but will also further reduce the quantum of nutrients and/or salts coming through into the waste water system.

Regular pen and flush lane scraping with direct and regular manure removal for spreading at “Tubbo” irrigation has been and remains the preferred and recommended practice.

#### **4.3.8 Manure Management**

Efficient manure, nutrients and salts management is driven by the following procedures and actions:

- Management of the cow nutrition to ensure the components of the cow’s diet is sufficient to maintain optimum nutrition with minimal nutrients and salts being passed through the cow and dropped onto the dry lot pens, freestall flush lanes and freestall loafing pen areas;
- Nutrition will also determine the nature and quantum of greenhouse gases generated through belching and flatulence;
- Regular and controlled scaping of the dry lot pens and loafing yards to minimise accumulation of manure and maximise export of manure for dispersion on “Tubbo” irrigation;
- Bobcat scraping of freestall lanes and cattle working yards to capture excess volumes of manure before it requires substantial flows of water to flush. The bobcat will have part of a tractor tyre attached to the front blade to enable appropriate cleaning of the concrete areas and carted separately to “Tubbo”; and
- Manure removed from the sedimentation basins shall be held for only a limited period of time sufficient to facilitate drainage of excess moisture before cartage to “Tubbo”. The stockpile of short term stored manure shall be on a concrete pad constructed to drain surplus moisture back into the sedimentation basins and avoid contamination of groundwater.

Manure carted to “Tubbo” will be spread on the irrigation at sustainable rates and 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.

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:

- The contingency plan – spreading on other Four Arrow's Group lands within the "Tubbo" aggregation viz:
  - "Belvedere" irrigation;
  - Coleambally Irrigation Area farms owned by the Four Arrows Group and which are associated with "Tubbo" operations;
  - These areas are in addition to the nominated 2,500ha as stated in the original EA.
- 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.

#### **4.3.9 Category 3 Water Ponds**

It is proposed to construct a total of four Category 3 water ponds, each with a capacity of 20ML covering 1ha each and storing water to a maximum depth of 2m. The Category 3 water ponds will preferably be earthen lined with a minimum 600mm of compacted earthen liner in accordance with the site capabilities depicted in Section 3.12.4.

As an additional, but not necessarily required risk management procedure to satisfy potential agency concerns, consideration could be given to adding a geo-membrane liner although the preferred option would be to increase the thickness of an earthen liner. Any pump station within the Category 3 ponds would be installed within this sealed environment to ensure no leakage in and around any infrastructure associated with that pumping station.

Not included in the water mass balances, but intended in practice would be to cover each of these Category 3 ponds with a membrane surface liner to capture any emitted greenhouse gases of which methane is the most likely. This captured methane would be flared off regularly and/or used for energy generation on-site.

Separate licensing for the methane flaring may be required after separate development applications, sub-project investigations and approval processes.

The Category 3 ponds would normally retain waste water at no greater than 50% capacity to provide adequate buffer storage capability in the event of storm rainfalls. This would provide at least 40ML of buffer capacity, sufficient to capture a 100mm event over a one day period for all the run-off from the whole of the containment area. The buffer storage would contain any rain run-off beyond 100mm until the irrigation cells are able to receive the remainder.

Water draining from the sedimentation basins and carrying non-settled solids, nutrients and salts would be pumped straight to the Category 3 ponds. The water would move through the ponds so that they would remain facultative. The waste water would need regular supplementation with additional fresh water supplied direct from the CICL channel system to cover evaporative losses in the flushing and holding processes.

Modelling projections are that in an average or D5 year some 30ML of additional water would be required to cover any evaporative losses through the uncovered system (Annexure 16.0a). The Category 3 pond water would be used to flush the lanes in the freestall shed and thus is constantly recycled. By re-cycling there is the multiple opportunities for settling of persistent solids in the sedimentation basins.



Excess and regularly diluted water would be pumped from the Category 3 ponds to the irrigation cells for irrigation purposes. The use of Category 3 water for irrigation is discussed in Section 4.3.11.

The recent review of waste water management literature by Dairy Australia has affirmed the above strategy to be the most effective and environmentally responsible waste water management system for the equivalent of Category 3 wastes in intensive dairy businesses.

The reduction in size of Category 3 water ponds from that proposed in the original EA is well in excess of 90% to that originally proposed. Hence the dramatic reduction in both storage volumes and areas of land covered by ponds substantially reduces the risks associated with clay liners, membrane liners and waste water management in general. Furthermore, the size of the revised Category 3 ponds and their spreading over four separate small ponds rather than a single larger facility will enable regular decommissioning of a pond for maintenance purposes.

Microbial activity will further breakdown the organic matter within the solids and consume nutrients, especially nitrogen, in the process.

#### **4.3.10 Category 4 Water Pond**

Provision has been made for the construction of a new small Category 4 water pond to act as a reserve Category 3 pond or as a small evaporation pond if required. The Category 4 pond would initially be earthen lined but could contain a membrane liner if required.

Should the water in the Category 3 water ponds begin to accumulate salts some of that water would be pumped to the Category 4 water pond for evaporation. The water removed from the Category 3 ponds will be replenished with high quality water direct from CICL supply system.

In the water budgets shown in Annexure 16.0 the water flow directed to the category 4 pond is noted. However there is no intention to use this pond except in a contingency event.

Operational performance monitoring of the Category 4 and Category 3 water ponds will determine ultimate usage of the Category 4 pond.

#### **4.3.11 Irrigation Cells**

It is proposed to construct four irrigation areas of 15ha each. These have been titled irrigation “cells” for the reason that it is intended to construct a simple 2m high bank with an approximate 3m crest around each of the cells. The 2m embankments would have 1 in 3 internal and external batters and a key of minimal depth sufficient to penetrate the B horizon by approximately 0.5m.

In times of extreme rain events it may be necessary to sacrifice the forage/silage crops growing in part or all of one or at the most two “cells” for limited periods of time. The details of sacrificing the crops being grown in each of these cells will be further explained in subsequent sub-sections.

The construction of the embankment and re-topsoiling of the “cell” floor shall be:

- To remove a small section of A horizon soils and place those A horizon soils in a nearby stockpile;
- The B horizon is then removed to construct the cell walls;
- When sufficient B horizon has been removed from the area stripped of A horizon, the A horizon from an adjoining strip within the cell area shall be removed and placed over the area where the B horizon has been previously removed;
- The new B horizon is then removed for cell wall construction;



- When an appropriate amount of B horizon has been removed, the A horizon from the third area to be stripped is placed back in the area completed; and
- This process is continued across the whole of each of the cells with the stockpiled A horizon placed back over the last section after the B horizon has been used area.

The volume of earth to be removed from B horizon is approximately 22.5cm as has been depicted in Annexure 22.0.

Within each cell consideration will be given to the construction of one or two simple rice paddy sized banks to further sub-divide each cell for optimal storm event management and minimal impact on any growing crop.

It is intended to install a spray irrigation system which will most likely be solid set. This spray irrigation system will have its rate of application designed to not exceed the infiltration rate of the soil.

Following installation of the spray irrigation system it is intended to establish raised beds with a GPS guided system to further assist with rain management and ensure rainfall/storm runoff with minimal impact on crop.

A map of the enhanced waste water management system with the Category 3 re-cycle ponds, the contingency Category 4 evaporation pond and the four spray irrigation cells is inserted over page.

#### **4.3.12 Forage Crops Grown in Irrigation Cells**

The preferred forage crops to be grown within the irrigation cells are:

- Maize for silage as the summer crop; and
- Oats or other winter cereal crop for silage.

Further consideration will be given to growing forage sorghums and other similar crops if such crops are the best crop for the system. The main deciding factors for producing cereal silage crops will be their potential for uptake of specific nutrients in the waste water and to optimise cattle rations.

Maize for silage will be sequentially planted from late September/early October each year through until December. The aim is to spread out the establishment, growth and harvest periods and to also spread out irrigated crop water requirements.

After a fallow of two to three months a winter cereal crop will then be sequentially established for an early to mid spring silage harvest.

There will be two crops grown on each parcel of land in any 12 month period. That is a maize silage crop will be followed by winter cereal followed by another maize in the next cropping year.

Annual soil testing for monitoring potential nutrient and salt build-up and for the determination of additional fertiliser needs shall be undertaken in accordance with documented best practice procedures. Decisions on the quantum of annual artificial fertiliser application to augment those nutrients within the managed waste water will be made in response to the system performance monitoring program.

In particular every effort will be made to ensure optimisation of uptake of nutrients and salts where possible by the forage crops. The nutrients and salts being taken up by the crops would be recycled through the dairy cattle and thereby reduce the mass of nutrients which would normally be imported into the project site as depicted in the original EA.



Assuming silage will be made from the forage crops grown in the irrigation cells, it is intended to cart the green material off-site to a nearby contracted CICL farm which is already growing and ensiling crops for the proposed integrated ethanol and dairy project. Thus there will be no construction of silage pits within the project site.

#### **4.3.13 Irrigation of Native Vegetation**

It is considered a low priority and less than best practice to fully irrigate native vegetation. Such a practice is inconsistent with the preferred habitat management for native flora species and the dependent native fauna.

Despite the preference for growing native species under natural conditions, it is imperative from a site aesthetic and project risk management perspective that native species do not excessively thin themselves out nor succumb to stresses of long hot and dry summers and autumns.

Therefore on a limited basis it is anticipated that the native vegetation would be:

- Assuredly established with augmentation of water needs by way of irrigation; and
- During the post establishment period to irregularly receive token amounts of supplementary water in especially the mid/late summer and autumn period up until the winter break arrives.

Refer SOC commitment 289.

In applying irrigation water to native plantings it is intended that only 20% of optimum water needs (ie  $K_c = 0.2$ ) would be applied over larger areas rather than supplying full demand amounts of water to smaller sections of the native plantings. Through this process and by rotation of the areas of native species being watered, no one area will be favoured and there will be significant dispersion of any irrigation water throughout the native plantings.

By such constrained volumes being applied the soil will remain essentially dry down to close to wilting point for most species. This water “deficit” strategy will ensure that significant amounts of rain will be absorbed into the soil profile and be effectively utilised by the native plantings. Furthermore, any potential rise in groundwater will be utilised by the native plantings and thus the project native plantings will contribute to regional groundwater management.

It is only excess water beyond that needed for the irrigation cells which will be used to water the native species.

#### **4.3.14 Surplus Category 3 Water**

All the water modelling indicates all the Category 3 water will be used on-site and no surplus Category 3 water will move off-site even in a decile extreme (DX) year. However, should an unforeseeable extreme event occur it is intended that the following options will be assessed and implemented in the appropriate order of priority at that time:

- Plan B - to purchase a nearby and/or adjacent Coleambally farm/s with suitable soils and landscape on which any additional Category 3 water may be sustainably used when mixed with CICL water for irrigation purposes;
- Plan C – to reach agreement with a nearby Coleambally farm/s and/or by another similar entity to augment their supplies of water from CICL; and
- Plan D – to build a pipeline direct to the already owned Four Arrow's Group Coleambally main Farms No's. 25 and 26 to the east along Eulo Road.

Refer SOC commitment 290.



Each of the above fallback options will require additional investigations and approvals prior to adoption. Hence constant performance monitoring and reporting will provide substantial lead-time for investigations and timely approvals.

At no point in time will it be intended to discharge surplus Category 3 water into DC400 or to inappropriately otherwise manage the disposal of surplus Category 3 water.

#### **4.3.15 Water Mass Balances**

Attached as Annexure 16.0 are revised water mass balances for a decile 5 (D5) and decile extreme (DX) year. A description of these two decile years was included in the original EA.

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 that have occurred 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 three pages of summary viz:
  - Page 1 – limited to meteorological data and the water balances in the Category 1 and Category 2 water storages;
  - Page 2 - water balances in the new Category 3 water recycle ponds and a possible Category 4 evaporation basin; and
  - Page 3 – the water balances and the sequential flow of water through each of the irrigation cells;

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

Within the four Category 3 water recycle ponds, the water is assumed to flow into these ponds on an aggregated basis with water being directed on an operational basis to any one or more 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 and to manage the oxygen and odour status of the water.

A total of 30ML of additional CICL channel water will be required to augment the evaporation losses which occur during the operation of the uncovered ponds and in the flushing of the freestall flush lanes. The 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

Excess water in the Category 3 ponds will be directed initially to Cell 1 of the irrigation cells.

In an average year it is expected that 275ML will be directed initially to irrigation cell 1.

All water received at irrigation cell 1 will be subjected to a decision tree process. If the crops within Irrigation Cell 1 required water, then water will be applied to those crops in accordance with Sub-section 4.3.12. Any water not required for use by way of irrigation in cell 1 will then be directed to cell 2 where the water will be subjected to the same “decision-tree” process. Assuming surplus water still remains after the decision tree application at cell 2 then that extra water will be directed subsequently to cells 3 and 4 under similar “decision-tree” processes.



Under monthly time-step modelling additional irrigation water is to be supplied direct from CICL main supply system to cells 2, 3 and 4 in both the D5 and DX years. Water applied to landscaped areas is depicted at the bottom of the cell 4 water mass balances.

In a DX year the flow of water follows the sequence found in a decile 5 year (D5) with the following variations:

- Even in a DX year the summer crop in cells 3 and 4 still need to be irrigated to finish summer crops in especially the first few months. This will be further facilitated with the inclusion of the internal rice embankments;
- Cell 4 begins to be flooded post-summer forage crop harvest in April and will remain near capacity for the remainder of the year. Surplus water begins to be pumped out of cell 4 for irrigation purposes back into cells 1 and 2 from November/December;
- Cell 3 remains unflooded in a DX year until September with the peaking of inundation at 35% of capacity by November dropping off quickly to 20% of capacity by December; and
- Winter crops are not able to be grown in any of the cells in a DX year and summer crops are able to be re-established in cells 1 and 2 within the spring of that extreme rainfall year.

The movement of water with the benefit of the above descriptors demonstrates the operational flow of water through the system is readily determined on the attached spreadsheets in Annexure 16.0.

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.

#### **4.3.16 Nutrient and Salt Mass Balances**

Attached as Annexure 17.0 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” on an assumed 4ML allocated per benefited hectare across the site. With the above crop rotation a total of 180ha of crop could be grown in 4 x 45ha lots, producing 967.5 tonnes of grain per year;
- A comparison of the incremental changes in the net changes in the total loading of the proposed project compared to the current averaged loading;
- The mass balance for the 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. The analysis data from water being delivered through CICL system was provided by Mr G Schultz Department of Natural Resources – samples obtained at the Gogelderie 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) through 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 17.0 is a summary of the salt and nutrient mass balances for each of the assessed elements. The following comments are a summary of the net outcomes assuming conservative likely yields from the forage crops (silage crops) being grown in the irrigation cells:

- Nitrogen – 8.1t/year is being directed to the irrigation cells to which would need to be added a further 20.3 tonnes of fertiliser N to ensure optimal crop performance;
- Phosphorus – 2.5t/year is being applied to the crops in the waste water. Additional artificial fertiliser of 1.8t/year is required leaving a net accumulation of zero tonnes of phosphorus;
- Potassium – 8.5t/year is applied as nutrient in waste water which is augmented by 11.2t/year as artificial fertiliser;
- Calcium – 22.7t/year is applied in the waste water to the irrigation cells with 17.0 tonnes being removed by the crops leaving 5.7 tonnes to accumulate;
- Magnesium – 19.9t/year are applied to the irrigation cells with 4.3 tonnes being removed in plant product for a net annual accumulation of 15.6 tonnes; and
- Sodium – 12.8t/year are applied and conservatively only 2.8 tonnes are removed leaving an accumulation of 10.0 tonnes. This rate of Na accumulation is 8.3 tonnes less than the 18.3t/year accumulating under current and foreseeable land use practices should the project not proceed.

To the above would be added token amounts of elements/nutrients contained in the extra CICL water purchased to replace evaporative losses. These token amounts are detailed in the table within Section 3.11.1.2.

The two primary and crucial calculations are the calcium:magnesium ratio of 1.1 and sodium absorption ratio of 1.4 in the waste water applied to the irrigation cells. These ratios indicate additional calcium could be applied to the soils as lime and/or gypsum to maintain soil structure.

Of particular note is that the reclaimed Category 3 waste water being applied to the irrigation cells is of significantly better quality than the existing groundwater (Table 4.0 Section 3.11.1.2) found at the project site.

The project environmental engineer has reviewed the analyses of the nutrient and salt mass balances and had advised that the project wastewater is of a quality which can be managed in a sustainable manner:

- Within the proposed irrigation system;
- Within the proposed Category 3 water storages without any geo-membrane liner; and
- Any geo-membrane liner requirement is technically not necessary but could be incorporated if required.



The balance of the above elements, the rate of accumulation of key elements and quantum of accumulation indicate a sustainable irrigation system which is further protected by the application of irrigation best management practices as defined in FAO Irrigation and Drainage Paper No. 47.

The adoption of FAO 47 practices is recommended for project risk management.

#### 4.3.17 Benchmark Data

As a benchmark, the total area proposed to be irrigated is 80ha of both productive irrigation (60ha) and native buffer plantings (20ha). Because the native plantings will only be partially irrigated to  $K_c = 0.2$ , the equivalent area of fully irrigated lands is  $K_c 0.2 \div K_c 1.01 \times 20ha = 4ha$ .

Therefore the total equivalent of fully irrigated lands is  $60ha + 4ha = 64ha$ .

The proposed dairy project shall only have 14,000 head of cattle under normal operations. However, if there is a market concern the short peak could be 18,000 head for up to 3 – 5 months on an estimated 1 year in 5 to 1 year in 10.

In 2006 a major beef feedlot was approved which intended to dispose of waste water by way of surface irrigation. That approval equated to 4.75ha of irrigation per 1,000 head of cattle. A comparison of the benchmark data is as follows:

Project dairy	- @ 14,000 cattle	4.57ha/1,000 head
	- @ 18,000 cattle	3.56ha/1,000 head
Beef Feedlot		4.75ha/1,000 head

Given the substantial differences in waste water quality:

- between the proposed Four Arrows Ethanol Pty Ltd dairy project and the approved feedlot;
- between freestall dairies and beef feedlots in general; and
- between the proposed irrigation systems to be employed.

Then the above benchmarks affirm viability of the proposed new enhanced waste water management system for the integrated Four Arrows Ethanol Pty Ltd project.

Annual performance monitoring of the waste water management system will ensure the risk of impact on local groundwater will be minimal. Modelling of salt throughout the plant industry feed analysis and soil EC measurement to a depth of up to 3 metres will be undertaken should soil EC levels rise:

- to unacceptable levels; and
- at an unacceptable rate

then tile drainage of the site to intercept any further salts will be installed or the irrigation cells relocated to alternative appropriate sites on surrounding properties that may subsequently be purchased.

**ANNEXURE 4.0**

**EXCERPT FROM ORIGINAL EA DOCUMENT – A  
CONSULTATION WITH COUNTRY ENERGY**

The closest natural gas pipeline in the case of a Victorian supply is the Gasnet's Chiltern Valley pipeline terminating at Koonoomoo approximately 151km from Darlington Point and approximately 118km from Coleambally. The Envestra Company has a secondary main running 31km from Koonoomoo to Finley; however this pipeline would need to be upgraded to cater for the combined Coleambally, proposed development and Darlington Point demand. It has been suggested within the feasibility study this option may be too expensive.

The NSW option is more viable than the Victorian option in terms of the overall capital costs involved.

The townships of Darlington Point and Coleambally would benefit significantly from the supply of natural gas. It is unlikely the pipeline would have been supplied under the current population conditions. However, with the inclusion of the ethanol plant this has meant a natural gas supply could be now a viable option to these townships.

Gas will be available for both domestic and commercial use. Domestic supply will provide alternatives for heating and cooking. At present energy for domestic users is only available from gas cylinders and/or reticulated electricity. Gas availability to commercial enterprises has the potential to attract more industry to both the Coleambally and Darlington Point areas, therefore providing economic benefit to these townships.

### ***Electricity***

Country Energy has deemed that no further infrastructure external to the property boundary is required to deliver an electrical supply to the combined ethanol and dairy enterprise under the current loading assessments that can be established at this stage of the proposal. A 33KV line already exists adjacent to the project property, running parallel to the eastern boundary and which supplies electricity to the Coleambally township. Other electrical infrastructure requirements such as mains, transpower stations, underground supplies and internal wiring will be established during the design and planning stages.

### ***Roadways***

Figure 3.3.3: *Access, Egress and Internal Roadways* indicate roadways access point and egress points within and from the proposed development site. The roadways have been broadly classified under three (3) grades, namely:

Heavy vehicle access;

Staff/visitor vehicle access; and

Management vehicle access.

#### ***Heavy Vehicle Access***

Heavy vehicle access and movement within and to and from the site is a key component of the investigation of the EA (investigation undertaken in detail in Section 4.4). The preliminary design of roadways for heavy vehicle access on-site has been developed under the premise that heavy vehicle movement should, where possible, be maintained in a singular directional flow to avoid the risk of collision and/or injury. With this in mind dual heavy vehicle access has been provided as an internal/access point and an exit/egress. This has been undertaken not only to avoid possible risk of collision or injury, but to ease the efficiency of heavy vehicle access on to and off site in light of the large numbers anticipated as part of the operation of the development.

**ANNEXURE 5.0**

**DIRECTOR GENERAL'S ENVIRONMENTAL  
ASSESSMENT REQUIREMENTS 2006**



NSW GOVERNMENT  
Department of Planning

RECEIVED

6 FEB 2006

Contact: Chris Ritchie  
Phone: (02) 9228 6413  
Fax: (02) 9228 6465  
Email: chris.ritchie@d.pn.nsw.gov.au

Our ref: 9041080  
Your ref:

Mr Bill Booth  
Booth Associates  
PO Box 1458  
GRIFFITH NSW 2680

Dear Mr Booth,

**Proposed Darlington Point / Coleambally Ethanol Plant and intensive Dairy, "Tubbo" Station - Murrumbidgee Local Government Area**

I refer to your correspondence of 23 January 2006 in which you seek the Director-General's Environmental Assessment requirements under Part 3A of the *Environmental Planning and Assessment Act 1979* (the Act).

It should be noted that the Director-General's requirements have been prepared based on the information provided to date. Under section 75F(3) of the Act, the Director-General may alter or supplement these requirements if necessary and in light of any additional information that may be provided prior to the proponent seeking approval for the project.

You should ensure that you consult with the Department prior to submission of a draft Environmental Assessment to determine:

- fees applicable to the application;
- relevant land owner notification requirements;
- consultation and public exhibition arrangements that will apply; and
- number and format (hard-copy or CD-ROM) of the Environmental Assessments that will be required.

Following submission of the draft Environmental Assessment, consultation will occur with the relevant authorities to determine its adequacy. Should the Director-General consider that the Environmental Assessment does not adequately address the environmental assessment requirements, the Director-General may require the proponent to submit a revised Environmental Assessment to address those requirements. Once the Environmental Assessment has been accepted by the Director-General, the application will be publicly exhibited for at least 30 days.

Should you have any questions in relation to these requirements, or preparation of the Environmental Assessment generally please do not hesitate to contact Chris Ritchie, Senior Environmental Planning Officer, Office of Sustainable Development Assessments and Approvals, on (02) 9228 6413.

Yours sincerely

26.1.06

Chris Wilson  
A/Deputy Director-General  
As delegate for the Director-General

**ENVIRONMENTAL ASSESSMENT REQUIREMENTS UNDER PART 3A OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979**

<b>Project</b>	Construction and operation of an Ethanol Manufacturing Plant with a production capacity of 275 Million litres of ethanol per year and a free stall dairy operation with a capacity to milk 6,000 cows. The dairy cows will be fed on a diet based on dried/wet distillers grain from the ethanol plant.
<b>Site</b>	"Tubbo" Station, Darlington Point (Lots 78, 79, 80 and 112 DP 750986), Murrumbidgee Local Government Area
<b>Proponent</b>	Four Arrows Ethanol Pty Ltd
<b>Date of Issue</b>	24 January 2006
<b>Date of Expiration</b>	24 January 2008
<b>General Requirements</b>	<p>The Environmental Assessment must be prepared to a high technical and scientific standard and must include:</p> <ul style="list-style-type: none"> <li>• an executive summary;</li> <li>• a description of the proposal, including construction, operation, and staging;</li> <li>• an assessment of the environmental impacts of the project, with particular focus on the key assessment requirements specified below;</li> <li>• justification for undertaking the project with consideration of the benefits and impacts of the proposal;</li> <li>• a draft Statement of Commitments detailing measures for environmental mitigation, management and monitoring for the project; and</li> <li>• certification by the author of the Environment Assessment that the information contained in the Assessment is neither false nor misleading.</li> </ul>
<b>Key Assessment Requirements</b>	<p>The Environmental Assessment must include assessment of the following key issues:</p> <ul style="list-style-type: none"> <li>• <b>Air Quality</b> – the Environmental Assessment must include a comprehensive air quality impact assessment prepared in accordance with the <i>Approved Methods for the Modelling and Assessment of Air Pollutants in NSW</i> (DEC, 2005), and the <i>Assessment and Management of Odour from Stationary Sources in NSW</i>, with particular focus on particulate and odour emissions. This assessment must include a cumulative assessment from the ethanol plant and dairy. The Environmental Assessment must also include a full assessment of the impact of greenhouse gases from the proposal;</li> <li>• <b>Water Management</b> – the Environmental Assessment must include a water balance for the site, including details on water sources, water consumption, recycling and the impact of any water release from the site on surface and groundwater. This assessment must also detail potential impacts on surrounding landholders and water licence holders;</li> <li>• <b>Transport</b> – the Environmental Assessment must include a Traffic Impact Study (TIS) prepared in accordance with the RTA's publication <i>Guide to Traffic Generating Developments</i>. The TIS must include details on the nature/mode of traffic generated, transport routes, traffic volumes and the potential impact of this on local and regional roads and intersections. Details on site access, internal roadways, infrastructure works and parking must also be provided. The Environmental Assessment must also provide an assessment on the use of rail for the project;</li> <li>• <b>Noise and Vibration</b> – the Environmental Assessment must include an assessment of the predicted noise impacts resulting from all noise sources, including rail and road traffic noise and the measures to manage any noise impacts. The noise assessment must be undertaken in accordance with the <i>Industrial Noise Policy</i> (EPA, 1999) and <i>Environmental Criteria for Road Traffic Noise</i> (EPA, 1999);</li> <li>• <b>Hazards and Risk</b> – the Environmental Assessment must include an assessment of the potential hazards and risks associated with the proposed project. A preliminary risk screening must be completed in accordance with <i>State Environmental Planning Policy No. 33</i> –</li> </ul>

	<p><i>Hazardous and Offensive Development (SEPP 33) and Applying SEPP 33 (DUAP, 1994), and where necessary, a Preliminary Hazard Analysis (PHA) undertaken;</i></p> <ul style="list-style-type: none"> <li>• <i>Waste Management</i> – the Environmental Assessment must identify the quantity and nature of all liquid and solid waste to be stored, disposed and/or treated at the site and describe how this waste would be handled, processed and, if necessary, disposed of, in accordance with the DEC's <i>Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes</i>.</li> <li>• <i>General Environmental Risk Analysis</i> – notwithstanding the above key assessment requirements, the Environmental Assessment must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of these additional key environmental impacts must be included in the Environmental Assessment.</li> </ul>
<p><b>Consultation Requirements</b></p>	<p>You must undertake an appropriate and justified level of consultation with the following parties during the preparation of the Environmental Assessment:</p> <ul style="list-style-type: none"> <li>• Department of Environment and Conservation;</li> <li>• Department of Natural Resources</li> <li>• Murrumbidgee Shire Council;</li> <li>• Department of Primary Industries</li> <li>• Roads and Traffic Authority;</li> <li>• Australian Rail Track Corporation; and</li> <li>• affected residents and relevant community groups.</li> </ul>
<p><b>Deemed refusal period</b></p>	<p>Pursuant to clause 3E(2) of the <i>Environmental Planning and Assessment Regulation 2000</i>, the deemed refusal period for the project will be 60 days.</p>

**ANNEXURE 6.0**

**AMENDED ENVIRONMENTAL BALANCE SHEET (EBS)**

**Environmental Balance Sheet : Four Arrows Ethanol Pty Ltd (Coleambally)**



Heads of Consideration	Option A: Combined dairy/ethanol on proposed site			Option B: Dairy to Tubbo & ethanol on proposed site			Option C: Both dairy & ethanol plant to Tubbo		
	Rating	Comments	Rating	Comments	Rating	Comments			
1 Flora terrestrial	7	potential extensive plantings of locally indigenous natives	7	potential extensive plantings of locally indigenous natives	7	potential extensive plantings of locally indigenous natives			
2 aquatic	6	potential substantial plantings to a wetlands area	6	potential substantial plantings to a wetlands area	6	potential substantial plantings to a wetlands area			
3 Fauna terrestrial	8	potential creation of wildlife corridor between Boona & Brett state forests	8	potential creation of wildlife corridor between Boona & Brett state forests	8	potential creation of wildlife corridor between Boona & Brett state forests			
4 aquatic	7	potential creation of wetlands habitat to achieve the objectives of the Coleambally LWMP	7	potential creation of wetlands habitat to achieve the objectives of the Coleambally LWMP	7	potential creation of wetlands habitat to achieve the objectives of the Coleambally LWMP			
5 Habitat avian	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome			
6 other terrestrial	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome			
7 aquatic	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome			
8 Environmental connectivity	8	excellent with an integrated site design	8	excellent with an integrated site design	8	excellent with an integrated site design			
9 Archaeology	8	suspected low potential	8	suspected low potential	8	suspected low potential			
10 Heritage	8	no impact expected	8	no impact expected	8	no impact expected			
11 Landscape consistency A	7	consistent with nearby Sunrice infrastructure	7	ethanol plant consistent with nearby Sunrice infrastructure	6	in a more remote location away from other infrastructure			
12 consistency B	7	consistent with the Coleambally Irrigation area	7	consistent with the Coleambally Irrigation area	7	consistent with the Coleambally Irrigation area			
13 Infrastructure natural gas	8	provide direct link into Coleambally township	8	provide direct link into Coleambally township	5	still be used for continuing into Coleambally but at possible greater cost			
14 electricity	8	available at site without substantial additional works	5	not available at site - thus requiring additional infrastructure	3	not available at site - thus requiring additional infrastructure			
15 water	8	available at site with the inclusion of additional storage design ensuring uninterrupted supply during CICL winter shutdown	5	although CICL water is available its winter access would fragment operations and potentially be more costly	8	available at site with the inclusion of additional storage design ensuring uninterrupted supply during CICL winter shutdown			
16 roads	8	direct & shortest route along highway without secondary roads and bridges being unduly pressured or upgraded	5	would require significant upgrade and extra maintenance of secondary roads and bridges throughout CIA	2	would require significant upgrade and extra maintenance of secondary roads and bridges throughout CIA			
17 Weeds	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings			
18 Pests vertebrate	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings			
19 invertebrate	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings			
20 Traffic hazards - fauna	4	the risk of collision due to kangaroos crossing and birds feeding alleviated using caution sign posting	4	the risk of collision due to kangaroos crossing and birds feeding alleviated using caution sign posting	4	the risk of collision due to kangaroos crossing and birds feeding alleviated using caution sign posting			
21 Odour	7	no suspected impact due to location of neighbouring receptors except for company owned housing	6	potential odour reduction at Coleambally site due to facility separation	6	no suspected impact due to location of neighbouring receptors except for company owned housing			
22 Dust	8	relatively minor	8	relatively minor	8	relatively minor			
23 Noise	6	suspected potential for minor impact	7	potential noise reduction at Coleambally site due to facility separation	5	increased heavy vehicle traffic along secondary roads			
24 Visual amenity	8	development will be designed to be aesthetically pleasing with extensive plantings of native species	8	development will be designed to be aesthetically pleasing with extensive plantings of native species	8	development will be designed to be aesthetically pleasing with extensive plantings of native species			
25 Traffic volume	5	potential for substantial increases contained to major highway	3	potential for substantial increases to major highway and secondary roads	3	potential for substantial increases to major highway and secondary roads			
26 safety	7	potential to create hazards requiring additional roadway upgrades access and egress locations	5	potential increased risk to localised traffic on secondary roads	5	potential increased risk to localised traffic on secondary roads			
27 access	8	all directed to one site with well designed, constructed and maintained traffic control lanes, signage & lighting	6	not all as well managed & controlled through constructed and maintained traffic control lanes, signage & lighting	6	not all as well managed & controlled through constructed and maintained traffic control lanes, signage & lighting			
28 consistency	7	consistent with the role of a major highway	5	only small part of traffic is consistent with the role of a major highway	5	increased secondary road traffic not consistent with the nature and management of those roads			
29 Hydrology ethanol	8	not expected to be an issue	8	not expected to be an issue	8	not expected to be an issue			
30 dairy	8	not expected to be an issue	8	not expected to be an issue	8	not expected to be an issue			
31 Hydrogeology ethanol	8	not expected to be an issue	8	not expected to be an issue	8	not expected to be an issue			
32 dairy	6	potentially a major issue but with attention to engineered solutions and performance monitoring can be well managed	6	still a potentially major issue but may cost less to mitigate with engineered solutions and performance monitoring	6	still a potentially major issue but may cost less to mitigate with engineered solutions and performance monitoring			
32 soils foundations	7	anticipated to be suitable for project structures	7	anticipated to be suitable for project structures	7	anticipated to be suitable for project structures			
33 water storages	6	will require engineering solutions and the installation of performance monitoring equipment	6	require attention to geotechnical and structural engineering with performance monitoring to ensure desired outcomes	6	require attention to geotechnical and structural engineering with performance monitoring to ensure desired outcomes			
34 water supply	9	CICL supply has the potential to be adequate	9	CICL supply has the potential to be adequate	9	CICL supply has the potential to be adequate			
35 drainage	9	all water to be managed on site in all but extreme wet year (>40% above wettest recorded year)	8	not as easy to integrate all three (3) categories of water quality	9	all water to be managed on site in all but extreme wet year (>40% above wettest recorded year)			
36 Wastes manure	8	the potential to replace significant need for artificial fertilisers at Tubbo irrigation	8	the potential to replace significant need for artificial fertilisers at Tubbo irrigation	8	the potential to replace significant need for artificial fertilisers at Tubbo irrigation			
37 water	8	designed to be processed on-site through an aerobic/anaerobic system with recycling through sheds	8	designed to be processed on-site through an aerobic/anaerobic system with recycling through sheds	8	designed to be processed on-site through an aerobic/anaerobic system with recycling through sheds			
38 animals	8	potential to bury at Tubbo in accordance with agreed disposal standards	8	potential to bury at Tubbo in accordance with agreed disposal standards	8	potential to bury at Tubbo in accordance with agreed disposal standards			
39 Chemicals	8	will be managed in accordance with industry guidelines integrating OH+S requirements	8	will be managed in accordance with industry guidelines integrating OH+S requirements	8	will be managed in accordance with industry guidelines integrating OH+S requirements			
40 Security	8	will be relatively secure at one well contained site with all access egress through gated & staffed control points	5	will require additional resources because of split operations	8	will be relatively secure at one well contained site with all access egress through gated & staffed control points			
41 Greenhouse gasses	8	no net adverse greenhouse gas balance envisaged due to offsets being integrated into site design	8	no net adverse greenhouse gas balance envisaged due to offsets being integrated into site design	8	no net adverse greenhouse gas balance envisaged due to offsets being integrated into site design			
42 Products distillers grain	8	potential to supply regional demand or extrude into pelleted livestock feed mixes - easy access to site	8	potential to supply regional demand or extrude into pelleted livestock feed mixes - easy access to site	8	potential to supply regional demand or extrude into pelleted livestock feed mixes - easy access to site			
43 ethanol/CO2	8	potential commercial markets available irrespective of site	8	potential commercial markets available irrespective of site	8	potential commercial markets available irrespective of site			
44 Social CIA community	9	the potential to give confidence to invest in township and in surrounding district	9	the potential to give confidence to invest in township and in surrounding district	9	the potential to give confidence to invest in township and in surrounding district			
45 CICL	9	the potential to provide confidence in CIA irrigators and CICL for optimisation of land, water and other resources	9	the potential to provide confidence in CIA irrigators and CICL for optimisation of land, water and other resources	9	the potential to provide confidence in CIA irrigators and CICL for optimisation of land, water and other resources			
46 local business	9	the potential to generate greater access to a wider range of professional & managerial skills for all businesses	9	the potential to generate greater access to a wider range of professional & managerial skills for all businesses	9	the potential to generate greater access to a wider range of professional & managerial skills for all businesses			
47 Economic regionally	9	suspected flow-on benefits to all regional communities for supply of product to project	9	suspected flow-on benefits to all regional communities for supply of product to project	9	suspected flow-on benefits to all regional communities for supply of product to project			
48 nationally	9	proposed development consistent with national biofuels action plan targets	9	proposed development consistent with national biofuels action plan targets	9	proposed development consistent with national biofuels action plan targets			
49 Commercial project itself	9	a single, integrated project with tight managerial control of operations, and with business critical mass	6	a more difficult project to staff & manage because of split locations and the non integration of enterprises	9	a single, integrated project with tight managerial control of operations, and with business critical mass			
50 other	8	located between other Four Arrows Group rural investments and adds to the sustainability of those investments	7	located between other Four Arrows Group rural investments but fragmentation detracts from investment	7	located between other Four Arrows Group rural investments but fragmentation detracts from investment			
<b>Total scores</b>	<b>393</b>		<b>373</b>	<b>-20</b>	<b>366</b>	<b>-27</b>			

**Notes :**  
 : The values are not important in their own right even though they are within a 0-10 scale.  
 : Values represent a shift in either a positive or negative direction from an arbitrary value.  
 : **The crux of the values** is their relationship to each alternative option.  
 : Shift to higher number indicates an improvement in the "head of consideration".  
 : A decline in the number from the current rating indicates a decline in quality.

green cells = improvement in the head of consideration  
 no colour = no perceived change in the head of consideration  
 red cells = degradation in the head of consideration

**ANNEXURE 7.0**

**BEST CASE (EBS) SCORES FOR HEADS OF  
CONSIDERATION**

# Environmental Balance Sheet : Four Arrows Ethanol Pty Ltd (Coleambally)



Heads of Consideration	Option A: Combined dairy/ethanol on proposed site		Option B: Dairy to Tubbo & ethanol on proposed site		Option C: Both dairy & ethanol plant to Tubbo	
	Rating	Comments	Rating	Comments	Rating	Comments
1 Flora terrestrial	7	potential extensive plantings of locally indigenous natives	7	potential extensive plantings of locally indigenous natives	7	potential extensive plantings of locally indigenous natives
2 aquatic	6	potential substantial plantings to a wetlands area	6	potential substantial plantings to a wetlands area	7	potential substantial plantings to a wetlands area
3 Fauna terrestrial	8	potential creation of wildlife corridor between Boona & Brett state forests	8	potential creation of wildlife corridor between Boona & Brett state forests	5	no linkage of state forests or the creation of other specific high value habitats
4 aquatic	7	potential creation of wetlands habitat to achieve the objectives of the Coleambally LWMP	7	potential creation of wetlands habitat to achieve the objectives of the Coleambally LWMP	7	creation of wetlands habitat to achieve the objectives of the Coleambally LWMP
5 Habitat avian	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome
6 other terrestrial	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome
7 aquatic	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome	8	potential plantings structured & managed for optimum outcome
8 Environmental connectivity	8	excellent with an integrated site design	8	excellent with an integrated site design	8	excellent with an integrated site design
9 Archaeology	8	suspected low potential	8	suspected low potential	8	suspected low potential
10 Heritage	8	no impact expected	8	no impact expected	8	no impact expected
11 Landscape consistency A	7	consistent with nearby Sunrice infrastructure	7	ethanol plant consistent with nearby Sunrice infrastructure	6	in a more remote location away from other infrastructure
12 consistency B	7	consistent with the Coleambally Irrigation area	7	consistent with the Coleambally Irrigation area	7	consistent with the Coleambally Irrigation area
13 Infrastructure natural gas	8	provide direct link into Coleambally township	8	provide direct link into Coleambally township	5	still be used for continuing into Coleambally but at possible greater cost
14 electricity	8	available at site without substantial additional works	5	not available at site - thus requiring additional infrastructure	10	not available at site - thus requiring additional infrastructure
15 water	8	available at site with the inclusion of additional storage design ensuring uninterrupted supply during CICL winter shutdown	5	although CICL water is available its winter access would fragment operations and potentially be more costly	10	available at site with the inclusion of additional storage design ensuring uninterrupted supply during CICL winter shutdown
16 roads	8	direct & shortest route along highway without secondary roads and bridges being unduly pressured or upgraded	5	would require significant upgrade and extra maintenance of secondary roads and bridges throughout CIA	10	would require significant upgrade and extra maintenance of secondary roads and bridges throughout CIA
17 Weeds	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings
18 Pests vertebrate	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings
19 invertebrate	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings	8	will be well managed and controlled by both project staff and through competition from extensive native plantings
20 Traffic hazards - fauna	4	the risk of collision due to kangaroos crossing and birds feeding alleviated using caution sign posting	4	the risk of collision due to kangaroos crossing and birds feeding alleviated using caution sign posting	4	the risk of collision due to kangaroos crossing and birds feeding alleviated using caution sign posting
21 Odour	7	no suspected impact due to location of neighbouring receptors except for company owned housing	8	potential odour reduction at Coleambally site due to facility separation	7	no suspected impact due to location of neighbouring receptors except for company owned housing
22 Dust	8	relatively minor	8	relatively minor	8	relatively minor
23 Noise	6	suspected potential for minor impact	7	potential noise reduction at Coleambally site due to facility separation	2	increased heavy vehicle traffic along secondary roads
24 Visual amenity	8	development will be designed to be aesthetically pleasing with extensive plantings of native species	8	development will be designed to be aesthetically pleasing with extensive plantings of native species	8	development will be designed to be aesthetically pleasing with extensive plantings of native species
25 Traffic volume	5	potential for substantial increases contained to major highway	3	potential for substantial increases to major highway and secondary roads	1	potential for substantial increases to major highway and secondary roads
26 safety	7	potential to create hazards requiring additional roadway upgrades to access and egress locations	5	potential increased risk to localised traffic on secondary roads	1	potential increased risk to localised traffic on secondary roads
27 access	8	all directed to one site with well designed, constructed and maintained traffic control lanes, signage & lighting	6	not all as well managed & controlled through constructed and maintained traffic control lanes, signage & lighting	1	not all as well managed & controlled through constructed and maintained traffic control lanes, signage & lighting
28 consistency	7	consistent with the role of a major highway	5	only a small part of traffic is consistent with the role of a major highway	1	increased secondary road traffic not consistent with the nature and management of those roads
29 Hydrology ethanol	8	not expected to be an issue	8	not expected to be an issue	8	not expected to be an issue
30 dairy	8	not expected to be an issue	8	not expected to be an issue	8	not expected to be an issue
31 Hydrogeology ethanol	8	not expected to be an issue	8	not expected to be an issue	8	not expected to be an issue
32 dairy	6	potentially a major issue but with attention to engineered solutions and performance monitoring can be well managed	8	still a potentially major issue but may cost less to mitigate with engineered solutions and performance monitoring	8	still a potentially major issue but may cost less to mitigate with engineered solutions and performance monitoring
32 soils foundations	7	anticipated to be suitable for project structures	7	anticipated to be suitable for project structures	7	anticipated to be suitable for project structures
33 water storages	6	will require engineering solutions and the installation of performance monitoring equipment	7	require attention to geotechnical and structural engineering with performance monitoring to ensure desired outcomes	7	require attention to geotechnical and structural engineering with performance monitoring to ensure desired outcomes
34 water supply	9	CICL supply has the potential to be adequate	9	CICL supply has the potential to be adequate	9	CICL supply has the potential to be adequate
35 drainage	9	the potential to replace significant need for artificial fertilisers at Tubbo irrigation (>40% above wettest recorded year)	8	not as easy to integrate all three (3) categories of water quality	9	the potential to replace significant need for artificial fertilisers at Tubbo irrigation (>40% above wettest recorded year)
36 Wastes manure	8	designed to be processed on-site through an aerobic/anaerobic system with recycling through sheds	8	designed to be processed on-site through an aerobic/anaerobic system with recycling through sheds	8	designed to be processed on-site through an aerobic/anaerobic system with recycling through sheds
37 water	8	potential to bury at Tubbo in accordance with agreed disposal standards	8	potential to bury at Tubbo in accordance with agreed disposal standards	8	potential to bury at Tubbo in accordance with agreed disposal standards
38 animals	8	to be managed in accordance with industry guidelines integrating OH+S requirements	8	to be managed in accordance with industry guidelines integrating OH+S requirements	8	to be managed in accordance with industry guidelines integrating OH+S requirements
39 Chemicals	8	will be relatively secure at one well contained site with all access & egress through gated & staffed control point/s	5	will require additional resources because of split operations	8	will be relatively secure at one well contained site with all access & egress through gated & staffed control point/s
40 Security	8	no net adverse greenhouse gas balance envisaged due to offsets being integrated into site design	8	no net adverse greenhouse gas balance envisaged due to offsets being integrated into site design	8	no net adverse greenhouse gas balance envisaged due to offsets being integrated into site design
41 Greenhouse gasses	8	potential to supply regional demand or extrude into pelleted livestock feed mixes - easy access to site	8	potential to supply regional demand or extrude into pelleted livestock feed mixes - easy access to site	8	potential to supply regional demand or extrude into pelleted livestock feed mixes - easy access to site
42 Products distillers grain	8	potential commercial markets available irrespective of site	8	potential commercial markets available irrespective of site	8	potential commercial markets available irrespective of site
43 ethanol/CO <sub>2</sub>	8	the potential to give confidence to invest in township and in surrounding district	9	the potential to give confidence to invest in township and in surrounding district	9	the potential to give confidence to invest in township and in surrounding district
44 Social CIA community	9	the potential to provide confidence in CIA irrigators and CICL for optimisation of land, water and other resources	9	the potential to provide confidence in CIA irrigators and CICL for optimisation of land, water and other resources	9	the potential to provide confidence in CIA irrigators and CICL for optimisation of land, water and other resources
45 CICL	9	the potential to generate greater access to a wider range of professional & managerial skills fore all businesses	9	the potential to generate greater access to a wider range of professional & managerial skills fore all businesses	9	the potential to generate greater access to a wider range of professional & managerial skills fore all businesses
46 local business	9	suspected flow-on benefits to all regional communities for supply of product to project	9	suspected flow-on benefits to all regional communities for supply of product to project	10	suspected flow-on benefits to all regional communities for supply of product to project
47 Economic regionally	9	proposed development consistent with national biofuels action plan targets	9	proposed development consistent with national biofuels action plan targets	10	proposed development consistent with national biofuels action plan targets
48 nationally	9	a single, integrated project with tight managerial control of operations, and with business critical mass	6	a more difficult project to staff & manage because of split locations and the non integration of enterprises	10	a single, integrated project with tight managerial control of operations, and with business critical mass
49 Commercial project itself	9	local between other Four Arrows Group rural investments and adds to the sustainability of those investments	7	fragmentation detracts from investment	10	local between other Four Arrows Group rural investments but isolation detracts from investment
50 other	8					
<b>Total scores</b>	<b>393</b>		<b>373</b>	<b>-20</b>	<b>374</b>	<b>-19</b>

**Notes :** The values are not important in their own right even though they are within a 0-10 scale.  
 : Values represent a shift in either a positive or negative direction from an arbitrary value.  
 : The crux of the values is their relationship to each alternative option.  
 : Shift to higher number indicates an improvement in the "head of consideration".  
 : A decline in the number from the current rating indicates a decline in quality.

green cells = improvement in the head of consideration  
 no colour = no perceived change in the head of consideration  
 red cells = degradation in the head of consideration  
 black cells = respondents perfect score for head of consideration

**ANNEXURE 8.0**

**GROUNDWATER ANALYSIS SAMPLE FROM PROJECT  
PIEZOMETER**

*AAW 3.0  
15/1/2007  
Validation report*



Because the land is your life.



Nutrient Advantage

### Standard Interpretation Report

<b>Trading Name</b>	BOOTH ASSOCIATES	<b>Field Name</b>	P1
<b>Location</b>	Griffith	<b>Section of Field</b>	
<b>Contact Name:</b>		<b>GPS Latitude</b>	
<b>Work Phone:</b>		<b>Sample Type</b>	Water
<b>Adviser:</b>	Thane Pringle	<b>Lab Report No:</b>	233035
<b>Phone:</b>	02 6968 1011	<b>Crop:</b>	
<b>Interpretation:</b>	17-Jan-2007	<b>Growth Stage:</b>	
<b>Chart:</b>	401a	<b>Planting:</b>	
Irrigation - Cereals (identical to 401b due summer/winter selection)		<b>Longitude:</b>	
		<b>Depth:</b>	0 - 0 cm
		<b>Sample:</b>	20-Dec-2006
		<b>Target Yield (t/ha)</b>	0

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Analyte	Value	Status	Nutrient Rate kg/ha	Comment
pH WA	8.30	Optimum		Generally no action required
Elect. Conductivity dS/m WA	3.00			Refer to Salinity Class.
Chloride mg/L WA	710.0	High		Leaf tip burn and/or poor germination may occur at levels >350mg/kg. Dilute with good quality water and/or choose tolerant variety. Avoid leaf wetting. Refer to section 2.6.
Nitrate Nitrogen mg/L WA	1.00	Satisfactory generally		Generally no action required.
Sodium mg/L WA	350.0	High		Levels >70 mg/L may cause foliar damage if leaf wetting occurs, particularly if evapotranspiration is high. Mix with or alternate with lower sodium water; use a higher rate less frequently; soil test and if necessary, apply gypsum to the soil and/or water. Choose a more efficient irrigation system, e.g. drip or trickle. Refer to the notes on Sodium in section 2.8.
Potassium mg/L WA	7.00	Satisfactory generally		Generally no action required.
Calcium mg/L WA	100.0	High		High levels impact on water hardness, cause crusting in pipes, and may reduce a potential soil sodicity hazard.
Magnesium mg/L WA	63.00	Satisfactory generally		Generally no action required.
Carbonate meq/L WA	0.00	Satisfactory generally		Generally no action required.
Bicarbonate meq/L WA	4.30	High		The long term use of high bicarbonate water in dry areas may affect soil permeability, because with high evapotranspiration, calcium and magnesium precipitate out as carbonates thereby increasing the sodium hazard. The lack of available calcium ions may cause plant nutritional imbalances and reduce vigour of growth. Dilute with lower bicarbonate water or acidify.
Sulfur mg/L WA	88.00	High		For every 10 mg/L of sulfur in the irrigation water, reduce fertilizer sulfur application by 10 kg/ha for every 100 mm of water applied..
Iron mg/L WA	0.60	Satisfactory generally		Generally no action required.



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Nutrient Advantage

### Standard Interpretation Report

<b>Trading Name</b>	BOTH ASSOCIATES	<b>Field Name</b>	P1
<b>Location</b>	Griffith	<b>Section of Field</b>	
<b>Contact Name:</b>		<b>GPS Latitude</b>	
<b>Work Phone:</b>		<b>Sample Type</b>	Water
<b>Adviser:</b>	Thane Pringle	<b>Lab Report No:</b>	233035
<b>Phone:</b>	02 6968 1011	<b>Crop:</b>	
<b>Interpretation:</b>	17-Jan-2007	<b>Growth Stage:</b>	
<b>Chart:</b>	401a	<b>Planting:</b>	
Irrigation - Cereals (identical to 401b due summer/winter selection)		<b>Target Yield (t/ha)</b>	0

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Boron mg/L WA	0.04	Satisfactory generally	Generally no action required.
Copper mg/L WA	0.01	Satisfactory generally	Generally no action required.
Zinc mg/L WA	0.11	Satisfactory generally	Generally no action required.
Manganese mg/L WA	0.01	Satisfactory generally	Generally no action required.
Aluminium mg/L WA	1.20	Satisfactory generally	Generally no action required.
Phosphorus mg/L WA	0.10	Satisfactory generally	Generally no action required.
Fluoride mg/L WA	0.31	Satisfactory generally	Generally no action required.
Salinity Class WA	4.00	High	Very high salinity water. Generally unsuitable for Cereal crops. For salt tolerance ranking of plants refer to Tables 3 & 4 in the Water Interpretation Manual notes. Unsuitable water may be used if properly managed. Soil test and consider the following options: changing irrigation type to non leaf-wetting types (e.g. to drip or trickle systems), application timing, amount and frequency, dilution or alternating with good quality water, improving soil drainage, leaching of soluble salts from the soil, choice of tolerant species, consider salinity implications of fertilizer and gypsum application. Refer Section 2.3 of the Water Manual.
Sodicity Class WA	2.00	Moderate	Medium sodium. Increasing problems. If EC is < 0.4 dS/m, ignore Sodicity Classification but check individual ion concentrations, because the values are so low that soil structure is unlikely to be affected. Soil test before recommending a gypsum application. If EC <sub>e</sub> in soil is high, refer to soil interpretation for treatment details: gypsum may not be recommended and irrigation with this water may not be wise. Avoid sodium sensitive crops. Refer to the Water Interpretation Manual Notes - Sections 2.4. and 2.8.
Total Dissolved Ions mg/L WA	2000		Refer to Salinity Class.
Sodium Ads. Ratio (SAR) WA	6.80		Refer to Sodicity Class.



Because the land is your life.



Nutrient Advantage

### Standard Interpretation Report

<b>Trading Name</b>	BOOTH ASSOCIATES	<b>Field Name</b>	P1
<b>Location</b>	Griffith	<b>Section of Field</b>	
<b>Contact Name:</b>		<b>GPS Latitude</b>	
<b>Work Phone:</b>		<b>Sample Type</b>	Water
<b>Adviser:</b>	Thane Pringle	<b>Lab Report No:</b>	233035
<b>Phone:</b>	02 6968 1011	<b>Crop:</b>	
<b>Interpretation:</b>	17-Jan-2007	<b>Growth Stage:</b>	
<b>Chart:</b>	401a	<b>Planting:</b>	
Irrigation - Cereals (identical to 401b due summer/winter selection)		<b>Longitude:</b>	
		<b>Depth:</b>	0 - 0 cm
		<b>Sample:</b>	20-Dec-2006
		<b>Target Yield (t/ha)</b>	0

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Res. Sod. Carb.(RSC) meq/L WA	-5.90	Out of Range	
Water Hardness CaCO3 mg/L WA	510.0	High	Extremely hard water. Suitability of water based on water hardness is difficult to assess as it is usually defined by the user's tolerance. This water may pose difficulties when used for irrigation purposes and for fertigation. Scale formation is likely to occur in irrigation equipment as well as Calcium and Magnesium compounds precipitating out of solution if sulfates, phosphates or boron fertilizers are used in fertigation. Check CCSI. If scale formation is likely, and remember that hardness increases with temperature, - suggest bury/cover pipes to avoid heating by the sun. Remove scaling with a 3% inhibited sulfamic acid solution, or hydrochloric acid to achieve a system flow of 0.5-1.0% for 30 minutes.
Calcium Carbonate Saturation Index WA	1.30	> Optimum	Moderate risk of scale formation from Ca and Mg carbonates. Regular maintenance of pipes, pumps and emitters is recommended. Refer to hardness correction, section 2.5.5.

**Notes:** Interpretations and recommendations given here are a guide only, and depend on representative samples being analysed, additionally environmental and managerial factors influence production, therefore Incitec Pivot Limited and Dealers do not accept any liability whatsoever arising out of these interpretations and recommendations for any damage, loss or injury of any nature and the user takes these interpretations and recommendations on these terms. This recommendation is made in good faith, based on the best technical information available.

**Chart Use:** Occasionally Interpretations/Recommendations will be compiled using, as a basis only, a Chart referenced to a different crop or situation. This is necessary only if there is no Chart defined in the system for your crop or situation.

**Water Testing:** Assessment of water quality only takes account of the above chemical properties of the water. If you suspect potential problems from biological, physical or pesticide contamination, Incitec Pivot Limited advises you seek further advice from a suitable laboratory.