sustainable growth

DairySA
REGIONAL DEVELOPMENT PROGRAM

South East Catchment
Water Management Board

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Project Plan & Prospectus

Developing an Environmental Footprint for the Dairy Industry, South East South Australia

May 2003

1 Foreword

The SE Dairy Industry (SA) has experience strong growth in recent years through a combination of increased productivity on existing farms and a number of dairy farm conversions.

This growth is set to further increase over the next 10 years through a rapid expansion phase. Some 50% of the total 2010 projected South Australian industry increased milk production (750 million litres) is projected to come from the SE (SA).

Recent growth has already lead to increase use of inputs such as water, fertilizer, seed and supplementary feed. Consequently, this intensification has lead to increased environmental scrutiny of the dairy industry in the SE by other community stakeholders.

Despite the excellence demonstrated in industry growth, on the environmental front, the impacts associated with current dairy management practices in the South East of South Australia are unclear. At present the industry lacks monitoring and management mechanisms to demonstrate their commitment to sustainable land management practices and to net environmental improvement.

Sustainable Agriculture is an issue many raw material (fertilizer, chemical, seed, irrigation etc) suppliers, farmers, food processors and scientists world wide are yet to completely understand and achieve, so clearly the SE Dairy Industry is not alone in the need to resolve answers and implement change.

In April 2002, the SE Dairy Consultative Committee, in partnership with DairySA, DRDC, the SE Water Catchment Management Board and PIRSA commissioned an environmental scoping study.

This study reviewed a range of environmental issues and provide a "starting point" to the sustainable industry growth. An important outcome from this initiative was a clearer understanding of grower practices potentially impacting the environment and a summary community concerns about our industry.

Consequently, in partnership with DairySA, our committee of dairy farmers and consultants have developed this funding proposal to develop an environmental

footprint for SE dairy farming. Practices associated with ground water impact are planned to dominate the research focus for this study.

Our committee firmly believes that this footprint study will provide an important environment benchmark, assisting our farmers learn to measure and monitor their activities environmentally and to drive the development of best practices enabling matching of land capability to farm productivity.

It is clear from the outset that there is a need for this project and the participating farms to link with neighbouring land users and stakeholders, perhaps at a catchment or regional scale, in order to achieve net sustainability improvements. We will endeavour to create linkages as this project develops and gains momentum.

Planned and effective environmental improvement can only occur through a better understanding of current practices. This footprint study will provide an important and credible focus on environmental / sustainability indicator assessment, training and on farm implementation and provide a useful platform for the further development and rollout of an industry environmental management system.

Our committee and dairy industry invite your support in securing the much needed funds to facilitate this project over the next three years.

James Mann
Chairman
SE Dairy Consultative Committee
Dairy Farmer, Donovans Dairy
30 May 2003

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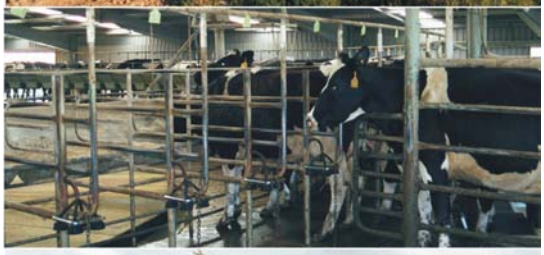
SE DAIRY FOOTPRINT 03/06

Table of Contents

1 FOREWORD 1
2 PROJECT ADMINISTRATIVE DETAILS 3
3 BACKGROUND 4
3.1 Setting the Compass for Sustainable Growth 4
3.2 Scoping Study – April to October 02 4
3.3 Why the SE & Why Now; 5
3.4 Scoping Study Summary 5
3.4.1 Scoping Study Process 5
3.4.2 The Key Learning's to Date 5
3.4.3 Challenges to Sustainable Industry Growth; 6
4 FOOTPRINT DELIVERABLES 7
4.1 Objectives 7
4.2 Critical Success Factors 7
4.3 Benefits 7
4.4 Outputs 7
4.5 Outcomes 7
4.6 Potential Impediments 7
5 INDUSTRY ADOPTION 8
5.1 Who is the target audience(s)? 8
5.2 What is the strategy(ies) for implementation 8
5.3 How will the proposal's outcomes be evaluated? 8
6 METHODOLOGY 9
6.1 Overview 9
6.2 Literature Review & Methods Research / Development 10
6.2.1 Broad Approach: 10
6.2.2 Why Do This Step – where is the value?: 10
6.3 Farm Selection 10
6.3.1 Broad Approach: 10
6.3.2 Why Do This Step – where is the value?: 10
6.4 Understand the Natural Resource Base & Monitoring Site Selection. 10
6.4.1 Broad Approach: 11
6.4.2 Why Do This Step – where is the value?: 11
6.5 Detailed Initial Environmental Risk Assessment 11
6.5.1 Broad Approach: 11
6.5.2 Why Do This Step – where is the value?: 11
6.6 Three Year Monitoring Study 12
6.6.1 Broad Approach: 12
6.6.2 Possible Footprint Sustainability Indicators 13
6.6.3 Why Do This Step – where is the value?: 15
6.7 Activity Timeline 15
7 INTELLECTUAL PROPERTY 16
7.1 Commercialisation path 16
7.2 Freedom to Use IP Commercially 16
7.3 IP Already Held 16
7.4 IP Anticipated from Project/Program 16
7.5 Identified/Potential Commercialisation Partners 16
8 RESOURCE ALLOCATION 17
9 ACTIVITIES 18
10 TIMETABLE 19
11 TEAM MEMBERS 20
11.1 Team details 20
12 RISK MANAGEMENT 21
13 ADMINISTRATION OF THE PROJECT/PROGRAM 22
14 CERTIFICATION 22





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2 Project Administrative Details

Developing an Environmental Footprint for the Dairy Industry, South East South Australia

DairySA Project Joint Funding Proposal

Project Number	DSAsp0085
Project/Program Director:	Mr James Mann, Chairman, SE Dairy Consultative Committee
	Farm Manager, Donovan's Dairy, Mount Gambier
Mailing Address:	RSD 6770, Mount Gambier, SA 5296
Phone:	08 87 38 4259
Fax:	08 87 384 271
Mobile:	0417 802 808
Email:	donovansdairy@ozemail.com.au
Project Manager:	Mr Jamie McMaster, Director & Environmental Consultant
	MAC Global Pty Ltd, *trading as* Outsourced Environmental
Legal Entity Details:	MAC Global Pty Ltd., ACN. 304 050 828, ABN: 665 042 623 92
Mailing Address:	PO Box 169, THE BASIN VIC 3154
Telephone:	03 9761 0204
Facsimile:	03 9761 0024
Mobile:	0407 317 288
Email:	jamie.mcmaster@outsourcedenvironmental.com.au
Web:	www.outsourcedenvironmental.com.au

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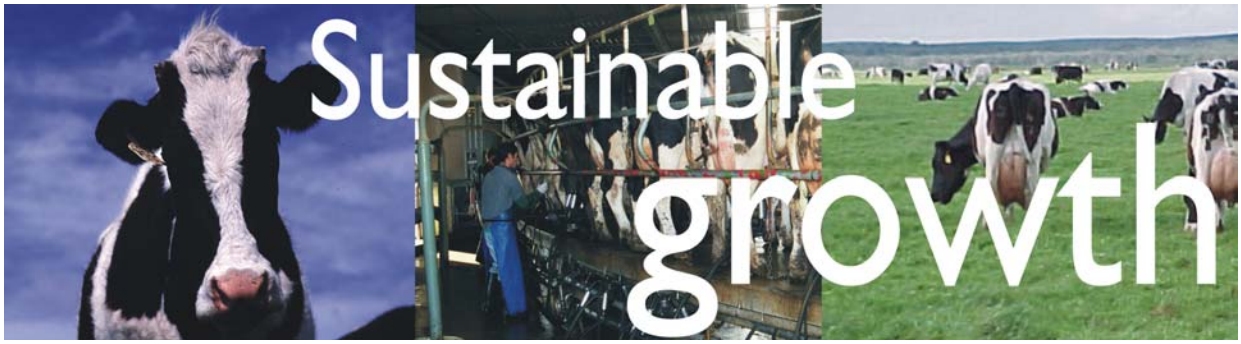

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3 Background

The SA Dairy industry Strategic Plan for 2010 highlighted significant growth potential for South Australia.

The SE Dairy Industry (SA) is in a rapid expansion phase with 50% of the anticipated increase in milk volume for SA projected over the next 10 years likely to come from SE Dairy Farms.

3.1 Setting the Compass for Sustainable Growth

While the meaning of "Sustainability" may change from one social and professional context to another, a suitable working definition for the purpose of this footprint project and the SE Dairy industry includes;

Sustainable Agriculture is the use of farming practices and systems which maintain or enhance:

- The economic viability of agricultural production;
- The natural resource base; and
- Other ecosystems, which are influenced by agricultural activities.

The SE Dairy Industry approach to sustainable development and growth needs to involve the adoption of farm practices that enable:

- Production of fodder and crops with high yield and nutritional quality to meet existing and future needs, while keeping resource inputs as low as possible,
- Ensuring that any adverse effects on soil fertility, water (surface & ground water) and air quality and biodiversity from agricultural activities are minimised and positive contributions are made where possible,
- Optimising the use of renewable resources while minimising the use of non- renewable resources.

Sustainable agriculture should enable dairy farmers and their respective local communities to protect and improve their well-being and environment. The challenge the SE Dairy Industry has is to find ways in which farming can become more productive, protect the environment, preserve natural resources and contribute to rural communities, while using fewer agrochemicals and other inputs. It poses a huge challenge for all involved in agriculture: farmers, scientists, experts, governments and businesses such as milk processors.

Environmental indicators that we believe relate to agricultural sustainability include;

- Soil Fertility & Health
- Soil Loss
- Nutrient Management
- Pest Management
- Biodiversity
- Product Value
- Energy
- Water Management
- Social & Human Capital
- Local Economy

3.2 Scoping Study – April to October 02

Accordingly, a scoping study commissioned in April 2002, facilitated a process to identify the key environmental issues, concerns and priorities of SE Dairy Farmers, the Community and Local Government stakeholders.

In addition, this initial study aimed to develop a road map for sustainable industry improvements given current activities and projected industry expansion.

DairySA, the SE Water Catchment Board and PIRSA have jointly funded this preliminary review and the development of a project plan and proposal.

The scoping study reviewed industry environmental risks, current best management practices and recent sustainability research in order to develop a plan to achieve net environmental and sustainability improvements for the industry.

10 dairy farmers representing the diversity of growing regions, soil types and irrigation management techniques have participated in this initial study.

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Dairy processing companies, government authorities and community stakeholders were also consulted during this scoping study.

The project commenced in April 2002 and concluded at the end of October 2002 via an industry workshop involving consideration of the key learning's arising from the study.

3.3 Why the SE & Why Now;

The ground water resources in the SE of SA are extremely vulnerable to nitrate contamination due to relatively high rates of ground water recharge, shallow depth, thin soils over limestone strata and very permeable limestone aquifers. Nitrate levels in particular have been on the rise over the past 30 years or so and local authorities consider intensive agricultural industries such as market gardening and dairy pastures to play a key role as diffuse sources of nitrate pollution.

The SE Dairy Industry saw it timely to initiate this study to start the ball rolling.

Given the anticipated expansion of the dairy industry proposed, the SE Dairy Consultative Committee considered control over key risk and wider industry adoption of sustainable land management practices to be essential.

Hence this project facilitated an initial environmental review, community consultation and marked the official start of a long and challenging journey towards sustainable growth.

3.4 Scoping Study Summary

A 3 part review focussing on existing farm practices, literature and community consultation identified **ground water impact** as a primary environmental risk for the dairy industry in the SE. Localised conditions relating to light textured soils, limestone geology, shallow ground water systems and intensive dairy production extenuate exposure. ***Local research is need to understand & quantify suspected ground water impacts for the SE dairy industry.***

3.4.1 Scoping Study Process

- This project was initiated at the request of the SE Dairy Consultative committee with funding support from DRDC, DairySA, PIRSA and the SE Water Catchment Management Board.
- This project facilitated a process to identify the key environmental issues, concern and priorities of SE Dairy Farmers, the community and government stakeholders.
- It aimed to initiate the development of a road map for sustainable industry improvements given current activities and projected industry expansion.
- 10 on farm reviews were conducted over 0.5 to 1.0 day per farm. The process involved consideration of key areas including: farmer consultation, soil fertility & health, nutrient management, pest management & chemicals, water management, biodiversity, waste & effluent management, social/ human capital, local economy and general environmental consideration.
- A survey of literature was undertaken covering nitrate leaching, water management, biodiversity and land capability.
- The regional consultative committee selected members of the community and government stakeholders to be interviewed on issues relating to their views about the sustainability of the dairy industry in the SE, the forecasted growth plans for the industry and the key messages they wished to convey to the industry.

3.4.2 The Key Learning's to Date

The on farm reviews revealed nitrate contamination of ground water as the dominate environmental risk. Factors contributing to this issue varied in their combination and significance from farm to farm however the following factors were considered the major localized issues:

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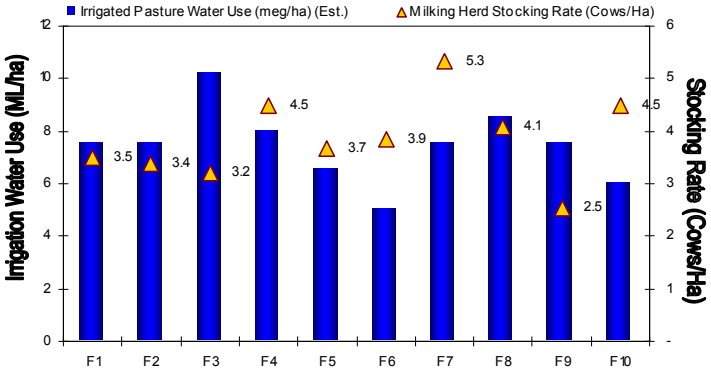
- *Free draining shallow sandy textured top soils over limestone;* Topsoil depths ranged from mere centimetres to > 1m.
- *Stocking rates varied from 2.5 to 5.3 cows/ha*; Stocking rate determining the intensity of urine patches and hence influencing the nitrate leaching potential.
- *Irrigation management*; Irrigation water use data was generally limited but was estimated to range from 5 to 10 ML/ha (see Figure 1).

Figure 1: Irrigation Use & Stocking Rate



- *Fertilizer management;* Nitrogen fertilizer inputs ranged from 120 to 506 kg N / ha / year (see Figure 2).
- *Effluent loadings;* 5 of the 10 farms failed to comply with the Environmental Protection (Milking Shed Effluent Management) Policy 1997 requirement of 5 ha of land for every 100 cows. The shortfall in farm effluent treatment area from ranged from 2.5 to 40 ha. Estimates of nutrient loadings suggested that most farms applied higher rates of nitrogen in effluent than the allowed rate of 100 kg/ha N/yr.

The farm reviews highlighted biodiversity was another significant issue requiring enhancement. 8 out of 10 farms had less than 1% native vegetation cover, clearly an opportunity for improvement. Linkages with regional biodiversity plans offered many potential benefits.

A review of literature revealed that research has already been conducted and best practices developed for several primary risk areas identified for the SE dairy industry. The challenge lies in quantifying the impact or footprint locally and ensuring industry adoption of existing best practices and future research findings prior to regulatory intervention.

The top five community concerns included:

1. Water quality - nitrates
2. Effluent management
3. Nutrient management and high fertilizer rates
4. Water use efficiency and depletion of the aquifer
5. Roads and infrastructure impacts with increased activity

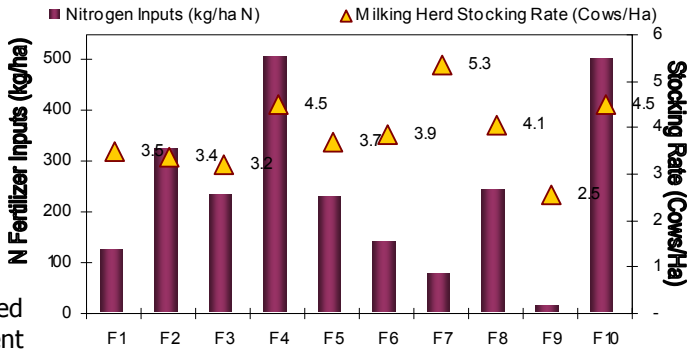
For further information see the scoping study workshop report (A Road Map for Sustainable Growth – Milestone 3 Project Report/Presentation, DRDC: SA11038, 30/10/2002).

3.4.3 Challenges to Sustainable Industry Growth;

The challenges identified include;

- Education & awareness at a farm level
- Advancing regulatory environment (effluent management, stocking & fertilizer rate concerns)

Figure 2: Fertilizer N, P & K Inputs and Stocking Rate



- Negative community awareness / perception
- Regional focus on intensive industries
- Industry self assessment tool is some way off
- Lack of local funds and resourcing to facilitate education and change management

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4 Footprint Deliverables

4.1 Objectives

- To begin to quantify & better understand the impacts of current pasture production, stock and effluent management practices on ground water (GW),
- To develop strategies to improve farm management and reduce GW impacts
- To develop practical methods and training tools that will assist in wider industry adoption,
- To demonstrate to the wider community that the dairy industry has the capacity of growing and improving sustainability,
- To provide a platform for the implementation of an industry Environmental Management System.

4.2 Critical Success Factors

- Industry support,
- Data integrity & sampling,
- Farmer trust, support & participation,
- Confidentiality in handling individual farm results,
- Project facilitator capable of fitting into dairy hours & culture,
- Development of BMP's that facilitate improvement both in short term and longer term,
- Regulator trust, support & participation,
- Community support and regular consultation.

4.3 Benefits

- This project represents a significant step towards developing and implementing an industry EMS that is relevant to the climate, the natural resource base, management techniques and grazing conditions for the SE,
- Improved understanding of the impacts of current activities on GW,
- Understanding of variability in current practices, natural resource base and grazing systems,
- Identification and demonstration of practices that have lower or minimal impact,
- Implementation of farm monitoring systems to improve productivity and reduce input costs,
- Demonstrate to wider community the importance of the industry and their commitment to do their bit in improving regional sustainability and environmental health.

4.4 Outputs

The intended outputs from this project include:

- Quantify the impacts of current practices on GW,
- With farmers develop strategies to improve farm management and reduce GW impacts,
- Assist in communication between the dairy industry, regulators, the CMA's and the wider community etc,
- Demonstrate to wider community that the dairy industry has the capacity to grow and improve sustainability,
- Provide a platform for the implementation of an industry Environmental Management System.

4.5 Outcomes

- Greater industry awareness of the footprint current dairy farming practices have on the environment,
- Farmer friendly tools to assist in monitoring a range of sustainability indicators relevant to the groundwater footprint for the SE,
- Credible benchmark to measure improvement in industry performance over time,
- Development of improved practices relevant to the SE and shallow porous soils / sensitive ground water systems.

4.6 Potential Impediments

Likely Impediments to adoption include:

- Farm profitability - incentives or capacity of farmers to invest into the preservation or improvement of their natural resource base asset,

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- Processor, Customer & Market Support – to assist with farmer transition to improved practices and sustainability,
- Managerial skills of farmers - ability to successful adapt or change to manage more "sustainably",
- Capacity of Farmers to change,
- Value system of farmers - recognizing the importance of their local environment – motivation to change,
- Whole family training - immediate personal support and accessible resources committed to sustainable technology and management systems.

5 Industry Adoption

5.1 Who is the target audience(s)?

- Dairy Farmers in the SE of South Australia (150 farmers & growing).

5.2 What is the strategy(ies) for implementation

- Have 10 South Australian Dairy Farms invited to partner with the project team over the 3 year monitoring study.
- Have these 10 pilot dairy farms act as case study farms for monitoring and assessment.
- Run industry workshops and field days with SE dairy farmers and key stakeholders in May 04, May 05 and May 06. A combined field day and workshop will be help on selected properties to enable key stakeholder review of progress and field monitoring results. This collective gathering of dairy farmers, funding partners, the consultative group and the footprint pilot project management team will be charged with specific workshop issues to resolve and discuss relating specifically to;
  - the environmental foot print study,
  - the best practice "enablers" required to drive change,
  - developing systems (EMS) for the industry.
- Progress and a final report will be generated to keep key stakeholder informed about the project progress and
- At the conclusion of the environmental footprint study have these 10 farms and the wider industry participate in a change management program over a set period of time (beyond the scope of this proposal).

5.3 How will the proposal's outcomes be evaluated?

- A project pilot management team will be established with members representing the participating dairy farms, the SE Dairy Consultative Committee, DairySA, SE Water Catchment Management Board, PIRSA, EPA, SELGA and the local community.
- This pilot project team will meet at least twice per year to review key progress and learning's arising from the footprint study. All progress report information will be treated with strictly confidential.

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6 Methodology

6.1 Overview

It is proposed to run this environmental footprint study on 10 commercial dairy farms in the SE of South Australia. The project design and methodology has been assembled to enable "real time" monitoring of these farms in a manner that as much as possible does not interfere with routine operations and farming practices.

In essence the project team aims to collect and collate data relevant to the assessment of ground water impact and farm sustainability without significant skewing or altering farm practices per se during the monitoring period.

To achieve this aim, the project management team will need to develop strong relationships with each of the participating farmers.

The following key points provide the background to the importance of this initiative;

- An opportunity to help pioneer the development of sustainable management technology for the SE Dairy Industry.
- The industry is now seeking a funding partner(s) to join them in progressing the launch of groundwater footprint and ecosystem research for the benefit of the SE dairy industry and the wider community.
- This project will generate practical and beneficial answers to environmental concerns related to the dairy industry. Many of the current practices associated with SE dairy production are believed to fall short of the requirements of sustainability. Environmental problems are of increasing concern from the point of view of preserving the natural resource base (soil and ground water quality in particular) used for production.
- Whilst there has been some work conducted in South Eastern Australia to quantify leaching losses under dairy pasture systems, limited work has been undertaken on shallow porous soils over limestone aquifers, as found in the SE of SA. Given that confined and unconfined aquifers in this region are used for domestic and stock drinking purposes, losses of nitrate pose a significant risk to this sensitive water resource. Limited work has been done to quantify the nitrogen losses in region to date.
- This project is a proposal to address some of the components of the sustainable land use challenge at the farm agri-ecosystem Level for the SE.
- It is noted that the excellent work underway at the "Macro" level tends to focus on individual indicators of environmental sustainability, and while this project seeks to complement the SCARM approach through the use of such indicators, the intent is to try and build a composite picture from them of the agri-ecosystem for a farm site and evaluate sustainability at the agri-ecosystem level. Further this work aims to provide some ground work required for the development of an Environmental Management System for the SE Dairy Industry.
- This project seeks to complement the current efforts into researching sustainability questions for dairy farming. Current work has mainly focused on leaching losses, nutrient cycling and other biophysical measures on less porous, fragmented or variable soil types than typically found in the SE, however does provide some useful learning's that are to be integrated into this project.
- It is clear from both a cursory examination of literature, consultation with local community, government agencies and industry experts and discussion with local dairy farmers that a 3 year reconnaissance study is needed to evaluate:
  - Environment monitoring indicator options relating to dairy farming and groundwater impact evaluation,
  - Field methodology for using/applying indicators in an intensive dairy farming environment,
  - Base-line data and interpretive or reference values for further work in the SE dairy industry,
  - A holistic approach to describing the agri-ecosystem status of a dairy property,
  - The best practices required or currently in place,
  - The key elements required for the development of a practical farm based Environmental Management System (ISO 14001).

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6.2 Literature Review & Methods Research / Development

The scoping study provided a "preliminary" review of literature relating to nutrient leaching, ground water impacts and the SE. However a far more detailed review of literature and consultation with leading experts in both Australia and offshore is required to finetune field monitoring and data interpretation technology.

6.2.1 Broad Approach:

A review of local and international literature will be conducted in specific reference to;

- Issues and information relating to farming practices contributing to leaching,
- Resin box technology for leaching assessments,
- Field techniques for nutrient & water leaching assessments,
- Water balance modelling (irrigation & rainfall),
- Ground water leaching impacts on shallow porous top soils (Netherlands & others),
- Environmental losses associated with intensively grazed systems,
- Sustainability indicators, practical methods for on farm use,
- Field sampling and laboratory analysis methods for dairy effluent assessment,
- Environmental foot print interpretation & analysis,
- Review and appraisal of existing best management practices for dairy effluent, nutrient and water management, pasture and herd management in the context of the SE.

Field methods research will also involve travel and meetings with leading researchers in Europe (Netherlands, Germany & United Kingdom) specialising in environmental footprint analysis and leaching losses under intensively grazed systems.

6.2.2 Why Do This Step – where is the value?:

- Given the importance and value of the ground water and natural resources in the SE, it is paramount that the most advanced information, learning and expertise be assembled to provide a solid platform for project development and footprint assessment.
- A significant amount of research already exists in the public domain with relevance to the goals and objectives associated with this pilot, consultation of this knowledge base will avoid duplication of effort and fast track the development of field and data management methods.
- Study of similar soil type, geology and farming systems in Europe will provide a useful basis for the review of field assessment technology for sandy porous top soils and intensive input systems. Further, European research into effluent management on shallow soils will provide a valuable insight for similar research in the SE.

6.3 Farm Selection

6.3.1 Broad Approach:

Following the completion of the literature review and methods development the selection of farms will be finalised.

The SE Dairy Consultative Committee have approached all farmers participating in the scoping phase of the project and invited their further participation.

The 10 farms participating in the scoping study represented a diversity of farming practices, herd sizes, grazing intensities, fertilizer and irrigation management practices and regional soil types and geological systems.

Local government agencies including PIRSA, Mines & Energy, EPA and SELGA will assist with the selection of the farms for the footprint study.

6.3.2 Why Do This Step – where is the value?:

- For this research to be credible and useful to the 150+ dairy farmers in the SE, due diligence is required in selection of "representative" farms and monitoring sites.

6.4 Understand the Natural Resource Base & Monitoring Site Selection

To assist with site selection and interpretation, a detailed study of the natural resource base for each participating farm will be conducted.

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6.4.1 Broad Approach:

- Collect past and present aerial photography (prints and digital) to assist in interpreting field data and understanding the natural resource base,
- Conduct a soil survey and land capability assessment for each dairy farm. This will involve referencing existing soil survey and land capability information systems developed by PIRSA and local authorities and then conducting a detailed farm assessment,
- Produce a range of soil and land capability maps (soil classification, readily available water, yield limiting features etc) detailing variability across target property paddocks and surrounding areas,
- Review field and desktop assessment of geology, hydrogeology, land surface (contours and aspects), water tables (depth & quality) and regional issues,
- Review of farm biodiversity (native vegetation and habitats),
- Provide an initial assessment of existing biodiversity,
- Provide a platform for archiving and strategically managing field data via a Graphic Information System (GIS). Existing GIS data from SELGA and PIRSA will provide an extremely valuable basis for the development of farm specific GIS information layers.

6.4.2 Why Do This Step – where is the value?:

- This step seeks to understand the environment in which environmental footprint and sustainability indicator assessments are to take place over the monitoring period,
- Provides the background data essential in interpreting the field measurements, in search for linkages between environmental performance and sustainability indicators/clusters
- Provides an environmental benchmark for assessment and interpretation

6.5 Detailed Initial Environmental Risk Assessment

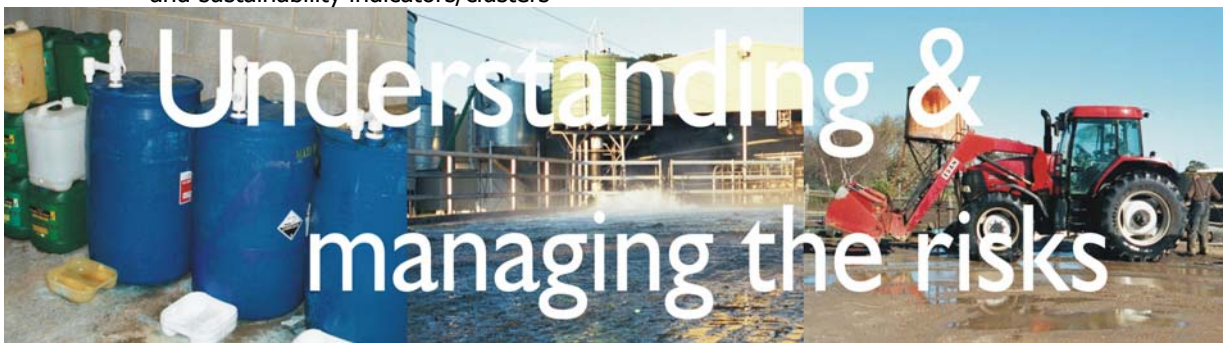
This step provides a detailed audit and review of existing and historical activities/practices and environmental issues present on each farm. The review process is to be facilitated against 10 Sustainability Indicators using a farm risk assessment method developed by the project consultants. A report will be provided to each farmer and a summary "aggregated" report made available for general review by the project management team and key funding stakeholders.

6.5.1 Broad Approach:

- Customise the risk assessment tool to evaluate the environmental performance of each participating dairy farm against the selected Sustainable Indicators and parameters relevant to ground water foot print assessment.
- Apply risk ranking methodology to prioritise on farm environmental risks, filter risks by key sustainability indicator cluster, compare risks and hazards on farm and between each farm,
- Key stakeholder consultation regarding audit template and risk methodology,
- Identify and quantify the environmental risks and hazards associated with existing and historical farming practices via on farm audits involving farm managers and staff,
- Photograph farm operations to provide historical record of existing environmental risks and farm productivity issues.

6.5.2 Why Do This Step – where is the value?:

- To gain a "detailed" understanding of the existing GW risks and hazards associated with dairy farming in the SE,



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- To ensure the research and field monitoring / investigation processes are focussed on key areas of concern, delivering maximum environmental benefit to key stake holders (farmers, the community, the wider environment),
- To avoid adopting inappropriate methodology and investing significant time and resources monitoring indicators / parameters of minimal relevance environmentally for each sustainability cluster
- To provide a sound basis for field methods development

6.6 Three Year Monitoring Study

This step forms the major field monitoring and assessment component for the footprint project. On each of the footprint pilot farms a range of selected indicators and variables will be monitored over a three year period.

No treatments are to be applied and no direct influence upon grower management practice is intended, the objective being to observe and measure the variables during the normal seasonal cycles of dairy farming under standard management in a way which is as unobtrusive as possible.

6.6.1 Broad Approach:

- Resolution of the range of GW indicators and parameters required to monitor and quantify the environmental footprint for the SE dairy industry based on the literature review, the natural resource base assessment and the environmental risk assessment,
- Documentation of field methods and sampling protocols,
- Soil (shallow and profile) sampling for nutrient analysis (spring & autumn),

- Installation of field weather stations for continuous climate monitoring,
- Installation of water and effluent flow devices to track volumes of effluent generated and handled at each dairy and volumes of effluent applied to pasture,
- Installation of irrigation meters and flow devices to enable the monitoring of applied irrigation water volumes,
- Installation of SAI leaching box technology in clusters in normal field environments and in paddocks where effluent is applied to pasture. The SAI systems allow the through flow of water and enable the collection of nutrients such as nitrate, phosphorus and a range of pesticides. The SAI systems will be removed and replaced on regular intervals throughout the monitoring phase of the project,
- Isotope tracer technology will also be considered, perhaps providing assistance in developing nutrient mass balance assessments,

Clearly the planning, literature review, understanding the natural resource base, environmental risk assessment and grower and community consultation phases of the project need to be completed prior to the selection of possible indicators.

However Section 6.6.2 provides an initial summary of probable indicators and parameters based on the key learning's from the scoping study.

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6.6.2 Possible Footprint Sustainability Indicators

SUSTAINABILITY CONSIDERATIONS

Sustainable Indicator Category	KEY CONSIDERATIONS FROM SCOPING STUDY	POSSIBLE SUSTAINABILITY INDICATORS & PARAMETERS
SOIL FERTILITY & HEALTH	○ Shallow and light textured soils pose leaching risks to aquifers ○ Some dairy country deemed unsuitable for intensive grazing ○ Establishment of permanent monitoring sites	○ Organic Matter, Soil pH (Surface & Deep), Earth Worm Density & Biomass, Microbial Activity, Basic Profile Soil Chemistry, Water Holding Capacities
NUTRIENT MANAGEMENT	○ Nutrient budgets driven from milk production goals or targets. ○ The recovery of nitrogen in dry matter and its relationship to nitrogen inputs (fertilizer, urine & effluent) requires further work in the SE. ○ Dry matter estimates not carried out on all dairy farms. ○ Nitrogen leaching losses from applied N, urine & effluent are unknown ○ Establishment of permanent monitoring sites, Records (e.g. fertilizer applied, pasture growth, supplements feed), Stocking rate & pasture utilisation	○ Inputs of nitrogen, phosphorus & potassium as synthetic fertilizers per year, % renewable fertilizer, nitrogen recovery % in pasture/milk, kg/ha leaching loss/yr for N, P and K, Soil nutrient status, whole farm nutrient budgets, nutrient mass balance (using water balance models, SAI leaching box technology, isotope analysis etc).
WATER MANAGEMENT	○ Range of water management practices in place, some inefficient ○ No metering of water means guessing water use ○ Scheduling on very shallow top soil difficult. Variability of soil across pivots extenuates problems with water ponding/leaching ○ Wider use of irrigation scheduling required ○ Weather data & objective measures of soil moisture to assist irrigation scheduling, effective pasture rooting depth, Readily Available Water, Irrigation & rainfall records	○ Ground water depth, nitrate levels in ground water (wells/bores/piezometers), rainfall (mm), irrigation volume applied (ML/ha, mm), Weather data & objective measures of soil moisture to assist irrigation scheduling, Effective pasture rooting depth, Readily Available Water, Irrigation & rainfall records
BIODIVERSITY	○ Farms are relatively void of biodiversity ○ Shelter and screening benefits could assist farmers ○ Linkages with local plans & strategies could enhance regional biodiversity and improve community perception of dairies ○ Land capability, stock shelter requirements, conservation status	○ % Native Vegetation Cover, Conservation Status, Species Richness, Boundary to Area Ratio, Weed Invasion, Feral Fauna, % Frog Abnormalities, ○ *Note: Biodiversity assessments will be limited to an "initial" understanding the natural resource base review.*

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6.6.2 Possible Footprint Sustainability Indicators (Continued)

SUSTAINABILITY CONSIDERATIONS	Sustainable Indicator Category	KEY CONSIDERATIONS FROM SCOPING STUDY	POSSIBLE SUSTAINABILITY INDICATORS & MEASURES
	WASTE & EFFLUENT MANAGEMENT	○ 150 days +/yr deemed unsuitable for effluent irrigation based on rainfall exceeding evaporation in Mt Gambier according to EPA ○ Pond storage limited and considered expensive ○ Effluent providing point source pollution risk to groundwater ○ Effluent records, pasture quality & palatability of effluent areas, bunding of fuel and chemical storages	○ L/day water used in sheds cleaning, cooling etc, L/day collected, tonnes/month solid waste, quantification of volumes of waste streams ○ Effluent storage capacity (months), effluent application area (ha) / 100 cows, nutrient and water application rate in effluent (both annual and individual application), monitor soil fertility in effluent areas, waste register with % of waste recycled (e.g. workshop waste, detergent, chemical, fertilizer & fodder packaging etc)
	PEST & CHEMICAL MANAGEMENT **Low risk area**	○ Leaching and drift impacts considered key ○ Containment and storage facilities required & PPE	○ kg/ha active ingredients, ecotoxicity of chemicals applied, active ingredients in surface and ground water, active ingredients leached (to be confirmed)
	SOCIAL / HUMAN CAPITAL	○ Labour availability and costs may provide a barrier to growth	○ Nos FTE/L & ha ○ *No formal monitoring for this indicator is envisaged for the GW footprint study*
	LOCAL ECONOMY	○ Dairy investment into local economy deemed significant ○ The triple bottom line benefits need quantifying	○ Input investment/L Milk, Number & Value of Up & Down Stream Industries Quantified ○ *No formal monitoring for this indicator is envisaged for the GW footprint study*

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6.6.3 Why Do This Step – where is the value?:

- The GW footprint will enable the quantification of a range of environmental variables, sustainability indicators and parameters on selected farms.
- At present there is no objective basis to quantify the GW impact and environmental performance for the SE dairy industry. This project will provide such a platform for assessment and provide a baseline for quantification of net environmental improvements achieved over time by proactive measures taken by the industry.
- The baseline data developed from this study will quantify the impact the dairy industry is currently having and enable the development of informed strategies for industry continuous improvement and best practice.
- Dairy farmers in the SE will become more aware of the environmental significance of their activities, they will learn to measure and monitor their farming practices environmentally and develop improved practices to reduce net environmental losses associated with milk production.
- On farm environmental / sustainability monitoring systems will be established enabling ongoing monitoring and the quantification of environmental improvements resulting in industry change management programs,
- The data collected on the selected farms will be aggregated by farm and by region to provide a more informed regional perspective. This data could be further combined with data collected for other SE rural industry sectors to provide an informative "state of the environment" reporting mechanism and enable net improvements achieved to be credibly profiled for wider stakeholder and community benefit.
- This project will provide a valuable dataset relating to water use efficiency and waste stream generation completing the Volumetric Conversions Project currently underway in the SE.

6.7 Activity Timeline

- Finalisation of project proposal - May 03
- Finalisation of project funding partners and resources required – June/July 03
- Initiation of project via a formal project management team meeting and planning workshop – August 03
- Finalisation of Initial Environmental Review / Risk Assessment – October 03
- Finalisation of Literature Review & Overseas Consultation – November 03
- Finalisation of the Understanding the Natural Resource Base – February 04
- Commencement of Footprint Monitoring – April 04
- Key Stakeholder Workshop & Review of Literature Review – May 04
- Annual Project Review – August 04
- Key Stakeholder Workshop & Review of Literature Review – May 05
- Annual Project Review – August 05
- Key Stakeholder Workshop & Review of Literature Review – May 06
- Final Project Review & Industry Workshops – August 06
- Completion, Approval Gained (by key stakeholders) and Release of Final Report – August 06

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7 Intellectual Property

All data and results from the project will be jointly owned by funding stakeholders in proportion equal to their relative contribution to the resource allocation required to facilitate the project.

7.1 Commercialisation path

To be confirmed once all funding partners have been secured.

7.2 Freedom to Use IP Commercially

To be confirmed once all funding partners have been secured.

7.3 IP Already Held

- Outsourced Environmental (OE) already holds IP relating to on farm "real time" sustainability indicator monitoring, assessment and data management systems,
- Further OE holds the copyright (on behalf of Horticulture Australia & Unilever Australasia) for an integrated on farm management system & training material called Grow Sustainable (integrating EMS, Food Safety & Occupational Health & Safety),
- OE holds the exclusive licence agreement for the use of SIA Leaching Box technology for SE Asia.

7.4 IP Anticipated from Project/Program

- Farm environmental monitoring systems relevant to the Dairy Industry in the SE.

7.5 Identified/Potential Commercialisation Partners

- DairySA
- SE Catchment Water Board
- Other Participating Funding Partners
- Outsourced Environmental

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8 Resource Allocation

Budget (Overall)	2003/2004	2004/2005	2005/2006	Total	% Total Amount
Operating	$288,000	$400,000	$400,000	$1,088,000	90.6%
Overseas	$12,000	-	-	$12,000	1%
Capital[##]	$100,000	-	-	$100,000	8.3%
Total requested	**$400,000**	**$400,000**	**$400,000**	**$1,200,000**	

Funding Partner Contributions;

Proposing organisations DairySA, SE Water Catchment Management Board, OE	$140,000	$140,000	$140,000	$420,000	35%
Other Contribution(s) (Yet to be confirmed)	$260,000	$260,000	$260,000	$780,000	75%
Full cost	**$400,000**	**$400,000**	**$400,000**	**$1,200,000**	

Source of Funds	2002/2003	2003/2004	2003/2004	Total	% Total Amount
Government & Industry Contributions					
DairySA **(To Be Confirmed)**	$40,000	$40,000	$40,000	$120,000	10%
SE Catchment Water Management Board **(To Be Confirmed)**	$100,000	$100,000	$100,000	$300,000	25%

Total Industry Funds	**$400,000**	**$400,000**	**$400,000**	**$1,200,000**	

Note:

Capital[##] : Several options exist for the procurement of capital for this project.

The budget can either: Option 1: Allow for the out right purchase of equipment such as water meters, sensors for pump and system operation, GPS, weather stations, infield rain gauges, computers, soil moisture sensing technology etc, or Option 2: The project managers could lease such equipment to the project on an annual fee basis and the project realise this expense directly as an operating cost.

The second option may be attractive to potential investment partners as it avoids the need to consider depreciation, field maintenance and post project completion capital divestment.

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9 Activities

No	Key Activities	Full Cost	DSA Component	DSA % of Full Cost
1	**Literature Review & Methods Research / Development**	$35,000		
	❑ Conduct global review of literature relating to environmental footprint assessment of intensive pasture systems, effluent management and environmental fate, leaching losses on shallow soils etc ❑ Consult with leading researchers in Australia and Europe regarding field assessment techniques ❑ Develop & document field methods			
2	**Initial Environmental Review**	$75,000		
	❑ Develop audit protocol, incorporating industry and region specific requirements ❑ Develop risk assessment methods and risk rank techniques to; o Prioritise risks on each farm o To aggregate risks by farm and region ❑ Facilitate environmental review with each farm ❑ Prepare reports for each grower and an aggregated report for participating farms ❑ Communicate key findings with each farmer (individually) and to the project management team and funding stakeholders via industry workshop and project planning meeting			
3	**Understanding the Natural Resource Base**	$130,000		
	❑ Finalise broad selection of participating farms ❑ Collate GIS, Aerial Photography and Existing Regional soil survey information ❑ Conduct detailed soil survey on participating farms, RAW, depth to impeding layers, land capability assessments and monitoring site selections ❑ Conduct reconnaissance biodiversity assessments ❑ Develop farm reports and maps and an aggregated report for key stakeholders			
4	**Environmental Footprint Indicator Monitoring & Best Practice Development**	$915,000		
	❑ Finalise above steps ❑ Select key environmental indicators and parameters ❑ Establish quality assurance mechanisms and protocols for field sampling, data management and interpretation ❑ Establish conventions regarding indicator and parameter interpretative thresholds ❑ Resolve monitoring sites ❑ Install monitoring equipment & test ❑ Conduct sampling (initial & ongoing) ❑ Collect, analyse and compile data (farmer, production, inputs, climate etc) ❑ Evaluate existing practices and develop improvement management techniques ❑ Prepare reports for key stakeholders in aggregated format ❑ Prepare final report			
5	**Development of On Farm Footprint Training & Awareness Material & Delivery via Industry Workshops**	$45,000		0%
	❑ Summarise key finding's ❑ Prepare reports for external review and verification ❑ Develop awareness training material ❑ Facilitation of industry awareness workshops and key stakeholder consultation			

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10 Timetable

Milestone Number		Milestone Details	Amount (Exclusive of GST)
Milestone No 1	Description	**Initiation of Dairy Environmental Footprint Study**	$300,000
Due: 1/08/03	Criteria	▪ Identification of project investors & partners ▪ Signoff and endorsement for project proposal ▪ Voluntary contributions received	
Milestone No 2	Description	**Key Stakeholder Consultation & Progress Report**	$100,000
Due: 1/05/04	Criteria	▪ Initial environmental risk assessment completed for participating farms with farm specific reports and an aggregated report developed and released. ▪ Understand the natural resource base assessment of the 10 farms complete and site selection for monitoring established. ▪ Monitoring progress report presented at key stakeholder/industry workshop. ▪ Farmer field day/workshop held	
Milestone No 3	Description	**Key Stakeholder Consultation & Progress Report**	$300,000
Due: 1/08/04	Criteria	▪ First year progress report completed ▪ Key stakeholder meetings	
Milestone No 4	Description	**Key Stakeholder Consultation & Progress Report**	$100,000
Due: 1/05/05	Criteria	▪ Monitoring progress report presented to key stakeholders ▪ Farmer field day/workshop held	
Milestone No 5	Description	**Key Stakeholder Consultation & Progress Report**	$300,000
Due: 1/08/05	Criteria	▪ Monitoring progress report presented to key stakeholders	
Milestone No 6	Description	**Key Stakeholder Consultation & Progress Report**	$90,000
Due: 1/05/06	Criteria	▪ Monitoring progress report presented to key stakeholders ▪ Farmer field day/workshop held	
Milestone No 7	Description	**Final Report Received by Due Date and all Previous Milestones Achieved**	$10,000
Due: 1/08/06	Criteria	▪ Final monitoring & footprint report presented to key stakeholders ▪ Change management process initiated ▪ Farmer field day/workshop held	

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11 Team Members

Name	Mr Jamie McMaster
Organisation	Outsourced Environmental
Phone	03 9761 0204
Name	Mr Lewis McMaster
Organisation	Outsourced Environmental
Phone	03 9761 0204
Name	Mr Jeff Kraak
Organisation	Outsourced Environmental
Phone	03 9761 0204
Name	Greg Dalton
Organisation	Outsourced Environmental
Phone	03 9761 0204
Name	Wolf Anno Bischoff
Organisation	Gutachterbüro TerrAquat
Country	Germany

11.1 Team details

Jamie McMaster, Project Manager, SE Dairy Environmental Footprint Project. His company Outsourced Environmental has led several large scale agricultural sustainability studies including the Unilever Australasia Grow Sustainably™ initiative. He brings experience in development and implementation of Environmental Monitoring and Management Systems, having worked across the Agribusiness Supply Chain in Australia, Brazil and California USA. Jamie has worked in both the Irrigation and Fertilizer/Agricultural Chemical Industry over the past 14 years and brings experience in project management, EMS, Agronomy, Irrigation and Fertilizer Management. Highlights over the past few years include the development of a fully integrated EMS/QA/OHS system for Unilever's processing tomato growers (Australia, Brazil & California), Co-Development of Incitec Fertilizers Nutrient Advantage System for Soil, Plant and Water Quality Assessments (Analysis Systems Agronomist Training School), Development of Incitec's award winning Environmental Management System & Training School for Agricultural Chemical and Fertilizer Dealers (Nationally) etc. (Outsourced Environmental is 100% Dedicated to this Project, Jamie will spend 35% time).

Lew McMaster, Principal Horticultural Consultant, Outsourced Environmental, provides more than 34 years experience in the Australian Horticultural Industry both as Senior Research Officer with the South Australian Department of Primary Industries and for the past 15 years as a private consultant. His expertise specialises in horticulture, agronomy, irrigation management and project management. (10% time).

Jeff Kraak, Agricultural Consultant, Outsourced Environmental, provides more than 17 years experience in agri-business management, soil fertility, nutrition management and the agricultural chemical industry. Jeff also co-developed the Incitec Fertilizers Nutrient Advantage System for Soil, Plant and Water Quality Assessments (Analysis Systems Agronomist Training School). Jeff has contributed to the Dairy Research and Development's Nutrient Management Team which advises DRDC on investment research priorities in the dairy industry and has also been heavily involved in the development and delivery of agronomy and nutrient management training across the eastern seaboard of Australia. As a consultant to the project Jeff brings a sound understanding of pasture agronomy, soils, fertilizer and agricultural chemical use, (50% time).

Greg Dalton, Environmental Consultant, Outsourced Environmental. provides services in revegetation and environmental consultancy. Greg has partnered with Outsourced Environmental as a biodiversity consultant for the Unilever Sustainable Agriculture Project and has assisted Outsourced Environmental develop innovative and widely regarded biodiversity assessment methodology and sustainability indicators. He has extensive background and experience in the identification and integration of native vegetation on farms. Greg is the author of over 24 publications on rural revegetation and is well connected with revegetation and native vegetation management workers all over Australia. Greg will be involved specifically in the Understanding the Natural Resource Base (farm biodiversity reviews) of the project. (5% time).

Wolf-Anno Bischoff, Environmental Consultant, Outsourced Environmental, Senior Soil & Environmental Chemistry, Consultant of TerrAquat. Wolf is also a lecturer on 'Anthropogenic Pollutants' for

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the Master of Soil Science program at the University of Hohenheim, Stuttgart. With his consultancy he has managed projects in Germany, France, Switzerland, Austria, Spain, Israel, Rwanda and Vietnam. He brings experience in conducting large scale field experiments and detailed experimental studies on the fate of fertilizers, pesticides and pollutants and the evaluation of their environmental impact. At present, his consultancy manages more than 20 experimental agricultural and horticultural fields in 3 countries. Wolf has already given advice on fertilizer and land use management to the Environmental Protection Agency of Germany, to federal state ministries and water providers.

Wolf has a broad experience in the choice of experimental set-ups to track the sources and fate of nitrogen including isotope studies and a patented method to measure leaching losses under agricultural fields. He will give full support to obtain meaningful indicators and data in the experimental section of the project. (up to 30 % time).

Services and expertise will be sourced from;

- Spatial Vision GIS & Mapping Systems Specialists
- TerrAquat Pty Ltd – SIA Leaching Box Technology

Other collaborators include;

- PIRSA Rural Solutions
- SE Water Catchment Management Board
- Environmental Protection Agency
- Department of Water Resources
- Limestone Coast Regional Development Board
- SELGA & SE Natural Resources Committee
- District of Grant Regional Council
- Bushcare
- Local Landcare & Catchment Management Groups
- Victorian State Chemistry Laboratory, Department of Sustainability

12 Risk Management

- Season weather conditions and their influence over abnormal pasture and milk production conditions. Whilst seasonal conditions can impact on yields of crops and pasture productivity, for environmental monitoring purposes these risks should not impact negatively on the objectives and outcomes of this project
- The size of the industry is growing. The number of farmers involved in this industry in the SE is anticipated to increase as will the herd sizes each year due to economies of scale, cost/profitability pressures and expansion of the industry. It will be important that the 10 farms selected for the monitoring study are located in areas likely to be involved in industry growth to ensure the key findings from the project remain relevant to the growing industry and its environmental footprint.
- Retention of consultant to manage project. This proposal and associated contract ensures consultant commitment to the project.
- The consultant will maintain public Liability of $20 million AUD & Professional Indemnity Insurance of $5 million AUD over the 3-year project period.

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13 Administration Of The Project/Program

Name Mr Jamie McMaster
Position Director
Organisation Outsourced Environmental

Street Address
Ground Level, 69 Mercia Avenue,
THE BASIN, VICTORIA 3154
AUSTRALIA

Postal Address
PO Box 169,
THE BASIN, VICTORIA 3154
AUSTRALIA

Phone 03 9761 0204 **Fax** 03 9761 0024
Mobile 0407 317 288
Email jamie.mcmaster@outsourcedenvironmental.com.au

14 Certification

This proposal has been seen and endorsed by your organisation and any collaborators involved.

_____ ___ / ___ / ___
Signature of Project/Program Leader Date

_____ _____
Name Organisation

_____ ___ / ___ / ___
Signature of Organisation's Administration Contact Date

_____ _____
Name Organisation

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