Fostering best management practices in natural resource management – towards an environmental management system in the cotton industry

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Steering Committee

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The members of the Steering Committee were:

Peter Alexander	Murray-Darling Basin Commission
Dallas Gibb	New South Wales Agriculture
Lamond Graham	Department of Natural Resources, Queensland
Bruce Pyke	Cotton Research and Development Corporation
Michael Logan	Oakville Pastoral Co
Allan Williams	A and A Williams Pty Ltd

Authors

This report was developed and edited by Allan and John Williams. The main body of the report, and appendices 1, 2, 3 and 4 were written by Allan Williams and John Williams, with input from Rachel Thomas and Michael Logan. The grower surveys discussed in Appendix 3 were conducted by Rachel Thomas. Appendix 5 was written by Clive Lyle & Associates. Appendix 6 was written by Allan and John Williams, and includes work undertaken by Noel Steward of Quality Assurance Services.

Design and Layout

Virginia Buckingham Graphic Design

Photographs

Cotton Australia

A & A Williams Pty Ltd
“Kia-Ora”
Narrabri NSW 2390
Telephone 02 6793 5301
Fax 02 6793 5302

Oakville Pastoral Co
“Oakville”
Narrabri NSW 2390
Telephone 02 6792 1165
Fax 02 6792 4521

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Chapter 1 Executive Summary

What is the aim of this report?

This report is investigating the appropriateness of introducing a certified environmental management system (EMS) in the cotton industry, to ensure the implementation of sustainable natural resource management practices on farms. The report aims to clarify the reasons for developing and implementing an industry EMS, and the implications of adopting such a course of action.

This project is a component of a Murray-Darling Basin Commission (MDBC) initiative to investigate the “Feasibility and benefits of introducing an appropriate audit and certification model to foster better management practice in natural resources management in the irrigation regions across the Murray-Darling Basin”.

Structure of report

This report investigates both the theoretical and practical issues associated with enhancing the cotton industry’s BMP Programme so that it is a comprehensive environmental programme. In order to achieve this the report provides a brief overview of the Australian cotton industry, its location and size, and some of the impacts it has on the natural resource base (chapter 3), before looking in detail at the reasons why a comprehensive environmental management programme might be introduced (Chapter 4). This is followed by a discussion of the critical elements for a successful industry wide environmental management programme, including a comparison between an EMS and the current BMP Programme, and a description of an appropriate model (Chapter 5). The suggested model and industry framework are briefly summarised in chapter 6, followed by a detailed discussion of the requirements for implementation, including estimated costs and timeframes (Chapter 7).

Key performance indicators, a critical component of an EMS are discussed in detail in chapter 8, followed by an exploration of the legal issues that might arise with the introduction of an industry environmental management programme (Chapter 9).

The necessary actions to progress the recommendations contained in the report are summarised in Appendix 1 (“Action Summary – Guidelines for Progression”).

Many of the conclusions in the main body of the report are drawn from a recent survey of cotton growers' current management practices. The detailed results of this survey are included at Appendix 3.

Appendix 4 contains a clause-by-clause analysis of the ISO 14001 standard for environmental management systems, including a comparison of the standard with the BMP Programme, and an outline of the actions required to have the BMP Programme comply with the standard.

Appendix 5 looks at the priority natural resource issues for the cotton industry and the Murray-Darling Basin Commission, and highlights issues that should be addressed in an industry environmental programme. Appendix 6 discusses the various types of standard that can be used in an environmental management programme (ie. 'specification', 'performance' and 'process' standards), and includes a summary of some environmental and Quality Assurance programmes currently being used in agriculture.

Recommendations

The proposed future framework for the cotton industry's environmental programme

It is recommended that the cotton industry's current environmental programme (the BMP Programme) be developed into a comprehensive environmental programme consistent with (and ultimately capable of being certified to) the international standard for environmental management systems, ISO 14001. Such a programme would involve each grower implementing a 'farm-specific' EMS, supported and overseen by an industry organisation. At a minimum, the industry programme should cover the following topics:

- Pesticide management
- Water management
- Soil and nutrient management
- Vegetation management
- Fuel management
- Waste management
- Energy conservation.

To help growers address the environmental priorities on their own farm, best management practices and principles should be developed for each topic. A core of 'non-negotiable' practices and principles should be included to ensure a consistent focus and minimum level of performance across the industry. In addition to guidance material on best management practices, material will be required to assist growers integrate the components of the EMS with their existing operations.

The elements of the industry EMS would need to be introduced gradually, component by component. The strong industry support and guidance for growers provided under the BMP Programme would need to be continued under an industry EMS. The practices and procedures implemented under an industry EMS would need to have a strong farming focus: the industry EMS will need to be as simple as practicable for growers to adopt, and meaningful for their farming operations. Every opportunity to reduce the cost of implementing the industry EMS needs to be taken and the potential savings available as a result of introducing an industry-wide EMS are noted throughout the study.

It is critical to note up-front that the introduction of an EMS on an industry -wide basis will be a long term process.

Under an industry EMS, auditing would be carried out and would cover both the implementation of 'core' best management practices, and the procedural components of an EMS. Audits would be undertaken both internally (ie. by the industry) and externally. Audit arrangements would be modelled on those developed under the North Otago Sustainable Land Management (NOSLaM) scheme in New Zealand. This involves external auditing and certification of the industry organisation responsible for overseeing the implementation of the industry EMS. This organisation would in turn ensure each farm involved in the programme is operating in accordance with the standard (ISO 14001). Random, external audits of farms in the programme would also be carried out by the external auditor.

The following targets and goals for the industry programme are suggested:

50% of cotton growers certified under the current BMP programme	Dec 2004
100% of cotton growers introduced to the industry EMS	Dec 2004
100% of cotton growers implementing best management practices	Dec 2005
25% of cotton growers certified under an industry EMS	Dec 2006
75% of cotton growers certified under an industry EMS	Dec 2010

Actions

EMS development and implementation and associated costs

Expanding and enhancing the BMP Programme in line with an EMS would require a number of modifications to the programme, and a significant commitment of resources. The development of the BMP Programme into a comprehensive environmental programme, capable of EMS certification would require the following:

- Consultation with growers to ensure the acceptability of the proposed framework ($20,000)
- Development of an industry environmental policy ($25,000)

- Development and implementation of best management practice guidance material, covering the following topics (estimated cost to develop materials: $200,000, over two years):
  - Pesticide management (already in place)
  - Water management (under development)
  - Fuel management (under development)
  - Soil and nutrient management (under development)
  - Vegetation management
  - Waste management
  - Energy conservation
- Development and implementation of guidance material on the 'procedural' components of an EMS (ie. the specifications of ISO14001) (estimated cost to develop materials: $150,000, over two years)
- Development and implementation of grower training package (estimated cost to develop materials: $255,000, over one year)
- Providing EMS training for industry implementation staff and auditors (estimated cost: $100,000, over one year).

Current industry arrangements for the development, implementation and auditing of the BMP Programme can be used to support an industry EMS. In particular, the 'on-ground' implementation activities of Cotton Australia, and the coordination and administration of industry audits conducted by the industry audit office will be key components of a strengthened industry environmental programme.

An expanded industry environmental programme will however, require an increase in the human resources that are currently used in the BMP Programme. The following recommendation is made to ensure adequate human resources are provided for the implementation and administration of the expanded industry environmental programme:

- The provision of an additional two industry implementation staff, for three years during the expansion of the programme (estimated cost: $450,000, over three years).

Considerable resources will be required to establish and maintain an industry-wide EMS. It is estimated that the total costs for the period 2001–2006 would be $6.85M. Assuming current arrangements regarding implementation and auditing are maintained, the cotton industry would be able to fund $4.8M, leaving a shortfall of $2.05M, largely due to the additional EMS and BMP guidance and training materials required, the on-going administration of the audit office (including external audits), and the suggested need for additional implementation staff.

Thus it is critical that every opportunity to minimise costs is taken, and an industry scheme is able to offer certain efficiencies that should help reduce costs to individual growers. Nevertheless, strong external support will be required, especially given the pioneering nature of the recommendations.

What is an EMS?

An EMS is a systematic or methodical way for an organisation to manage its activities that have an impact on the environment. An effective EMS is based on the common sense, cyclical **process** of plan, do, check, and review. Important components of an EMS include an environmental policy, a planning process to identify and address environmental impacts, plan implementation and monitoring, operational controls, audit and review.

Best Management Practices are directed to the identification and management of key or specific issues (eg. environmental, occupational health and safety) at the grower level. Whereas an EMS focuses on the process of environmental management, BMPs focus on solutions, and are an integral component of the implementation of an EMS.

ISO 14001 is the international standard for environmental management systems. ISO 14001 provides a comprehensive, flexible framework for the development of an EMS. ISO 14001 is a “process” standard, not a “performance” standard: ISO14001 sets out the generic procedures that an enterprise should adapt to its operations to effectively manage its environmental impacts, but it does not prescribe the level of environmental performance, nor particular environmental outcomes that the enterprise must achieve.

The importance of an environmental programme in the cotton industry

As is the case in most other agriculture industries, the cotton industry faces a number of challenges relating to its use of, and potential impact on, the natural resource base. The industry’s reliance on the natural resource base, coupled with the increasing regulatory and community pressure on the agricultural sector to demonstrate its responsible management of these resources, demand a coordinated, industry-wide approach to environmental management.

An industry-led, comprehensive environmental programme provides the best opportunity for ensuring that the natural resource issues facing the industry are properly addressed on cotton farms. An effective industry programme will help improve farming practices and production efficiencies, helping to ensure the adaptability and sustainability of the industry.
A strong industry programme will effectively demonstrate the industry’s commitment to responsible environmental management.

In addition to the direct benefits to growers and the industry of sustainable natural resource management, an industry environmental programme has the potential to deliver benefits such as relief from regulatory pressure, assured access to markets, and reductions in on-farm production and legal compliance costs.

The cotton industry has made significant progress in addressing its environmental impacts, particularly through its Best Management Practices Programme (BMP Programme). This programme currently focuses on the environmental and human health risks associated with pesticide use, but is being expanded to address the range of environmental impacts associated with cotton production. The imminent expansion of the programme provides the opportunity to review its operation and to suggest ways that it can be strengthened and improved.

An appropriate model for a cotton industry environmental programme

To help determine an appropriate model for the industry's environmental programme, a number of 'essential features' of an industry programme have been identified. Listed below, these criteria are considered necessary to achieve both high grower adoption rates, and environmental outcomes.

- Industry-led and voluntary
- Informed by regulation and government policy
- Linked with Basin, State and catchment natural resource management strategies
- Strong external support
- Flexible: can accommodate all types of farming enterprises and be integrated with environmental or quality assurance programmes in other agriculture industries
- Whole of farm focus: coverage of all relevant issues
- Simple, clear and achievable
- Includes performance goals and focuses on continual improvement
- Uses flexible, effective management tools and procedures
- Provides feedback to growers, the industry and external stakeholders
- Audited by third parties
- Enables market differentiation of products or enterprises
- Capable of being implemented gradually.

The BMP Programme satisfies the majority of these criteria but can be strengthened by expanding and modifying it in line with the requirements of an EMS.

An industry EMS would ensure comprehensive, farm-specific coverage of all the environmental impacts directly associated with cotton production. An industry EMS would provide growers with a management framework that is flexible, adaptable, and focused on continually improving farm practices and performance.

An EMS can readily incorporate a range of best practices and performance goals, and quickly adapt to changing practices and performance targets. Under an EMS, best practices would become simply a means of improving performance, rather than an ultimate goal of farm management.

An industry EMS would also allow the effectiveness of the industry programme to be objectively verified by third parties, enhancing the credibility of the programme and helping secure potential benefits relating to relief from regulatory pressure and access to markets.

Importantly, the BMP Programme has a number of similarities with an EMS. These similarities provide a strong base from which to expand the BMP Programme, and will help ensure a smooth transition to an EMS.

Measuring the success of the industry EMS – key performance indicators

Setting meaningful performance goals will be important for the effectiveness and credibility of the industry EMS. Performance goals and indicators can be set around management decision-making, operational outcomes, and environmental conditions. In an industry programme, performance goals may be established at the farm and industry levels. Industry and farm performance goals will need to be consistent with those set at the Basin, state and catchment scales.

In general terms, the performance of the industry environmental programme would be assessed by the proportion of growers certified under the programme, and by the achievement of environmental outcomes. Performance indicators that could be used in an industry programme include:

- Grower adoption of best management practices for:
  - Pesticide management
  - Water management
  - Soil and nutrient management
  - Vegetation management
- The proportion of growers certified under the programme
- Improvements in farm water use efficiency
- Improvements in river water quality
- An increase in the area dedicated to native vegetation on cotton farms.

Responsibility for monitoring and measuring on-farm performance will generally fall to the grower; the responsible industry organisation could collect data from farms to report on the industry's performance. Monitoring and measuring environmental conditions is generally best done by governments, researchers or community groups.

Benefits of an industry EMS

The primary benefit of an effective industry EMS would be the widespread adoption of farming practices that are directed at the efficient and sustainable use of the natural resource base. Having the industry's commitment to responsible environmental management externally verified would bring further potential benefits to growers and the industry.

These environmental and associated benefits include the following:

- The adoption of sustainable farming practices on cotton farms
- Efficient use of the natural resource base
- Reduced risk of production losses, in either the short or long term
- Reduced environmental impact of cotton production
- Reduced risk of conflict with other land or water users
- Positive contributions to Basin and catchment natural resource objectives
- The maintenance of good relations between the cotton industry and governments, helping maintain a degree of industry self-regulation
- Access to markets and/or premiums for Australian cotton
- Positive community perceptions of the industry
- Cost savings resulting from improved production efficiencies, reduced raw inputs, and reduced waste
- Improved record keeping, and consequently an improved ability to identify and manage issues in a timely fashion.

Grower surveys

As part of the project, a survey of grower management practices was undertaken. The aim of the survey was to gain an understanding of current farm practices with a view to determining the appropriateness of, and requirements for introducing an industry EMS. The survey also helped determine the impact that the BMP Programme has had on cotton farming practices.

Some of the key survey findings included:

- Low levels of administration staff, particularly on smaller farms
- Small numbers of hours dedicated to record keeping and administrative tasks
- Common use of informal management styles
- Significantly higher levels of training, planning, and use of written procedures in relation to issues targeted in the BMP Programme
- Significant on-farm actions undertaken as a result of the BMP programme.

The survey results have the following implications for an industry EMS:

- It will need to involve strong industry support, through the development of guidance material, and 'on the ground' advice on implementation
- It will require additional implementation staff to those used in the BMP Programme
- It should be introduced gradually
- It should be consistent with and tied to the BMP Programme.

BMP Programme current progress

By January 2001, the level of grower participation in the BMP Programme was estimated at 60%. As at March 2001, 110 cotton growers had had a BMP audit.

Action Summary

To expand the BMP Programme into a comprehensive EMS, the following actions are suggested. These actions are discussed in Appendix 1.

1. **Key stakeholders to hold meeting**
2. **Undertake consultation with industry members**
3. **Undertake consultation with government agencies**
4. **Develop an industry environmental policy**
5. **Establish roles, responsibilities and structures to oversee the implementation and administration of the industry EMS**
6. **Develop best management practice guidance material for all relevant issues**
7. **Oversee the implementation of best management practices for all relevant issues**
8. **Develop guidance material for the ‘procedural’ components of the industry EMS**
9. **Provide appropriate training in EMSs for industry implementation staff and industry auditors**
10. **Oversee the implementation of the industry EMS on farms**

Chapter 2 Introduction

This project is a joint initiative of the MDBC and the cotton industry to determine an appropriate model for the introduction of an industry-wide environmental audit and certification scheme. The project is a component of a Murray-Darling Basin Commission (MDBC) programme to investigate the "*Feasibility and benefits of introducing an appropriate audit and certification model to foster better management practice in natural resources management in the irrigation regions across the Murray-Darling Basin*". Another component of the MDBC programme is investigating related preliminary issues for the rice, dairy and viticulture irrigation industries, as well as Land and Water Management Planning Groups, Rural Water Authorities, Municipalities and Catchment Authorities throughout the Murray-Darling Basin.

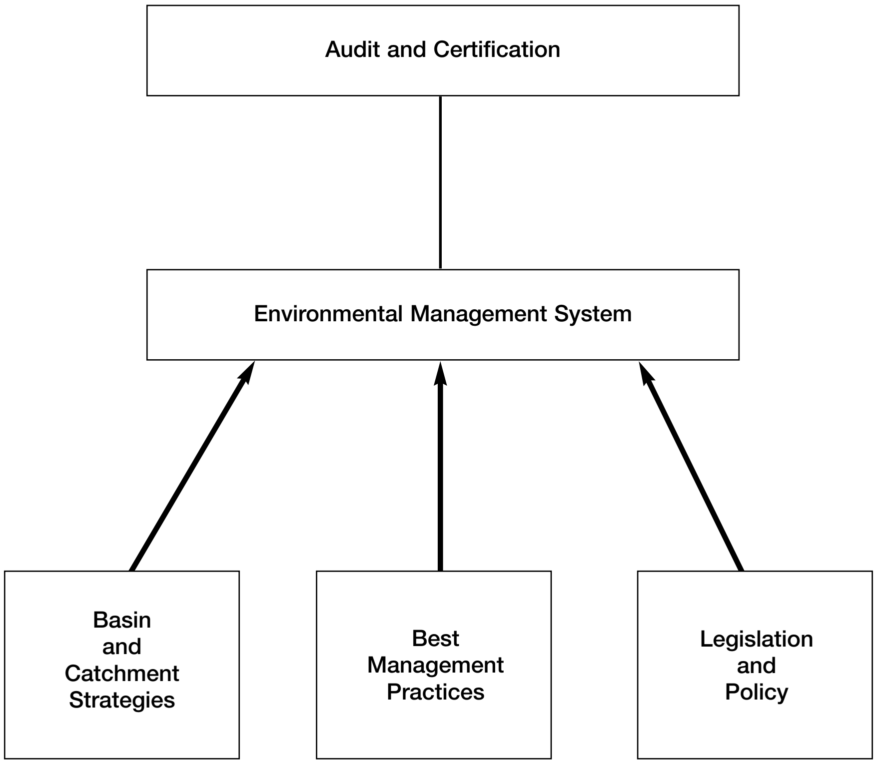
This project builds on the extensive work on environmental management that has already been undertaken in the cotton industry by the Cotton Research and Development Corporation (CRDC), and Cotton Australia. These organisations have played leading roles in developing and implementing environmentally responsible practices on cotton farms. In particular, CRDC and Cotton Australia have been responsible for the success of the industry's programme for the safe use of pesticides, the BMP Programme.

This report highlights the importance of implementing a comprehensive environmental programme in the cotton industry, and outlines the features considered essential for an effective industry programme. The report concludes that a certified industry environmental management system already introduced in the Executive Summary can effectively build on the current industry environmental programme, ensuring that current and future environmental and associated issues facing the industry continue to be properly addressed. The report outlines the advantages of developing the BMP Programme in line with an EMS, as well as the costs that this would entail. Recommended actions and timeframes for the implementation of an industry EMS are also included.

Notes on terminology

- The title of the MDBC programme under which this report has been prepared refers to an "*audit and certification model*". As discussed in the body of the report, audit and certification are two of a number of important components in an effective environmental programme. It is assumed in this report that an industry environmental programme would contain audit and certification components, in addition to a number of other essential features. Indeed the current industry environmental programme, the BMP Programme, includes audit and certification components.[1] A core aim of the report is therefore to identify ways to improve and strengthen the industry's existing environmental audit and certification programme.
- Reference is made throughout the document to the 'Best Management Practices Programme' (BMP Programme), and the 'Best Management Practices Manual' (BMP Manual). The BMP Programme is the cotton industry's scheme for the safe use of pesticides. The BMP Programme is a simple environmental management system with an audit and certification component: under the programme growers assess their operations against industry-recommended practices, plan to improve their practices where necessary, and can arrange an audit to be undertaken to assess their progress. The BMP Manual is the document through which information and guidance is given to growers on the implementation of specific best management practices.
- Best Management Practices focus on solutions to specific issues, and underpin the process of an EMS.
- An EMS is a flexible, rigorous approach to environmental management that focuses on the implementation of a set of generic managerial procedures. These procedures are based on the management cycle of 'plan, do, check and review', and are underpinned by an environmental policy and a commitment to continual improvement. A more detailed description of an EMS is provided in Chapter 5.
- The relationship between the components of effective environmental management can be represented diagrammatically (Figure 1).

Figure 1 Audit and certification, and EMS

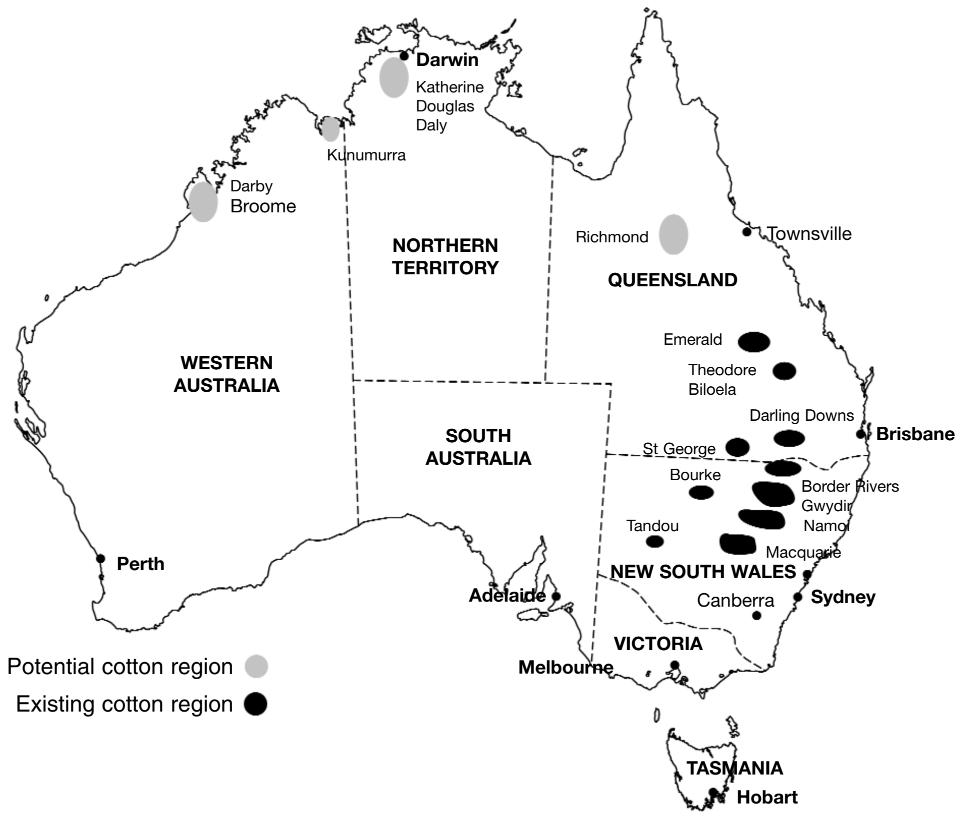


Chapter 3 An Overview of the Australian Cotton Industry

Cotton has been grown in Australia since the 1800s, although the modern cotton industry was not born until the 1960s, when the construction of large dams in northern New South Wales and southern Queensland made the development of irrigated production systems in these areas possible. A reliable supply of water, and the arrival of a small group of American cotton growers were the main driving forces behind the growth of irrigated cotton in Australia.[2]

Irrigated and dryland production expanded rapidly during the 1980s and 1990s. 1985 production totalled 1.1 million bales while 1998 production was 3 million bales (one bale = 227 kg of cotton lint). Average production for the last three years (1997–2000) is over 3 million bales per annum.[3]

Figure 2 Cotton Growing Regions of Australia



As Figure 2 shows, the major cotton growing areas are located in central and northern New South Wales, and southern Queensland, within the Murray-Darling Basin. Approximately 95% of the cotton produced in Australia comes from regions within the Basin. Table 1 shows the areas of irrigated and dryland cotton for 1999 and 2000.[4]

Table 1 Areas of irrigated and dryland cotton production, 1999 and 2000

Production system	Area grown (ha) 1999	Area grown (ha) 2000
Irrigated	403, 300	402, 400
Dryland	131, 100	59, 500
Total	**534, 400**	**461, 900**

Australian cotton growers consistently achieve the highest yields of any of the world's large cotton producers. For example, in 1999 and 2000, the average yield on Australian farms was 1366 and 1574 kg/ha respectively. Corresponding figures for the USA were 725 and 696 kg/ha, and for China, 1064 and 1040 kg/ha.[5]

Cotton is a significant Australian agricultural industry, being the fourth largest rural export earner in Australia, behind grains, beef and wool. Most of the Australian crop (generally around 90%) is exported[6]. The value of Australian raw cotton exports was $1.7 billion in 1999, and $1.6 billion in 2000.[7]

Impact of cotton production

Cotton production generates significant economic benefits in the regions where it takes place. For example, a 1996/97 study[8] found that irrigation industries around Bourke (of which cotton was by far the largest component), contributed approximately $71 million to the gross output of the Bourke Shire, and generated around 700 jobs out of a shire total of 1,500. The study also found that approximately 45% of employment in Bourke was directly or indirectly related to irrigated agriculture.[9] Similarly, a 1993 study of the MacIntyre Valley found that the cotton industry generated approximately 1500 jobs, 10% of all employment in the valley, and contributed $234 million to total gross economic output in the region (for 1991–92).[10]

There are estimated to be in the order of 1200 farms producing cotton in New South Wales and Queensland. The majority of these farms are family enterprises[11]. Many cotton growers produce other crops such as wheat, sorghum, lucerne or soy beans, or run livestock such as cattle or sheep. As Table 1 indicates, most Australian cotton is produced under irrigation.

Along with other irrigation industries, the cotton industry is a significant user of water. Total national agricultural net water consumption in 1996–97 was 15.5 million ML, which comprised 70% of the total net water consumption for Australia.[12] Net water consumption by cotton for 1996–97 was 1.8 million ML (or 12% of total use by agriculture). Corresponding figures for rice, sugar and grapes were 1.6 million ML, 1.2 million ML, and 650,000 ML respectively.

Water use efficiency

Average figures for water use efficiency in Australian cotton production are: 5.8 ML/ha, producing $612/ML worth of raw product (fibre).

Corresponding averages for rice are: 10.7 ML/ha and $289/ML.

Corresponding averages for sugar are: 7.1 ML/ha and $418/ML.

Controlling insect pests in cotton is also an important component of production. The damage caused by pests such as heliothis, mirids, tipworm and mites can significantly reduce yield. The industry has developed a range of practices to help control these pests, and growers are increasingly adopting integrated pest management strategies to help reduce their use of pesticides. Average numbers of pesticide applications in cotton for the years 1997–99 are shown in Table 2[13].

Table 2 Average numbers of pesticide applications

Year	Number of applications (conventional cotton)	Number of applications (Bt cotton[14])
1997	10.3	5.0
1998	10.0	5.7
1999	14.7[15]	9.3
2000	10.3	6.2

Chapter 4 The importance of implementing an environmental programme in the cotton industry

Summary of main points

There are a number of factors contributing to the need for a comprehensive environmental programme in the cotton industry. These factors include the following.

Reliance on the natural resource base

The cotton industry is a significant user of land and water resources in the Murray-Darling Basin. The industry's reliance on these resources means that it needs to develop effective, long-term strategies that ensure cotton farms are managed sustainably. Cotton production is also affected by changes to the natural resource base that are outside the industry's control. The industry needs to ensure that farm management practices can adapt to possible changes in the condition of, or access to land and water resources. An industry environmental programme that helps growers manage their land and water resources efficiently and sustainably will help ensure the longevity of the industry.

Impact on the natural resource base

The cotton industry's use of natural resources means that it inevitably impacts on those resources. The industry's impact on the natural resource base can affect the interests of other users. The industry recognises the rights and interests of other users of the natural resource base (including both consumptive and non-consumptive uses), and the need to take these rights and interests into account when carrying out its activities. Reducing its environmental impact is part of being a good citizen, and will minimise the risk of conflict with land and water users, governments or community groups.

Public demonstration of responsible natural resource management

A coordinated industry-level approach to natural resource management in cotton production will help ensure the widespread implementation of efficient and sustainable farming practices. An industry programme can effectively link government policy and regulations with farming practices and best enables growers to collectively demonstrate their responsible management of natural resources.

Related benefits of responsible natural resource management

In addition to helping ensure sustainable production and reducing the risk of natural resource degradation, an industry environmental programme can bring a number of other benefits to the industry and individual growers. These include relief from regulatory pressure, access to markets, and reductions in production costs.

Chapter 4 The Importance of Implementing an Environmental Programme in the Cotton Industry

This report examines the feasibility and benefits of developing and implementing an environmental audit and certification scheme in the cotton industry. To determine the feasibility and benefits of such a scheme, it is necessary to address the following two fundamental issues:

- The importance of implementing a comprehensive environmental programme in the cotton industry
- What is an appropriate model for a cotton industry environmental programme?

The first of these issues is addressed in this chapter. The second is addressed in Chapter 5, where the essential features of an industry environmental programme are compared with those of the current industry programme (the BMP Programme). Chapter 5 highlights the aspects of the BMP Programme that can be strengthened to make the programme more effective into the future, and suggests that an EMS is an appropriate model on which to base these changes.

Why have an industry environmental programme?

There are a number of factors contributing to the cotton industry's development and implementation of a comprehensive environmental programme. Discussed below, the most significant of these include:

- The industry's reliance on the natural resource base
- The industry's impact on the natural resource base
- The industry's desire to demonstrate its commitment to responsible natural resource management
- The industry's desire to maintain control of its activities
- Ensuring access to markets
- Reducing on-farm production costs.

Reliance on the natural resource base

The cotton industry is a significant user of land and water resources in the Murray-Darling Basin. The continued production of high quality cotton relies on the future availability of adequate land and water resources; ie. minimum quantities of good quality water, and a good quality of soil. The industry's reliance on these finite resources means that it must use the land and water that it owns, or to which it has access, efficiently and sustainably.

Minimising the industry's impact on the natural resource base is of obvious importance for the future wellbeing of the industry. Growers who manage their operations with a view to continually improving the condition of the natural resource base will be viable well into the future. Sustainable natural resource management can help reduce the risk of production losses in either the short or long term. An industry environmental programme can help ensure the widespread adoption of sustainable farming practices, and improve on-farm production efficiencies.

Additionally, the industry's access to and use of natural resources will continue to be affected by factors largely outside its control; for example, the rights and impacts of other resource users, and environmental conditions such as upland salinity and drought. The industry's sustainability is dependent in part on its adaptability. It is important that the industry position itself to be able to quickly and effectively respond to changes in the natural resource base brought about by external factors. An industry environmental programme that helps growers manage their land and water resources efficiently and sustainably will enable growers to accommodate or adjust to any changes in the natural resource base as they occur.

Impact on the natural resource base

A corollary of the industry's reliance on natural resources is the impact that its use of those resources can have on other consumptive, and non-consumptive uses. Minimising the industry's impact on other users and uses of natural resources is important for a number of reasons. For example, the industry recognises its responsibilities as one of many users of natural resources, and is committed to being a 'good citizen'. The industry appreciates that rights to the use of the natural resource base are accompanied by obligations regarding the proper use of those resources, which includes taking other users and uses into account, and minimising the potential impact that the industry's use of natural resources could have on these other interests. It is in the industry's best interest to maintain good relations with other land and water users, agriculture industry groups, governments, and community groups. If the industry is perceived by these stakeholders to be using natural resources irresponsibly or inefficiently, its relations with these groups will suffer. In particular, a failure to meet government or community expectations regarding natural resource management is likely to lead to tighter regulation regarding the access to and use of these resources. An effective industry environmental programme will help demonstrate the industry's commitment to responsible natural resource management, and reduce the risk of cotton production adversely affecting other users of the natural resource base.

This should in turn reduce the risk of conflict between the industry and other stakeholders, such as governments, other land and water users, community groups, and non-government organisations.

The industry has already made significant progress in addressing the potential impacts that its activities can have on land and water. The BMP Programme developed by the Cotton Research and Development Corporation is the industry's central environmental strategy. The BMP Programme was born out of the industry's desire to minimise the environmental and human health risks associated with its use of pesticides. Minimising the risk of harm to other landholders is a strong focus of the programme, and indeed the programme was initially known as "Good Neighbours". This theme of 'doing the right thing' remains strong in the expansion of the BMP Programme beyond issues associated with pesticide use.

Implementation of the BMP Programme on farms is the responsibility of Cotton Australia. To help provide the BMP Programme with clear direction and focus, Cotton Australia has also developed draft environmental policies for a range of issues relevant to cotton production. The BMP Programme is supported and supplemented by a strong environmental research effort, overseen by the Cotton Research and Development Corporation, and the Australian Cotton Growers' Research Association. Industry-sponsored research is continuing in areas such as integrated pest management, water use efficiency, and soil and nutrient management. A detailed discussion of the BMP Programme and the potential for its continued expansion and improvement is included in Chapter 5.

Natural resource issues

The following is an outline of the natural resource issues of highest priority for the cotton industry and the MDBC, and of the natural resource issues that an industry environmental programme should address.

The following have been identified as priority issues for the cotton industry:[16]

- **Pesticide management**
- **Surface and groundwater management**
- **Groundwater quality**
- **Protection of wetlands**
- **Floodplain buffer zones**
- **Water harvesting on floodplains**
- **Soil salinisation.**

Of these issues, the management of pesticides and (surface and ground) water will continue to have high priority. Effectively controlling insect pests and having access to an adequate supply of water are vital components of irrigated cotton production systems. Both these components can however, lead to off-site environmental impacts. Their importance to the industry, combined with this potential for off-farm impacts ensures thorough coverage of pesticide and water management in the industry's environmental programme. Similarly, soil and nutrient management are important components of cotton production, and therefore essential inclusions for an industry environmental programme.

The four "Key Result Areas" of the MDBC's Basin Sustainability Programme are as follows:[17]

- Water quality
- Sustainable agricultural productivity
- Nature conservation
- Cultural heritage.

Under these headings, objectives of the Irrigated Regions Strategic Plan include:[18]

- Substantially reducing salt, nutrient, sediment and other contaminating exports from rural sources to streams and rivers
- Protecting groundwater quality
- Continuously improving the efficiency and effectiveness of irrigation water use
- Engaging the irrigation industry at the regional level in establishing river flow regimes that provide an appropriate balance between consumptive and in-stream water uses
- Ensuring the sustainable use of groundwater resources
- Maintaining key ecological processes.

Similarly, objectives of the Riverine Environment Strategic Plan include:[19]

- Improving the quality of the water in streams, rivers and groundwater … by implementing appropriate flow regimes
- Establishing flow regimes that provide an appropriate balance between consumptive and in-stream, wetland and floodplain water requirements

- Maintaining/re-establishing viable populations of native species and the integrity of ecological communities … within floodplain, wetland, riparian [and] in-stream … ecosystems.

To ensure the effectiveness and credibility of the industry environmental programme will need to take into account the priority issues of the industry, and those of the MDBC. These issues can be addressed through the implementation of practices and procedures within the following topics:[20]

- Pesticide management (already in place)
- Water management (including irrigation, stormwater and drainage)
- Soil and nutrient management
- Vegetation management.

In addition to industry and MDBC priorities, a comprehensive industry programme will also need to take into account state government regulation and policy, and any natural resource management strategies being developed at the State, catchment or regional scales. Indeed, an industry programme provides an effective mechanism for translating large-scale natural resource management strategies into actions or operations on the ground, across a large number of farms.

Pesticide management

The BMP Programme provides detailed information on all facets of pesticide use relevant to cotton growers. The best management practices on which growers are audited and certified have as a principal aim the minimisation of the risk of pesticides moving off-farm, either as drift or in irrigation or storm water run-off. The BMP Programme covers pesticide application, storage and handling, farm design, and integrated pest management. The industry will continue to update and improve the recommended pesticide management practices as technology or government policy and regulation change.

Water management

Although the cotton industry's major concern in relation to water focuses on security of the right to use, it is clear that any use rights will need to be balanced with a commitment to use water efficiently and to responsibly manage water movement (for example tail water and stormwater. Part of this industry commitment is already evident in the planned development of best management practices relating to water use. This component of the BMP Programme is to be completed by 2002, and will address issues such as distribution, application and storage efficiencies, system maintenance, and drainage. The industry in Queensland has also committed to a 10% improvement in farm water use efficiency over five years (commencing 2001).

The role that planning under the industry programme plays in meeting State and catchment land and water management planning requirements will need to be clear. Indeed, it may be possible for adoption of the planning and practical recommendations under the industry programme to become one means for growers to substantially meet their legislative responsibilities. It needs to be appreciated that in light of the industry programme being a voluntary scheme, its alignment with legislative requirements (cf. a Code of Practice under Queensland environmental legislation) could mark a significant change in its status. Such a change would require full consideration by the appropriate cotton industry organisations, and grower approval, as well as government support.

Soil and nutrient management

Soil management practices outlined in the industry document, SOILpak have been widely adopted by growers. Problems associated with soil degradation, compaction, sodicity and waterlogging have been addressed to a large extent and are therefore not a high priority for the industry. Nonetheless, to help ensure the continued use of effective soil management practices, and to help growers address potential problems should they arise, the future expansion of the industry programme will include soil management, covering topics such as soil nutrition and structure, erosion, compaction, salinity and sodicity.

Vegetation management

Vegetation management is an area where close attention to Basin, State and catchment strategies will be particularly important. Industry expertise in ('production-based') issues surrounding pesticide, water, and soil management enables strong industry input in these areas. In relation to vegetation management, the industry may need to rely to a greater extent on local and regional strategies to determine appropriate industry and farm practices. Vegetation management is also an area subject to potentially significant variability, owing to differences in regional ecology, farm geography, farm design, and levels of past clearing that can dramatically affect the appropriateness of practices between farms. Vegetation management will need to cover both the riparian and non-riparian zones, and address issues such as conservation of remnant native vegetation, revegetation, and pest control.

Public demonstration of responsible natural resource management

To ensure that effective natural resource management practices are being implemented consistently across cotton farms, and to be able to demonstrate this fact to other stakeholders, an industry-level approach to natural resource management is considered most appropriate. An industry programme can help ensure that the interests and priority issues of both external stakeholders, and industry members (growers) are taken into account and addressed in a co-ordinated way on a large scale. Industry organisations are well positioned to translate government policy and regulation, scientific research, and Basin and catchment natural resource strategies into plans and practices that can be adopted in a consistent way across farms. A centralised, coordinated approach to environmental management on an industry scale helps ensure an acceptable minimum standard of practice is achieved across the industry, providing the best opportunity for industry-wide environmental outcomes.

A centrally administered industry environmental programme provides the best opportunity for growers and the industry to demonstrate to other stakeholders that effective natural resource management practices are in place. Industry organisations provide convenient focal points for communications between industry members, as well as with external stakeholders.

A transparent and credible environmental programme can effectively establish the industry's credentials in relation to environmental management. For example, the National Registration Authority has included the following statement on the label for the insecticide endosulfan: "*When used on cotton (endosulfan) must be used in accordance with the current Australian Cotton Industry Best Management Practices Manual ...*" This reference to the industry programme in a regulatory document reflects the industry's genuine commitment to responsible pesticide management, and the regulator's faith in the industry's expression of this commitment. Credible environmental management is important in and of itself, as well as being vital to secure benefits relating to industry self-regulation and access to markets.

Managing environmental issues through a centralised industry programme also helps reduce implementation and administrative costs for growers. For example, implementing and maintaining an environmental programme requires a minimum level of documentation and record keeping. Industry-developed documentation provides a good starting point for growers to assess their operations, and record their farm planning and environmental management. Similarly, strong industry involvement on the ground, through workshops and farm visits can help growers save time during the planning stage. Under an industry programme, administrative support in relation to arranging and undertaking audits will also help reduce the time and resources that would otherwise be required if growers acted alone.

Related benefits of responsible natural resource management

In addition to helping ensure sustainable production and reducing the risk of natural resource degradation, an industry environmental programme can bring a number of other benefits to the industry and individual growers. These benefits are further reasons for developing a comprehensive industry environmental programme. Briefly discussed below, these benefits relate to relief from regulatory pressure, access to markets, and reductions in production costs.

Industry self-regulation

If agricultural industries pull their weight in relation to environmental management, regulators may be prepared to allow a greater degree of industry self-regulation than would otherwise be the case. In any event, responsible natural resource management should help industry avoid excessive regulatory burdens. This outcome would be beneficial to both the regulated and the regulators. Environmentally responsible industries should require less in the way of regulatory resources, as Gunningham and Johnstone note: “an [effective environmental programme] passes responsibility back to the regulated, [which means] the regulators can take an oversight role”[21].

Effective environmental management in agriculture demands a cooperative approach involving natural resource managers (such as cotton growers), regulators and other stakeholders. An objectively demonstrable commitment by the cotton industry to responsible natural resource management will help facilitate a cooperative approach, and ensure that the industry maintains a degree of control over its activities. An appropriate level of industry self-regulation will help ensure that the methods employed to satisfy the industry’s environmental and legal responsibilities are acceptable to growers. This will facilitate grower adoption of environmentally sound practices, and therefore the achievement of natural resource outcomes on an industry scale.

The industry intends to keep pace with or stay ahead of government and community expectations in relation to environmental management. The implementation of an effective industry environmental programme, aimed at ensuring the sustainability of cotton production, and minimising its impact on the environment should help the industry meet (or stay ahead of) government and community expectations regarding natural resource management, and ensure constructive relations between the industry and governments.

Ensuring access to markets

"There has been a noticeable demand in the last decade from consumers for more environmentally friendly and responsible products and services"[22].

The potential impact of an increase in demand for 'environmentally friendly' produce is an important consideration, and the implementation of an effective industry environmental programme would allow the industry to take advantage of changes in market priorities as they occur.

Heinze states that in relation to agricultural commodities generally: "international market trends suggest that in some markets failure to adopt internationally accepted best management practices or EMSs may disadvantage Australia's agricultural export opportunities in the longer term, and that taking the lead may even enhance our market position"[23]. Similarly, Gunningham and Sinclair note that "those who cannot demonstrate a commitment to sustainable environmental management may be excluded from some international markets by non-tariff trade barriers based on environmental issues"[24].

Marketing Australian cotton as 'green' or as a fibre produced under environmental and agricultural best practice could secure access to markets that would otherwise not be open. The industry's heavy reliance on export trade underlies the importance of keeping pace with international trends in this area, and therefore of the value in implementing a comprehensive environmental programme that is capable of being recognised internationally.

Case study

Oakville Pastoral Company

Oakville Pastoral Company was the first cotton farm in the world to be certified to ISO 14001. A significant incentive for the company developing a comprehensive environmental programme and pursuing ISO certification, was the potential to differentiate its cotton and therefore secure premiums in niche markets. The company has been certified to ISO 14001 for a number of years, but at this stage has not secured market premiums for its cotton. Nonetheless, the company believes the decision to pursue ISO 14001 certification was a good one, as in addition to improving the farm's environmental performance, the company is well prepared to take advantage of changes in market priorities as they occur.

Reducing on-farm production costs

An industry environmental programme has significant potential to improve on-farm efficiencies, leading to cost savings. The 'greengold thesis' suggests that: "improved environmental performance has the potential to improve economic efficiency and business image"[25], resulting in financial benefits for environmentally responsible enterprises.

In relation to cotton production, cost savings may be realised through more efficient use of water, pesticides, fertilisers and fuel, as well as through reducing equipment and machinery breakdowns, and waste. Similarly, practices such as conservation tillage, nutrient and soil testing, and integrated pest management are 'environmentally superior', and can save growers money. The improved record keeping that an industry programme can bring, should lead to an improved ability to identify, and hence manage, issues in a timely fashion.

An industry environmental programme that compromises farm productivity or profitability will not be successful. Implementing the management practices and procedures demanded by an industry environmental programme may prove to have a number of up-front costs for growers, detracting from the attractiveness of the long-term benefits that improved management practices and operating efficiencies can bring. For example, many cotton farms are small to medium-sized operations with relatively simple management systems and styles. Implementation of the industry programme on these enterprises may demand in relative terms, significant human and financial resources.

The industry's management of the costs to growers of implementing the programme will be instrumental in influencing grower attitudes, and in determining the viability of the programme. Introducing the programme gradually will help spread growers' implementation costs, and avoid overwhelming growers with excessive demands on their time or resources. An industry-based scheme should help relieve growers of some of the administrative costs of implementing an environmental programme. The industry also needs to make the benefits of the programme clear to growers. The cotton industry is currently investigating 'industry partnerships', to involve industry service providers in the programme, and to provide financial benefits to participating growers. This and similar strategies highlighting the benefits of the industry programme will need to be pursued to foster grower participation in the programme.

Chapter 5 An Appropriate Model for the Cotton Industry's Environmental Programme

Summary of main points

The success of the cotton industry's environmental programme will be measured by the proportion of growers certified under the programme, and resulting improvements in farming efficiencies and natural resource conditions. A number of features of an industry environmental programme have been identified as essential to achieving this success. These features, or criteria are as follows:

- Industry-led and voluntary
- Informed by regulation and government policy
- Linked with Basin, State and catchment natural resource management strategies
- Strong external support
- Flexible: can accommodate all types of farming enterprises and be integrated with environmental or quality assurance programmes in other agriculture industries
- Whole of farm focus: coverage of all relevant issues
- Simple, clear and achievable
- Includes performance goals and focuses on continual improvement
- Uses flexible, effective management tools and procedures
- Measurable: provides feedback to growers, the industry and external stakeholders
- Audited by third parties
- Enables market differentiation of products or enterprises
- Capable of being implemented gradually.

The BMP Programme satisfies the majority of these criteria but can nonetheless be strengthened to help the industry fully realise the benefits of responsible natural resource management. For example, the 'process' components of the BMP Programme can be strengthened to ensure growers address all the environmental impacts of their operations in a way that is most appropriate to their particular situation, and that is focused on continual improvement. Also, the BMP Programme is audited by 'internal' industry auditors, and therefore may not give the same level of assurance to external stakeholders, as a programme that is subject to external audits.

An industry EMS can build on the strengths of, and address the gaps in the BMP Programme. In particular, an EMS will help expand the industry programme to ensure it covers the full range of environmental impacts associated with cotton production. This will be achieved through the implementation of flexible management procedures, backed up with industry guidance on potential environmental issues that can arise in cotton production, and practical solutions to those issues. An industry EMS can be audited by external parties, providing an independent and objective assessment of the industry's progress. External audits will be important to ensure the credibility of the programme, and to secure potential benefits such as market access and regulatory relief.

Chapter 5 An Appropriate Model for the Cotton Industry's Environmental Programme

This chapter describes the features considered essential for the cotton industry's environmental programme[26], and based on these features, outlines an appropriate model for the industry programme.

For brevity, the discussion here of possible models for the expansion of the current programme has been reduced to a comparison of the BMP Programme with an EMS[27]. An industry environmental programme based on an EMS has been considered an option by the industry for some time. This is due to the strong links between the BMP Programme and an EMS, and an independent belief that an EMS can be an effective long-term strategy for environmental management on an industry scale.

It is important to note that a number of other models have also been considered by the industry, both prior to and as part of this project. For example, the development of the BMP Programme included extensive research into local and overseas environmental programmes. More recently, a Quality Assurance Services (QAS) report[28] commissioned by the Cotton Research and Development Corporation for this project investigated a range of possible programmes and standards that the industry could use in its expansion of the BMP Programme. The QAS report concluded that only a small number of programmes or standards, other than ISO 14001 would be appropriate models for the future development and expansion of the BMP Programme.

The QAS report recommended that the following programmes or standards could be of use in this respect:

- the NOSLaM Enviro-Ag Scheme (New Zealand)
- the Farmcare Code of Practice for Sustainable Fruit and Vegetable Production (Queensland)
- ISO 9000 standard for quality assurance.

Of these, the industry considers only the NOSLaM programme to be worthy of further investigation. The NOSLaM programme is certified to ISO 14001 and includes an auditing framework that could be adapted to an EMS in the cotton industry. A discussion of the particular components of the NOSLaM programme that could be of use to the cotton industry is included below. The industry has discounted the other options recommended in the QAS report for the following reasons: the Farmcare Code of Practice for Sustainable Fruit and Vegetable

Production, as it currently stands, is not readily audited, and the industry believes an industry EMS can serve the purpose of an 'environmental code of practice'; ISO 9000 addresses issues relating to product quality, not environmental issues, and the industry does not plan at this stage to develop a formal industry quality assurance programme.

The industry has invested considerable time and resources into ensuring the effectiveness of its environmental programme, and the success of the BMP Programme militates against the industry making radical changes to its structure or content. Nonetheless, a key principle behind the BMP Programme is that it should be continually reviewed and improved. As the following discussion indicates, an EMS can effectively build on the strengths of the BMP Programme, without significantly affecting the nature of the programme. An industry EMS is the logical next step for the BMP Programme, to ensure its continued improvement and expansion.

What is an environmental management system?

An environmental management system is a systematic or methodical way for an organisation to manage its activities that have an impact on the environment.[29] An EMS focuses on processes relating to planning, plan implementation, monitoring and review already commonly understood as important aspects of good business management. An effective EMS is based on the common sense, cyclical process of 'plan, do, check, review'.

An EMS sets a broad procedural and structural framework for management to determine appropriate operational and environmental outcomes, and ways of achieving those outcomes. Importantly, adopting an EMS means committing to the continual improvement of environmental management and therefore of environmental performance.[30] Effective implementation of an EMS demands continuous monitoring of the system, as well as its periodic review. The practices and performance goals established under the system are therefore continually reassessed, and improved or modified to ensure that the enterprise is effectively addressing its environmental impacts, and improving its performance.

A significant attraction to adopting an EMS is its creation of a managerial framework that involves all levels and components of the enterprise in environmental management. It is not limited to any one or group of activities, or to a particular environmental hazard or impact. Rather, it looks at the entire enterprise and how it operates, to ensure environmental issues are considered and acted upon at all stages of its operations. This embeds environmental issues as relevant concerns to everyone in the enterprise, and can change the norms of the enterprise to reflect environmental values. Environmental issues become central, rather than peripheral to the enterprise's activities.

The cotton industry's Best Management Practices Programme

The cotton industry's Best Management Practices Programme is the main industry strategy to improve on-farm environmental performance. The programme was born out of concerns over the impact of pesticide use on the riverine environment, and provides comprehensive practical guidance to help growers minimise both the environmental and human health risks associated with pesticide use. Guidance on risk assessment, planning and auditing is also included to give the practical advice contained in the BMP Manual a simplified process or systems context. The BMP Programme consists of the following elements:

- Risk Assessment – worksheets contained in the BMP Manual help growers identify and assess risks relating to pesticide use on their farm
- Best Management Practices Booklets – these provide detailed information on best management practices for issues highlighted through self-assessment
- Action Plans – growers are required to develop action plans to address areas of identified risk; action plans focus on the implementation of best management practices recommended in the BMP Manual
- Auditing – growers can be audited on their adoption of the 'BMP process' as well as their implementation of specific best management practices.

Best Management Practices

A definition

Heinze provides a useful general definition of Best Management Practices, recognising the link between BMPs and a systems-based approach: "BMP is an extension of the traditional management approach of providing information and setting guidelines and rules for implementation at the grower level. BMPs identify key issues (environmental, occupational health and safety etc) which can be managed at the grower level and provide information (on risk identification and solutions) within a process-based framework which better enables the grower to confidently manage these issues in a way which leads to continuous performance improvement. The development of BMP is a logical first step to 'systemising' a grower's approach to managing a wide range of issues at farm level."[31]

Best Management Practices underpin the operation of EMS, providing solutions to the issues identified as requiring action during the EMS process.

Essential features of an industry environmental programme

The following characteristics of an industry environmental programme are based on criteria listed in the above-mentioned Quality Assurance Services (QAS) report[32], and the cotton industry's experience in developing and implementing environmental management practices through the BMP Programme. The criteria outlined here are consistent with the recommendations on the principles or essential features of EMSs, made at a 1998 National Workshop on environmental management systems in Agriculture[33].

Industry led and voluntary

To help encourage grower participation and effect changes in farm management practices, it is important that the industry programme be voluntary, and be controlled by the industry. Industry control is vital to foster 'ownership' of (and therefore participation in) the programme at the grower level. An industry environmental programme that is driven by its participants (ie. that is voluntary), provides the best opportunity for industry ownership of and stewardship over the environmental issues relevant to its operations. Existing research strategies and structural and communication arrangements within the cotton industry ensure that relevant information and support can be readily provided to growers. A voluntary, industry-led programme should foster innovation on farms, and help maintain the farming focus of the industry's research effort.

Self-directed initiatives are more likely to be successful than 'command and control' mechanisms of change. Effecting long-term improvements in environmental management on farms will require changes to the culture that exists on many farms. Cultural changes that are generated from within an enterprise have a greater chance of enduring than those that are imposed by external forces. Maintaining control of one's 'destiny' is also a significant motivator. For example, the experience of a voluntary best management practices programme in Ontario, Canada was that "producers [took] an aggressive approach toward voluntary practices, realising that they are preferable to mandatory practices."[34]

An industry-led programme will help ensure that the industry's priority issues are addressed in a way that is acceptable to the industry. Industry control of the programme should not however, detract from the effectiveness of the practices included under the programme. Any concerns of this nature can be addressed through other components of the programme, such as external auditing and certification, and the inclusion of performance goals that are consistent with those established at the Basin, State or catchment levels. Consultation with governments, community groups and non-government organisations will help ensure that practices recommended under the industry programme effectively address the concerns of these stakeholders.

To help ensure acceptable adoption rates under a voluntary programme, it will be vital that the industry develop and highlight incentives for participating growers. Work in this area has already commenced under the BMP Programme, and incentives and 'rewards' for growers involved in the industry programme will continue to be investigated as the programme expands.

BMP versus EMS – a comparison

The BMP Programme and an EMS are both appropriate models for an industry-led and voluntary, environmental programme. Both models can be readily implemented on farms, on an industry scale. Current industry structures and communication arrangements can support either model.

As discussed further below, an industry EMS should provide greater flexibility in relation to farm management than the BMP Programme, and therefore greater scope for innovation and site-specific solutions to local issues. Providing ample scope for innovation and encouraging farm-based methods of addressing environmental issues are important components of a voluntary programme. An inflexible or overly prescriptive programme runs the risk of stifling innovation, and low grower participation rates. Conversely, a programme without sufficient practical content will not help educate growers in environmental issues, nor provide helpful guidance on farm-based solutions. This balance of flexibility and practical guidance (or 'process' and 'content') is important for the effectiveness of the programme.

Informed by regulation and government policy

Legal compliance should be a minimum performance requirement of the industry's environmental programme. Legal obligations can provide a convenient starting point for action, and help establish the credibility of the industry programme. Implementing farm practices that are consistent with relevant government policy should help achieve a minimum standard in relation to environmental protection and natural resource outcomes. Consultation with governments will continue to be important as the industry's environmental programme is expanded. Action undertaken by the cotton industry will need to be consistent with that undertaken by governments at the federal, state and regional levels.

BMP versus EMS – a comparison

The practices and procedures included in either a 'BMP model' or an EMS can readily address relevant legal obligations and government policy initiatives.

The BMP Programme is designed to help growers meet a number of their legal obligations regarding pesticide use, and consultation with government agencies during the development of the programme has helped ensure that recommended best management practices are consistent with relevant regulations and policy.

As best management practices are developed for issues beyond pesticide use, the industry will continue to take cognisance of legislative and government policy initiatives.

An industry EMS will require growers to identify and comply with both the environmental legislation and regional and/or catchment strategies and policies that affect their operations. This will help entrench legal compliance as a minimum performance goal of the industry programme. The flexibility of an EMS will help the industry and growers adopt and adapt to relevant legislative and policy requirements as they emerge, using farm-specific solutions underscored by industry-recommended best practices.

Linked with natural resource management strategies developed at Basin, State and catchment scales

A number of natural resource strategies are currently being developed or implemented at the Basin, State, catchment and regional scales.[35] To ensure that farming practices implemented under the industry programme make a positive contribution to these strategies, and to help growers avoid duplicate or conflicting demands, it will be important to develop the industry programme such that it can readily meet the requirements of these government initiatives. The programme will therefore need to be flexible and adaptable, to enable any relevant targets or practices under these other initiatives to be easily adopted on farms. In other words the programme itself will need to demonstrate the 'continuous improvement' cycle expected of the participants.

Industry organisations are well placed to translate and implement broad scale natural resource strategies in a way that is meaningful for growers. Consolidating the numerous natural resource management requirements to which growers are subject will be cost effective, as it need only be done once at the industry level, rather than at the individual farm level. This will help avoid growers becoming overwhelmed, reduce costs and promote adoption of relevant practices at the farm level.

BMP versus EMS – a comparison

The BMP Programme does not currently contain direct linkages with Basin or catchment strategies. An industry EMS should provide an appropriate framework in which to establish ongoing linkages.

As the industry programme is expanded to address issues beyond pesticide use, linkages with Basin and catchment strategies will need to be established. These linkages can be made through the industry adoption of relevant Basin and catchment natural resource targets, and the development and implementation of farm best practices that contribute to the achievement of these targets. An EMS involves the ongoing setting, monitoring and review of environmental objectives and targets, under the guidance of an environmental policy.

This can provide an effective means for Basin and catchment natural resource targets to be included and amended as necessary, within the industry programme.

To be most effective, farming practices that are directed at achieving Basin or catchment natural resource targets need to be site or farm-specific. Industry-recommended practices may therefore only have limited application on some farms.

The flexibility of an EMS will allow growers to either adopt practices recommended by the industry, or otherwise develop their own methods to meet natural resource targets. These targets may also derive from regional strategies and policies.

An industry EMS will therefore help ensure industry natural resource performance goals reflect Basin and catchment targets, and that these goals are consistent across the industry. Once Basin or catchment targets are in place, an industry EMS will assist growers meet these targets by providing guidance on effective practices, and flexibility to enable industry-recommended practices to be adapted to different farming situations.

Strong external support

A comprehensive industry environmental programme will benefit external as well as internal stakeholders. For example, an effective programme will help ensure that growers meet their legal obligations, and that they adopt practices that make a positive contribution to government environmental policies and strategies. Developing and implementing an industry environmental programme will however, demand significant human and financial resources from industry organisations. Strong support from external stakeholders during the development and early implementation of the programme is therefore both reasonable and necessary. As noted by Barr and Cary (at page 3) "Motivation, financial incentive, financial capacity, skill capacity and appropriate technology are necessary before changes in farm management behaviour can be expected. Policies to change motivation, for example to attempt to encourage a stewardship ethic without addressing other issues such as skill capacity or financial incentives, are likely to have only a small impact". This support could be provided in a number of ways, including direct financial support for the development of the programme by governments, formal endorsement, or relief from regulatory requirements.

External support is likely to depend on the potential effectiveness of the programme, rather than the model on which it is based. A comprehensive industry EMS should help realise natural resource outcomes sought by the industry and external stakeholders. Support from external stakeholders will be vital for the success of the programme.

Flexible: able to accommodate all types of farming enterprises, and able to be integrated with environmental or quality assurance programmes in other agriculture industries

A large proportion of cotton growers run livestock and/or grow other crops in addition to cotton. To help ensure that these growers address the environmental impacts of their entire enterprise, and that growers who are involved in other industry schemes are not subject to duplicate or conflicting demands, the cotton industry programme must be flexible and adaptable. It must be capable of being extended beyond cotton production, and must not be inconsistent with other production systems or industry programmes[36]. This degree of flexibility is most likely to be achieved through the use of generic management procedures that can be adapted to the full range of farming enterprises. Within this management framework, detailed guidance can be provided on practices and principles that can help growers improve their resource use efficiency and reduce environmental risks.

BMP versus EMS – a comparison

The BMP Programme is currently focused on issues associated with cotton production, and has not as yet provided growers with explicit advice on how to integrate cotton best management practices with other agricultural production systems, or with the requirements of environmental or quality assurance schemes in other agricultural industries. Nonetheless, the industry believes[37] that the majority of practices currently recommended under the BMP Programme are consistent with other agricultural land uses, and where appropriate could be incorporated in other industry schemes[38].

To be most effective, an industry environmental programme must be comprehensive. Industry-recommended best practices are unlikely to be able to cover every situation on every farm. As the industry programme expands to cover a greater number of environmental issues, it will become increasingly important that these issues be addressed within a flexible management framework that equips growers with tools and skills that can be used to address all of the environmental impacts of their operations, irrespective of the particular production system. An industry EMS can provide this framework: it will require growers to address all their environmental impacts, and it will provide them with the management tools to enable them to do so (for example, risk assessment, farm planning, activity and performance monitoring, and management review). These tools and skills will be backed up with industry guidance on typical environmental issues associated with agricultural production, and principles and practices that will help growers address these issues.

An EMS provides a flexible framework that can readily sit above or alongside the 'additional' requirements of environmental or quality assurance programmes developed by other agricultural industries. An EMS can readily incorporate the range of practices or performance goals that could be required by other agricultural programmes. The generic nature of an EMS framework means it can be used to oversee all of a farm's environmental activities, in a coordinated, holistic way. Similarly, the practices and procedures typically required under quality assurance programmes[39] should be able to be integrated with the generic requirements of an EMS.

Whole of farm focus: coverage of all relevant issues

An effective industry environmental programme will need to address the full range of environmental impacts of cotton production. Given the significant proportion of cotton growers who are mixed farmers, the industry programme would also need to provide these growers with management tools and guidance on practices and procedures that will help them address these other components of their operations. A combination of close industry guidance on relevant natural resource issues and practices that can be adopted to meet them, within a flexible framework that enables growers to assess their own situation and implement their own least-cost solutions, has the greatest potential to create long-term improvements in natural resource management on farms.

An industry programme should at minimum address the following general issues:

- Pesticide management
- Water management
- Soil and nutrient management
- Vegetation management.

Issues such as fuel use, waste and energy should also be included, but are arguably of lower priority than the former. To ensure that external stakeholders concerns are properly met, the industry programme should include a core of 'non-negotiable' issues and/or practices that growers will need to address before they can be certified under the programme.

BMP versus EMS – a comparison

The BMP Programme is currently limited to issues associated with pesticide use. The industry plans to develop best management practices for the range of environmental (and other) issues relevant to cotton production. This guidance material provides a strong starting point for growers to determine and address the particular environmental issues on their farm. As noted above however, industry-recommended best practices cannot cover every environmental issue on every farm. By its nature, a 'pure' BMP approach has limited flexibility and may not effectively address the range of environmental issues across farms.

An EMS requires that an enterprise address all of its environmental impacts. An industry EMS that includes detailed guidance on potential environmental issues on farms, and principles and practices that can assist growers address these issues as they exist on their own farm, provides an appropriate balance of 'process' and 'content' that will help ensure the comprehensiveness of the industry programme.

Simple, clear and achievable

Full grower adoption of the industry programme will be dependent on it having simple, practical content, and clear drivers for implementation. As the various natural resource and environmental issues are raised with growers, relatively simple 'solutions' to the issues should also be recommended. Where necessary, a clear rationale for introducing new practices should also be included (for example, improving farm efficiencies, or reducing the risk of environmental harm). Suggested practices and procedures should be easy to incorporate into existing farm routines, and must not place unreasonable resource demands on growers. If implementing the programme on-farm is overly complicated, or onerous in terms of financial or human resources, grower participation in the programme will most likely be low. Strong industry-level support and guidance will help minimise the costs to growers of adopting the programme.

An industry-scale environmental programme will require a significant commitment of financial and human resources on the part of the responsible industry organisations. These costs need to be controlled to ensure the viability of the programme. A programme with excessive resource demands will be difficult for the industry to support. Cost-sharing between the different industry organisations, as well as contributions from governments will help spread costs and ensure the future of the programme. An outline of indicative costs and cost-sharing arrangements for a comprehensive industry environmental programme is included in Chapter 7.

BMP versus EMS – a comparison

An important aspect of the BMP Programme has been its emphasis on practical solutions to environmental issues on farms. This practical focus will need to be maintained as issues beyond pesticide use are addressed. That is, the development and implementation of meaningful best practices on farms will continue to be a key aim of the industry programme.

An industry EMS can build on the practical aspects of the BMP Programme, and provide growers with greater flexibility in the practices they can use to achieve environmental objectives and targets. These practices will be overseen by a set of management procedures that growers can implement in a way that is most appropriate to the size and nature of their operations. An EMS is comprehensive, but it need not be onerous. The flexibility of an EMS framework gives an enterprise scope to put procedures in place that match the existing complexity of their business.

The similarities between the BMP Programme and an EMS should allow the necessary modifications to be made without creating excessive costs for the industry. Current industry arrangements for the development, implementation, and auditing of the BMP Programme could be used in an industry EMS without significant alteration.

Includes clear performance goals and focuses on continual improvement

Performance goals are important components of an effective environmental programme, providing a focus for day-to-day activities, as well as a ready indication of an individual farm's, or the industry's progress. It is equally important to establish a framework whereby performance is continually assessed and improved. A programme that stops at the implementation of a particular set of practices, or at the attainment of a certain performance goal is inherently limiting and inflexible.

Important performance goals for the industry programme will include the number of growers involved in, and certified under, the programme (ie. adoption and compliance rates), improvements in water use efficiency, improvements in surface water quality, and improvements in the condition of native vegetation in cotton growing areas. An effective industry programme should provide scope for growers to go beyond the performance goals set by the industry or catchment managers.

The BMP Programme contains performance goals relating to grower uptake of the programme, and the implementation of particular best management practices. The programme does not currently however, include performance goals that directly relate to improvements in resource use efficiency or environmental conditions.

BMP versus EMS – a comparison

An industry EMS can help improve the effectiveness and credibility of the industry programme through its requirement to establish appropriate performance goals. An important component of an EMS is its focus on continual improvement. A convenient way to entrench the philosophy of continual improvement is to constantly set and improve performance goals. An EMS requires that performance goals be set around an enterprise's environmental impacts, and that these goals be reviewed and improved where possible. These goals can be in the form of policy commitments, or environmental objectives and targets that are set as part of environmental plans. An EMS can therefore provide a framework where performance goals can be set at both the industry and farm levels. Industry performance goals will need to be consistent with those developed at the Basin or catchment scales, and will provide the minimum standard for goals set at the farm level.

Uses flexible, effective management tools and procedures

Effecting long term, fundamental changes to how growers address the environmental issues on their farms requires more than the introduction of new or improved farming practices, or the establishment of performance goals. To be most effective, the farming practices and performance goals that are contained in an industry programme need to be given a broader management context. Growers should be educated on the skills and procedures necessary for good management. For example, an effective system (or cycle) of environmental management should include a statement of the enterprise's environmental policy (ie. long term goals), procedures to assess the enterprise's environmental impacts, procedures to develop and implement plans that address identified impacts, activity monitoring, auditing, and performance review.

Robust management tools and procedures will help growers assess their own operations and implement appropriate site-specific solutions to address identified environmental impacts. A systematic approach to environmental management ensures that environmental issues are central, rather than peripheral to the enterprise's operations. Mere practices or performance goals are unlikely to be as effective as practices and goals situated within a flexible management system that provides for their continual assessment and improvement.

BMP versus EMS – a comparison

The BMP Programme provides growers with a simple management framework through which they can address their environmental impacts. The 'BMP process' involves growers assessing and planning to address their environmental impacts, implementing their environmental plans, and checking the implementation of their plans through audits. However, the end point of the BMP process is the implementation of particular practices, and there is only limited provision for a cycle of management that is focused on continual improvement.

An industry EMS can strengthen the 'process' component of the BMP Programme, ensuring growers carry out their activities under a robust cycle of management that involves all aspects of the farm and farm workers, and that is focused on continual improvement. The systematic, cyclical nature of an EMS ('plan, do, check, review') helps entrench the importance of environmental management in the culture of the enterprise. Within this cycle, an EMS involves assigning specific responsibilities for environmental management, training workers to carry out tasks in an environmentally sound manner, and undertaking ongoing monitoring and review of the enterprise's operations with a view to making appropriate improvements. The flexibility of an EMS helps ensure that the environmental practices and procedures adopted are those most appropriate to the size and nature of the enterprise.

Measurable: provides feedback to growers, the industry and external stakeholders

To ensure continual improvement and transparency in the programme, it should include procedures for feedback on performance to be provided to growers, the industry, and external stakeholders. For example, auditing, communication and reporting arrangements should be put in place to enable information on natural resource issues, best management practices, research, and industry performance to be exchanged between internal and external stakeholders. Centralised administration and coordination within the industry programme will help facilitate this flow of information.

BMP versus EMS – a comparison

The BMP Programme contains a number of mechanisms whereby feedback on grower and industry performance is provided to internal stakeholders. For example, BMP audits provide information to growers on their implementation of best management practices, as well as helping the industry assess the rate of grower involvement in the programme. Similarly, the BMP Management Committee and industry publications provide opportunities for communication on the industry programme to take place between industry members.

An industry EMS would build on the mechanisms and strategies for feedback established under the BMP Programme. Auditing, centralised administration of the programme, and industry publications will continue to be features of the industry programme. An industry EMS would also involve the development of formal processes for the periodic review of the programme, and for internal and external communications regarding the programme. These components of an EMS will help ensure that growers, industry organisations and external stakeholders are kept informed of the progress and future direction of the programme.

Audited by third parties

An audit/certification component helps to ensure the effectiveness and credibility of the programme. Audit and certification is an effective means to provide growers with feedback on their progress, as well as demonstrating to other parties that the industry is 'doing what it says it is doing'. This is best done through the use of third party auditors who are external to the industry. Third party auditing provides an independent, objective assessment of an enterprise's performance. This objectivity is important to establish the credibility of the programme, and to help secure potential regulatory or market benefits.

A definition of auditing

Auditing is a flexible process that can be used to assess any part of an enterprise's operations, and that can be based on a range of criteria (for example, management practices and procedures, production inputs and outputs, or environmental conditions). ISO 14010[40] contains the following definition of an environmental audit: a "systematic, documented verification process of objectively obtaining and evaluating audit evidence to determine whether specified environmental activities, events, conditions, management systems, or information about these matters conform with audit criteria, and communicating the results of this process to the client".[41]

BMP versus EMS – a comparison

An industry EMS will strengthen the auditing component of the BMP Programme. Auditing under the BMP Programme is undertaken by contractors who are third party in relation to growers, but who are involved in the cotton industry in some other capacity. Under an industry EMS, these 'industry' auditors will continue to verify grower compliance with the programme. These audits will by backed up by audits of the industry organisation overseeing the programme, and (randomly) of growers, undertaken by auditors who are external to the industry. Further discussion of auditing arrangements under an industry EMS is included in the section of this chapter titled: An industry EMS: Implications for the BMP Programme.

Market differentiation

An important driver for the on-farm adoption of an industry environmental programme is the potential for market benefits. For example, access to some markets may in future become conditional on demonstrating sustainable production practices. Beyond mere access to markets, there may be potential for premiums to be paid for produce that has been produced in a sustainable way. To secure market-related benefits resulting from environmentally responsible production, an industry programme will need to be comprehensive, credible, and capable of supporting some form of product and/or enterprise labelling.

BMP versus EMS – a comparison

The industry is currently investigating the use of a certification mark to use on cotton produced on farms certified under the BMP Programme. Under an EMS, a certification mark could continue to be used on cotton produced under the industry programme. Additionally, EMS certification (which applies to enterprises, and not products) would allow the industry and growers to use the label of the certifying body. This label could be used on for example, the label on bales of cotton, industry publications and industry and individual farm letterhead.

Capable of being implemented gradually

Given the potentially large number of natural resource issues relevant to cotton production, and the range of practices that can be used to address these issues, it will be important that the programme be implemented gradually, issue by issue, and farm by farm. Such an approach will help avoid overwhelming growers, and will help ensure that each issue is clearly explained and addressed in a focused way. Close guidance for growers adopting the programme will be vital to its success. Workshops and farm visits enable 'hands-on' advice to be provided to growers on the implementation of recommended management practices and procedures.

BMP versus EMS – a comparison

The BMP Programme has been successfully implemented through grower workshops and farm visits conducted by industry (Cotton Australia) staff. Components of the programme have been introduced gradually, issue by issue. An EMS can and should also be implemented through this type of approach. An industry EMS would involve the development and implementation of guidance material on both environmental issues (including recommended best practices and principles that can be used to address these issues), and the 'process' components of the management system. Both these aspects of the programme can be implemented gradually, component by component, consistent with the current arrangements under the BMP Programme.

Advantages of an EMS over the BMP Programme

The BMP Programme has been an effective means of helping growers implement practices that minimise the environmental and human health risks associated with pesticide use. The practical 'BMP' approach to this important industry issue has fostered grower involvement in the programme, and created a strong base on which to expand the programme. As the industry seeks to adopt a long-term approach to the full range of environmental issues associated with cotton production however, the use of a 'best management practices' approach appears limited, and an industry EMS appears as the logical evolution of the current programme that can best address future industry needs.

Table 3 provides a simple comparison of the BMP Programme and an EMS, based on the essential features of an industry environmental programme outlined above. Features of an industry programme marked with an asterisk* (in the 'EMS column') are already present in the BMP Programme, but can be more strongly or effectively included in a programme modelled on an EMS.

Table 3 Essential features of an industry environmental programme: BMP and EMS

Feature of programme	Contained in current BMP Programme?	Potential to include in an industry EMS?
Industry-led and voluntary	Yes	Yes
Informed by regulation and policy	Yes	Yes
Linked with Basin and catchment strategies	No	Yes
Strong external support	Yes	Yes*
Flexible: can easily accommodate other programmes	No	Yes
Whole of farm focus (coverage of all relevant environmental issues)	No	Yes
Simple, clear and achievable	Yes	Yes
Performance goals and continual improvement	Yes	Yes*
Uses flexible management tools and procedures	Yes	Yes*
Provides feedback to stakeholders	Yes	Yes*
Audited by external second parties	Yes	Yes
Audited by external third parties	No	Yes
Internationally recognised	No	Yes
Market differentiation	No	Yes
Gradual implementation	Yes	Yes

The preceding discussion, and Table 3 highlight that the BMP Programme and an EMS have a number of features in common. These similarities should help ensure a smooth transition from the BMP Programme to an industry EMS. An industry EMS will however, require the strengthening of a number of the components of the BMP Programme. It is useful here to highlight the aspects of the BMP Programme that can be most significantly improved through its development into a comprehensive EMS.

Whole of farm focus: coverage of all relevant issues through best practices

The BMP Programme is currently limited to pesticide use, whereas an EMS requires all of an enterprise's significant environmental impacts to be addressed. An industry EMS will provide a flexible framework under which best practices for the full range of environmental issues relevant to cotton production can be implemented on farms. An industry EMS will help facilitate the implementation and continual improvement of best management practices. For example, effective industry-wide natural resource management will require best management practice guidance material to be developed for water management, soil and nutrient management, and vegetation management. As the numerous natural resource issues and farming practices are 'introduced' to growers, it will become increasingly important for growers to have management structures and procedures in place that ensure that these issues are properly addressed and integrated with existing farming operations. An EMS will provide growers with rigorous management procedures and tools to assess their own situation and develop site-specific solutions to issues highlighted through the industry programme. An EMS can help establish best management practices as the minimum standard for farm and natural resource management.

The emphasis on continual improvement embedded in an EMS would help avoid the implementation of particular best management practices becoming the ultimate goal of farm management. Under an EMS, industry-recommended and farm-developed best practices will be continually assessed and improved to ensure their effectiveness. While the full adoption of best practices on farms is an important industry goal, it is equally important that as the industry programme matures it generates objectives and goals that are focused on farm efficiencies and natural resource outcomes. An industry EMS provides the best opportunity for encouraging continual improvement in best practices, and natural resource management. Best management practices would then become in many cases the means to achieve industry and farm natural resource goals, rather than the goals themselves.

Programme flexibility and adaptability

An EMS is a flexible management framework that can be adapted to any enterprise, and that can incorporate any number of practices or performance goals. Procedures under an EMS such as those relating to the assessment and planning around environmental impacts, activity monitoring, auditing and review equip managers with powerful tools that can be applied to a wide variety of situations. In relation to the cotton industry, this would help ensure that all the environmental impacts of mixed farms are addressed, and provides the best opportunity for cotton farming practices to be integrated with the various natural resource management strategies being developed by governments and other agriculture industries.

Focusing on generic management processes provides a high level of flexibility and adaptability in relation to the practices that can be implemented on farms to meet environmental objectives. The appropriateness of a particular farming practice varies from farm to farm, and many 'best practices' are likely to be improved over time. Using a model based on generic management procedures provides flexibility and incentive for growers to continually develop their own least cost solutions to natural resource issues as they exist on their farm. Under an industry EMS, this site-specific flexibility would be supported by guidance on possible solutions to farm issues, and a comprehensive set of management procedures that ensures a consistent approach to environmental management is being taken across the industry.

While the industry has been conscious of not being overly prescriptive in the practices recommended under the BMP Programme, the level of detail required to ensure a practice is meaningful on a majority of farms, runs the risk of it being incongruent with existing practices on a minority of farms. Auditing growers against practices that they cannot, or need not adopt for legitimate reasons (relating to for example, farm location or design, climate or topography), is of little use. Similarly, auditing growers on practices that are constantly evolving with advances in science and technology is problematic. A programme based on flexible management procedures helps avoid this problem of becoming overly prescriptive. The same set of generic procedures can be used across farms, with the specific 'content' of the procedures being determined (within industry guidelines or objectives) by individual farm managers or owners.
Best management practices can be advisory, or non-mandatory where appropriate, and growers can adopt those practices that are suitable to their situation. A proviso of this approach will be the inclusion of a core of non-negotiable best management practices or goals, ensuring an acceptable minimum standard of farming practices across the industry.

External third party auditing

Auditing is an important means for growers and the industry to assess their progress, and to demonstrate to other stakeholders that cotton farms are being managed responsibly and sustainably. To ensure the credibility of the auditing component of the programme (and therefore the credibility of the entire programme), external, third party auditors should be used. Auditing under the BMP Programme is undertaken by contractors who are 'third party' in relation to growers, but who may be involved in the cotton industry in some other capacity.[42] Growers (or farms) are audited against cotton-specific best management practices recommended in the BMP Manual. The use of auditors who are associated with the industry is both a strength and a weakness of the BMP Programme. Using auditors who are familiar with cotton production has been effective in educating growers on the implementation of best management practices. These auditors are externally reviewed by an independent organisation to ensure the rigour of those audits. Nevertheless, the use of these 'industry auditors' may not bring the same level of assurance to external stakeholders regarding the independence and objectivity of audits, as audits undertaken by external parties.

The objectivity and independence of external third party audits helps ensure the credibility of the programme. While the effectiveness and credibility of the industry programme are important in and of themselves, they are also necessary for the realisation of any potential regulatory or market benefits that may accrue to environmentally responsible industries.

An industry EMS: Implications for the BMP Programme

The above discussion of the significant advantages of an EMS serves to highlight the most significant changes that an industry EMS would effect on the BMP Programme. The practical implications of these changes are outlined in Table 4 and explained in the following pages. Chapter 7 details how the transition from the BMP Programme to an EMS could be achieved, including estimated timeframes and costs. Appendix 4 provides a detailed analysis of the practical requirements associated with introducing an ISO 14001-based EMS in the cotton industry.

Table 4 Significant changes to the BMP Programme to support an EMS

Feature of BMP Programme	Change required to support an EMS
Focus on the environmental and human health risks of pesticide use	Coverage of all environmental impacts associated with cotton production
A simple management framework based on self-assessment, developing and implementing action plans, and undertaking a farm audit	Comprehensive management procedures under an environmental policy, including those for: – assessing environmental impacts – planning around objectives and targets – plan implementation – training – emergencies – activity and performance monitoring – documentation and record keeping – auditing – management review
'Internal' industry auditing of best management practice implementation	External third party auditing of management procedures

Coverage of all environmental issues associated with cotton production

To ensure the continued effectiveness and credibility of the industry environmental programme, it will need to address the full range of environmental issues associated with cotton production. Indeed, implementing an EMS requires an enterprise to address all of its significant environmental impacts.

Expanding the coverage of the industry programme will involve the development of best practice guidance material for the following:

- Pesticide management (already in place)
- Water management (including irrigation, stormwater and drainage)
- Soil and nutrient management
- Vegetation management
- Fuel management
- Waste management
- Energy conservation.

As noted above, adequately addressing these matters will require the development of a core of 'non-negotiable' issues and practices. Certification under the programme will be conditional on these core issues being addressed, either through practices recommended by the industry or other effective means developed by individual growers. Implementation of best management practices for these topics will continue to be overseen by industry personnel. Growers will be 'introduced' to these topics one at a time, through farm visits and workshops. This close industry guidance has proven to be an effective transfer mechanism under the BMP Programme, and should be continued to ensure proper coverage of all issues on farms.

An industry EMS will oversee the on-farm implementation of appropriate management procedures that will ensure the comprehensive, site-specific coverage of environmental impacts on individual farms. These management procedures will sit both above and alongside the industry-recommended best management practices for the various environmental topics outlined above. Indeed, an industry EMS will assist growers to go beyond the issues and practices highlighted by the industry. Discussed further below, the procedures required under an EMS will be 'introduced' to growers gradually, as will have been done for the introduction of best management practices.

An effective industry environmental programme will also need to take cognisance of the natural resource strategies and targets being developed at the Basin, State and catchment scales.

An industry EMS should provide an effective framework through which these external initiatives can be integrated with cotton farming practices. For example, Basin and catchment natural resource targets can, where relevant, be adopted or adapted to the objectives and targets required under the planning procedures of the industry EMS. The periodic review of EMS objectives and targets will help ensure that changes in Basin or catchment targets are quickly reflected in industry and farm goals and practices.

Comprehensive management procedures

An industry EMS will require the implementation on farms of a distinct set of management procedures. It is recommended that these procedures be based on the specifications of ISO 14001. ISO 14001 establishes a flexible framework for environmental management. Both the industry and individual farms can be audited and certified for compliance with the requirements of the standard. The standard is internationally recognised and respected, and has received considerable attention from governments and industries in Australia. Given that a number of farming operations have implemented ISO 14001, the standard is workable and adaptable to farms. The industry is conscious of avoiding developing its own EMS 'standard' or model, and of therefore contributing to what could become a confusing plethora of different EMS 'standards' in agriculture all seeking to achieve the same or similar ends (as has occurred in the food safety/ quality assurance area). Further, ISO 14001 is an internationally recognised and accepted system, and using it as the basis for the industry EMS would reduce the need to justify and explain the merits of the system itself.

ISO 14001 contains provisions for the following:

- The establishment of an environmental policy
- Planning around identified environmental issues (including setting objectives and targets)
- Implementing environmental plans and ensuring day to day operations are carried out in line with the environmental policy and objectives
- Checking progress and ensuring faults are rectified
- Documenting and recording the procedures and practices that have been put in place
- Auditing
- Reviewing the system (ie. continuous improvement).

A detailed discussion of the requirements of each of the components of ISO 14001 is contained in Appendix 4. This discussion includes an outline of the implications for the BMP Programme of using the standard in the industry programme.

A number of aspects of the BMP Programme are consistent with the requirements of ISO 14001. For example, the BMP Programme requires growers to address the following:

- Employee training relating to the safe use of pesticides
- Emergency procedures for storms, pesticide spills or fire
- The keeping of records relating to pesticide storage and use
- Work procedures relating to pesticide storage and use
- Monitoring practices and procedures associated with pesticide use.

Further, the BMP Programme involves growers assessing their farm operations and infrastructure to determine priorities for action, developing action plans and objectives to address areas of environmental risk, and arranging for an audit to be carried out with respect to their adoption of best management practices. Each of these components of the BMP Programme corresponds with a general requirement under ISO 14001. Whilst conformance to ISO 14001 requires coverage of issues beyond pesticide use, and the implementation of more comprehensive management procedures, it is important to recognise that the BMP Programme provides a good introduction to the procedures and practices required under an EMS.

To ensure farm compliance with the EMS, guidance material on each component of the standard will need to be developed. This guidance material will need to be kept simple, and have a farm focus. An EMS is comprehensive, but it need not be complex and onerous. ISO 14001 states that "this International Standard … has been written to be applicable to all types and sizes of organisation."[43] Similar to the approach taken for implementing best management practices on farms, growers will be introduced to the components of the industry EMS one at a time, through workshops and farm visits. Priority will be given to implementing components of the EMS that are most similar to aspects of the BMP Programme. For example, requirements for the assessment of, and planning around identified environmental issues, and operational controls will be implemented first. Further components of the standard will be introduced gradually over time, until each element of the standard has been addressed.

Auditing the implementation of the EMS will be undertaken by both 'internal' industry auditors, and external auditors. The auditing framework will be based on the 'group certification' model developed under the NOSLaM scheme in New Zealand, discussed on the following page.

External third party auditing

Under the BMP Programme, growers are audited on their implementation of a core of best management practices, as well as their adoption of the 'BMP process' (ie. assess, plan, do, review). The auditing component of the BMP Programme helps growers assess their progress, and verifies the implementation of best management practices across the industry. Auditing is carried out by industry-accredited, private contractors who report to an industry body (currently the Cotton Research and Development Corporation). These auditors are familiar with cotton production systems and farming practices, and have proven to be effective assessors of the implementation of best management practices. A number of factors help ensure the quality and objectivity of industry BMP audits. For example, the selected auditors have been formally trained in auditing methods and protocols, through a course recognised by the Australian auditors' association (Quality Society of Australasia) and the International Environmental Auditors' Association. Industry auditors are accountable to the Cotton Research and Development Corporation, which monitors and reviews their performance.

Implementation of best management practices on farms will continue to be an important focus of the industry programme. Auditing farms on the implementation of core best management practices is an effective means to collect information on grower adoption rates, and to ensure that 'non-negotiable' practices are being implemented 'correctly'.

'Internal' industry audits will continue to be an important component of the programme. It is also recommended that random third party (external) audits be conducted to maintain the level of assurance required by external stakeholders, and to help keep costs to a minimum. Outlined below, an industry EMS would therefore involve both industry and external audits.

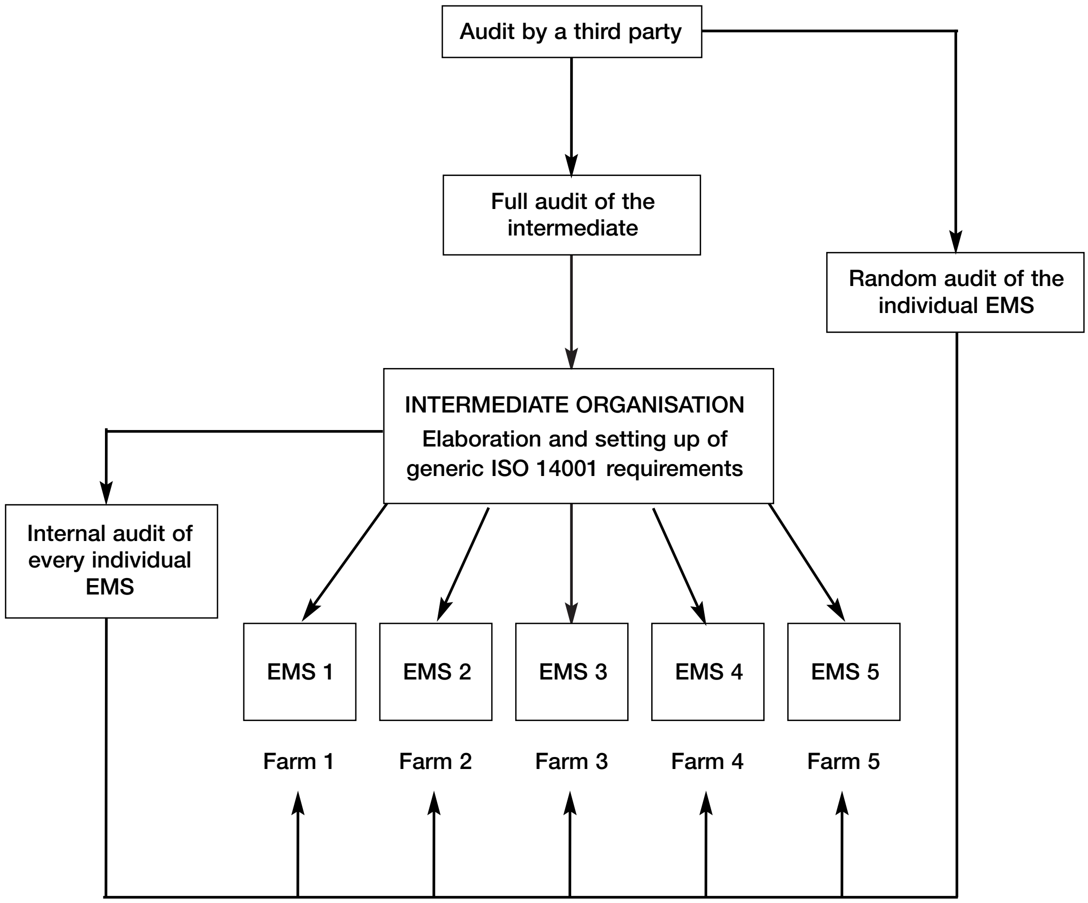
An industry EMS would require the implementation of procedures and practices under the system to be audited; namely, the implementation of the specifications of ISO 14001. Auditing under an industry EMS will be based on the 'group certification' arrangements developed by the NOSLaM Group in New Zealand, for use in their ISO 14001-based Enviro-Ag Scheme. An outline of these arrangements follows, and a diagrammatic representation is presented in Figure 3.

Group certification

The industry organisation responsible for the administration of the programme conducts audits of farms seeking to be certified under the industry EMS. This 'internal' check ensures industry control of the farms that can be certified under the programme. The industry organisation is in turn audited by an external party. Given that the industry organisation will not be a farming enterprise, this is a 'paper audit' of the written procedures and practices that the industry is implementing on individual farms. Random 'external' audits are also carried on participating farms.

Group certification arrangements should help centralise and simplify the administrative requirements of the auditing component of the programme, and help reduce the auditing and administrative costs for growers.

Figure 3 Group management model for establishing an EMS (adapted from NOSLaM, 2000)



Chapter 6 Recommendations – a framework for the cotton industry's environmental programme

It is recommended that the cotton industry's BMP Programme be developed into a comprehensive environmental programme consistent with, and ultimately capable of being certified to ISO 14001. At a minimum, the industry programme should address the following issues:

- Pesticide management
- Water management
- Soil and nutrient management
- Vegetation management
- Fuel management
- Waste management
- Energy conservation.

Addressing each of these issues on farms will involve the development and implementation of best management practices and principles. Farm-specific best practices will be implemented under the framework of an EMS.

Guidance material on best management practices and principles, and on the components of an EMS will be developed at the industry level. This guidance material should include a core of 'non-negotiable' practices or issues that growers seeking certification under the programme must address. Particular attention should be paid to integrating these industry-recommended practices and principles with practices and targets stemming from natural resource management strategies operating at the Basin, State or catchment scale.

To avoid growers becoming overwhelmed, implementing best management practices and the components of an EMS should be carried out gradually. Priority should be given to educating growers on the relevant environmental issues, through the implementation of best management practices and principles. It is suggested that development of appropriate material can commence as soon as approval for expansion of the programme has been given by the relevant industry organisations, with the timing of the implementation of that material dependent on the rate of adoption.

Audit and certification of both the implementation of 'core' best management practices, and the components of an EMS would need to be undertaken. Audit arrangements under an industry EMS should be modelled on those developed under the NOSLaM scheme in New Zealand.

This involves external auditing and certification of the industry organisation responsible for overseeing the implementation of the industry EMS. This industry organisation in turn ensures each farm involved in the programme is operating in accordance with the standard (ie. ISO 14001). Random, external audits of farms in the programme would also be carried out by the external auditor.

Chapter 7 Development and Implementation Strategy

Existing Arrangements under the BMP Programme

Development of documentation: Cotton Research and Development Corporation

The Cotton Research & Development Corporation has funded the development of the BMP Manual since its inception. The Corporation is well positioned to co-ordinate and oversee the development of appropriate guidance material, which effectively integrates research findings, government policy and regulation, and accepted industry best practices. The development of the separate modules of the BMP Manual is managed under the Corporation's research funding programme.

The BMP Manual contains guidance material on best management practices for the following:

- Pesticide application
- Pesticide storage and handling
- Farm design and management
- Integrated pest management
- Farm hygiene.

Modules on the following are currently being developed:

- Water management
- Soil and nutrient management
- Petrochemical storage and handling
- Occupational health & safety.

Implementation: Cotton Australia

Implementation of the BMP Manual is currently the responsibility of Cotton Australia, the peak organisation representing cotton growers. Cotton Australia has a team of eight Grower Services Managers (GSMs) located throughout the regions where cotton is grown[44]. One of the primary responsibilities of these GSMs is to facilitate grower involvement in the BMP Programme. One objective of the GSMs is "To support cotton growers to be sustainable, environmentally responsible and 'world's best practice' producers of cotton"[45]. Relevant goals, strategies and performance indicators to help achieve and measure progress towards this objective include the following:

Goal **Support cotton growers in all aspects of production.**

Strategies

- Maintain a regular call cycle on all growers
- Facilitate the collection and sharing of grower knowledge
- Position field staff in best locations to ensure services are spread equitably and effectively
- Maintain an up-to-date list of growers in each region.

Goal **Have 100% of growers implementing BMP by June 2001.**

Strategies

- Organise regular BMP sessions to meet the needs of growers and ensure that all sections of the BMP Manual are addressed
- Help growers on a one-on-one basis
- Work with the Cotton Research and Development Corporation to build on the current industry audit programme to continually improve its scope, depth and availability
- Participate in the BMP Management Committee to ensure that grower needs and concerns are addressed in the BMP programme.

Performance indicators for each GSM include the following:

- Each grower visited/contacted by field staff at least twice per year
- Four BMP workshops conducted for each cotton growers association per year
- Positive grower feedback on the BMP Programme.

The current annual budget for the BMP Programme activities of the GSM team (which accounts for 75% of their time) is $650,000. As at December 2000, progress towards the goal of having 100% of growers implementing BMP by June 2001 was 60%.

Audit programme: Cotton Research and Development Corporation Audit Office

The BMP audit programme was developed out of the need to objectively verify the on-farm implementation of best management practices. A pilot audit programme was run to investigate the feasibility and requirements of an industry-wide audit and certification programme. Particular attention was paid during the pilot stage to the need to develop an audit programme that:

- Ensures consistent assessment of grower compliance with the BMP Manual

- Generates information to enable the industry to report on the adoption of BMPs
- Is cost effective for growers and the industry.

This pilot programme audited 34 growers. Based on the success of the pilot programme, a 'full-scale' audit programme has now been put in place. As at March 2001, 110 'initial compliance' audits and 38 'industry certification' audits[47] had been conducted.

Farm audits verify the compliance of the farm's operations with the BMP Manual, providing an objective assessment for the grower, as well as advice on areas where improvements can be made. The requirements for a cotton grower to arrange an audit are[46]:

- That they have worked through the BMP Manual and completed the self-assessment worksheets
- That they have completed the self-assessment summary worksheets, ready to send to the auditor
- That they have written action plans that address all the areas identified through the self-assessment process as needing attention.

It is important to note that growers are not expected to have completed all of their action plans at the time of the first audit, nor is it necessary that a grower has ranked all their activities as "1" in the self-assessment worksheets for an audit to be done. It is the fact that improvements are being made that is important, the same philosophy of continual improvement embodied in ISO 14001.

The main features of the audit programme are as follows:

An **Audit Office** has been established to administer and oversee the operation of the audit programme. Roles and responsibilities of the audit office include[47]:

- Acting as a contact point for growers seeking information on audits, and to promote the audit programme
- Maintaining a database on audits that have been conducted
- Liaising with the various industry bodies involved in the BMP Programme, to assist with the integration of the components of the programme (ie. development, implementation and auditing)
- Overseeing the selection, training and registration of industry auditors
- Monitoring and reviewing the performance of industry auditors
- Maintaining and reviewing audit documentation.

The audit office currently has three part-time staff, who are responsible for the administration of the audit programme. The operation of the audit office has been funded by CRDC until early 2002, after when it is planned to be self-funding. The office received funding in the order of $250,000 for the financial years 2000 and 2001. This figure represents the start-up costs for the office, and its operating costs for this period. Ongoing annual operating costs for the office are likely to be approximately $75,000. This does not include any costs associated with reviewing BMP materials, estimated to be $50,000 per annum.

Audit documentation developed under the industry programme includes the following:

- Selection criteria for auditors
- Procedures and guidelines for auditors
- Initial contact form
- Background information form
- Opening meeting guidelines
- Audit checklist
- Closing meeting guidelines
- Template audit report
- Document register.

Standardised documentation helps ensure the consistency and uniformity of audits (i.e. two different auditors should reach the same conclusions if they audit the same farm, and different farms are assessed using the same criteria and procedures). A final check on the quality of the audit report is carried out by the Audit Office before the auditor is permitted to invoice the grower.

Industry auditors are required to complete an environmental systems auditor's course (run by Quality Assurance Services) that has been tailored to the BMP Programme. The course is recognised by both the Australian Auditors' Association (Quality Society of Australia) and the international Environmental Auditors' Association (EARA). Field experience in cotton production is an important component of the selection criteria, and prospective industry auditors are interviewed by a panel of industry representatives[48] before being approved for registration as an auditor There are currently seven registered industry auditors.

While the auditors are self-employed (i.e. independent of any cotton industry organisation), they work under a contract with the Cotton Research and Development Corporation that governs their conduct as auditors.

The auditors are subject to performance reviews, and are only registered as industry auditors for a 12 month period, with their registration renewal being based on the results of the performance review. Currently, the Corporation also funds their training in environmental auditing.

Auditors are neither employees nor clients of the growers whose farms they audit, and do not readily fall into any of the traditional auditor categories (i.e. first, second or third party). They are neither first nor second party auditors as they are independent of the cotton grower or farm being audited (one of the requirements is that auditors may not audit their own clients, partner's clients or family members[49]), and are properly termed third party auditors with respect to growers. However, their current close links to a cotton industry organisation could create a perception that they are not truly independent or objective in their assessment of farm operations. At this stage, the value provided by auditors who have experience in cotton production outweighs any resulting negative perceptions, although in time it may be necessary to ensure the credibility of the programme through the use of auditors who are external to the industry.[50]

Growers seeking an audit can either contact the audit office, or an auditor to make arrangements. Audits take up to half a day to complete, and the current audit fee is $500, plus any travelling and accommodation costs. It is important to highlight the significant resources and costs involved in an industry-wide audit scheme – at the current cost, of $500, audit fees alone (ie. before any implementation costs) for growers would total over $600,000* per annum, and if a 5% level of random auditing is added, total fees increase to at least $650,000 per annum.

Three 'types' of audit are carried out under the BMP Programme. The first audit results in an audit report detailing a farm's strengths and areas for improvement, along with a certificate that recognises the grower's initial compliance with the Manual. Within 14 months of the initial audit, the grower will be contacted by the audit office to arrange an "Industry Certification Audit". The auditor conducting this audit uses the initial audit report to check whether suggested improvements have in fact been made. Upon successful completion of this audit the grower receives a certificate and a gate sign, indicating their certification under the programme. This certification is valid for 18 months, after which time a surveillance audit is required to maintain the validity of the certification.

The audit criteria are limited to the best management practices contained in the Manual, while the scope of the audit is limited to growers' cotton production practices.

*assuming 1,200 growers and annual audits

BMP Management Committee

The BMP Management Committee is a sub-committee of the Australian Cotton Industry Council (ACIC). ACIC is an industry forum responsible for managing industry policy, coordinating industry involvement in national programmes and promoting co-operation between industry bodies.[51] Different organisations within the cotton industry have different roles and/or interests in the BMP Programme, and the BMP Management Committee was established to ensure that all these organisations have ample opportunity to provide and receive information on the progress of the programme.

The Management Committee meets monthly to exchange information on the progress of on the various components of the programme (ie. development, implementation, and auditing), and to recommend actions to enhance the future development of each of these components. The following industry organisations are represented on the BMP Management Committee: Australian Cotton Growers Research Association, Cotton Australia, Cotton Research & Development Corporation, the Australian Cotton Co-operative Research Centre, and Cotton Consultants Australia.

Next Steps

The industry structures and strategies outlined above for the development and implementation of the BMP Programme could readily support an industry EMS. A smooth transition from the BMP Programme to an industry EMS will be important to help maintain grower involvement in the programme. Effecting as little substantive or structural change to the BMP Programme as practicable will help make this transition seamless.

The following outlines key considerations for the 'next steps' in the development and implementation of an industry EMS. Various summary tables of the likely actions, responsibilities, timeframes and costs for the development and implementation of the programme are also included.

Meeting of key stakeholders

To ensure the recommendations contained in the report are progressed in a way that is acceptable to the key stakeholders, it is suggested that a dedicated meeting be held involving representatives from Cotton Australia, the Cotton Research and Development Corporation, the Murray-Darling Basin Commission's Irrigation Issues Working Group, and the project team. This meeting should aim to refine the proposed actions, timelines and budgets contained in this report. Both Cotton Australia and CRDC have nominated appropriate people within their organisations to be involved in such discussions.

Industry consultation

The implementation of an industry EMS will need to include a process for consultation with growers and industry organisations. The framework for an industry EMS proposed in this report will form the basis of consultations. Consultation will provide an indication of the level of grower support for an industry EMS, and will help ensure that the roles, responsibilities, timeframes and budgets included in the proposal are acceptable to industry stakeholders.

Similar to the process used under the BMP Programme, consultation will be co-ordinated through local cotton grower associations with the assistance of Cotton Australia. Consultation should commence in mid 2001, and should be undertaken for a period of one to two months.

Undertake consultation with Government agencies

A number of issues raised in the report require discussion with relevant government agencies. Briefly these include:

The legal status of audit reports in Queensland. In New South Wales, documents prepared for the sole purpose of a voluntary audit cannot be used as evidence against any person claimed to have breached environment protection legislation. In Queensland however, no such legislative protection is provided, and the situation should be clarified before the industry expands its environmental audit and certification programme.

Requirements of the Queensland Environmental Code of Practice for Agriculture. A comprehensive industry EMS has the potential to meet the requirements of the Queensland Code of Practice. Adopting a Code of Practice carries legal benefits in the event of prosecution. To help ensure that the industry's programme meets the requirements of the Queensland Code of Practice, ongoing discussions with the Queensland Environmental Protection Agency will need to be undertaken.

The potential for the industry programme to satisfy regulatory requirements for natural resource management. Land and water management legislation in New South Wales and Queensland may create resource management and planning obligations for growers. The industry believes that a comprehensive industry EMS will help growers meet many of these regulatory requirements. Establishing an industry programme that is recognised under state natural resource management legislation will help avoid duplicating growers' farm planning obligations. The feasibility of using the industry to meet legislative requirements will depend on the nature of those requirements.* The implications of using a voluntary programme to meet regulatory (ie. mandatory) requirements will need to be determined.

* While new water management legislation has recently commenced in both New South Wales and Queensland, much of the practical detail of the reforms will be contained in regulations that are yet to be enacted.

Consultation with government agencies should be led by Cotton Australia and the Australian Cotton Growers Research Association. Consultation should commence as soon as practicable after approval for the expansion of the industry programme has been given by the relevant industry organisations.

Industry environmental policy

An industry environmental policy should be developed as a priority. This will highlight the environmental issues and goals for the industry, providing a strategic context for the expansion of the BMP Programme. The development of the policy should be led by Cotton Australia and/or the Australian Cotton Industry Council. Consultation on the industry policy should be undertaken, and could be done in conjunction with industry consultation on the proposed industry EMS framework (ie. through local cotton grower associations, commencing mid 2001 for a period of up to two months).

Development of the industry environmental policy will build on the work already undertaken by Cotton Australia in this area, and should include commitments to the following:

- Continual improvement of environmental management in the industry
- Industry-wide adoption of Best Management Practices
- Meeting legal obligations and basin, catchment or regional obligations relating to farm planning and natural resource management
- Pollution prevention
- Responsible management of pesticides and agricultural chemicals
- Sustainable use of water resources, including increasing efficiency of water use
- Sustainable use of soils
- Responsible management of flora and fauna, recognising the need to integrate agricultural production practices with practices that directly enhance bio-diversity
- Increasing the energy efficiency of farming practices
- Reducing farm waste.

An industry environmental policy containing the above listed commitments would satisfy the requirements of ISO 14001. The costs associated with developing and consulting on an industry environmental policy should not be significant, and should be met as part of Cotton Australia's operating costs.

Establish roles, responsibilities and structures to oversee the implementation and administration of the industry EMS

Effective implementation and administration of an industry EMS will require the establishment of appropriate roles and responsibilities within the industry. Industry personnel would be responsible for matters such as the development of EMS documentation, coordination and running of grower workshops and farm visits, arranging and overseeing audits, collating information and reporting on the industry's performance, and overseeing the periodic review of the programme.

Current industry arrangements for the development, implementation and administration of the BMP Programme should meet most of the structural requirements for the introduction of an industry EMS. The current roles and responsibilities of the CRDC, Cotton Australia, the industry audit office and the BMP Management Committee in relation to the BMP Programme, could continue with the introduction of an industry EMS.

As the industry environmental programme expands however (in terms of both the number of issues covered, and the number of growers involved), the resource requirements for maintaining the programme will similarly increase. It is recommended that at a minimum, expanding the industry programme will require an additional two (Cotton Australia) implementation staff, for a period of three years. The current annual budget for the eight industry (BMP) implementation staff is $650,000. Strengthening this component of the programme with an additional two staff will therefore require in the order of $450,000 in additional funding, over three years (ie. $150,000 p.a.). These extra implementation staff will be in greatest demand as the new modules are introduced to growers. After time, and as a majority of growers have become familiar with the programme, these additional implementation staff may no longer be required. Additional implementation staff will most likely be required from the start of 2003, until the end of 2005. Extra staffing during these three years should ensure proper coverage of guidance material for both environmental best management practices, and the 'procedural' components of the industry EMS (to be completed in 2002, and 2003 respectively).

The industry audit office is currently staffed by three part-time employees, and has a first year annual budget of $55,000.[52] As the programme expands, it is likely that the number of growers seeking audits will increase, and that the administrative requirements of the audit component of the programme will therefore also increase. A mature industry programme will likely require two full-time administrators, responsible for overseeing the auditing component of the programme.

Based on current resource levels, the ongoing budgetary requirements for the industry audit office will be at least $75,000. CRDC has committed to funding the audit office until April 2002, after which the office is expected to become self-funding. Depending on the financial capacity of the audit office at the time of CRDC 'hand over', additional funding for the office may be required at that time to ensure its viability.

As the industry's environmental programme matures, consideration should be given to establishing a central administrative body, responsible for coordinating and overseeing the different components of the programme. Current arrangements for the administration of the BMP Programme (and which will form the basis of the arrangements for an industry EMS), involve Cotton Australia, CRDC, ACGRA, and the BMP Management Committee. Although these arrangements have proven effective, an expanded, mature industry environmental programme may require a centralised administrative effort to ensure the efficient and effective running of the programme.

Guidance material on best management practices and principles for the range of environmental issues associated with cotton production will provide growers with a good starting point for addressing the environmental issues on their farm. Guidance material will need to be provided on the following topics:

- Pesticide management (completed)
- Fuel management
(funding already committed – to be completed by mid 2001)
- Water management
(funding already committed – to be completed by early 2002)
- Soil and nutrient management
(funding already committed – to be completed by early 2002)
- Vegetation management
- Waste management
- Energy conservation.

The development of these materials should be overseen by the CRDC. Given the existing commitments to the development of modules for fuel and land and water management, development of the additional four modules could commence by mid 2001. These additional modules could then be completed by the end of 2002. Based on the cost of developing the current BMP guidance material, the cost of developing these additional materials would be in the order of $200,000.

Implementation of best management practices

Under an industry EMS, best management practices for the range of environmental issues relevant to cotton production will continue to be introduced ‘step by step’, with close support for growers provided by the industry. Guidance for growers implementing best management practices is provided by Cotton Australia field staff, through grower workshops and farm visits. As noted above, this component of the industry programme could be temporarily strengthened through the addition of two extra staff. This will help ensure that each grower is familiar with the programme, and that they have access to industry support during the implementation of the programme on their farm.

Implementing industry-recommended best management practices for the topics listed above will be commenced as the relevant guidance materials are completed. Overseeing the implementation of best management practices will be an ongoing industry commitment. Best management practices will be periodically reviewed, and the guidance materials updated and improved as necessary. The industry should aim to have all growers implementing best management practices for all the above-mentioned topics, within three years of the full set of guidance materials being completed.

If current levels of industry implementation staff are maintained through the expansion of the programme, no significant additional costs will be incurred. If current staffing levels are increased by the addition of two staff for a period of three years (as recommended), the resultant cost is likely to be in the order of $150,000 p.a. (ie. a total of $450,000).

Development of EMS guidance material

Guidance material for growers on each component of the EMS will need to be developed to ensure its effective and consistent adoption. Development of this guidance material should be coordinated by the Cotton Research and Development Corporation. EMS guidance material will be based on the specifications of ISO 14001. The analysis of ISO 14001 undertaken as part of this project will provide a solid foundation on which to build the development of EMS guidance material for growers.[53] EMS guidance material will need to include simple ‘training packages’ for aspects of an EMS requiring particular skills. Industry implementation staff would then be responsible for ensuring that growers were sufficiently trained to implement and maintain an EMS on their farm. In particular, growers should be provided with training in risk assessment[54], the fundamentals of EMS audits, and conducting a review of the farm EMS. The proper implementation of these ‘training packages’ will require industry implementation staff to be trained in each relevant area.

EMS guidance material will need to include advice to growers on their environmental legal obligations. Whilst the industry has developed significant material on this topic in relation to pesticide use, further work in this area may require the industry obtaining further professional advice.

An ISO 14001-based EMS will also require environmental objectives and targets to be continually established. The industry guidance material on environmental objectives and targets should be informed by any relevant performance goals established in Basin, State or catchment natural resource management strategies. These goals would assist the industry to establish appropriate objectives and targets for growers.

Developing best management practices for the topics listed above should be an industry priority, and the development of EMS guidance material should therefore commence in early or mid 2002. This guidance material could then be completed by early 2003, and would cost in the order of $150,000 to develop.

Implementation of EMS components

Implementing the 'procedural' components of the industry EMS will be undertaken in a 'step-by-step' manner, using the same industry personnel and delivery mechanisms as those used to implement best management practice guidance material (ie. Cotton Australia staff conducting workshops and farm visits). Priority will be given to introducing the components of an EMS that have already been covered by, or are most similar to, components of the BMP Programme. This will help ensure that the strengths of the BMP Programme are effectively built on, and that at the outset, a close connection is made between the BMP Programme and the industry EMS.

Implementing a number of the components of an EMS may require industry staff to provide training to growers in specific management tools or skills (for example, risk assessment, EMS audit procedures, and management review). The industry has submitted a funding application (under AAA FarmBis, for 2001–2002) for the development of appropriate EMS training materials. The estimated cost of developing EMS training materials (noted in the funding application) is $255,000. This training package will supplement the guidance material to be developed around the 'procedural' requirements of the EMS. Providing growers with EMS training in these areas will also require industry staff to be trained in the relevant topics, and in the delivery of the training package. These training needs are discussed further on the following page.

Industry guidance for growers implementing or improving their farm EMS is likely to be an ongoing task. The industry should however, aim to achieve minimum levels of grower adoption or compliance with the industry EMS. For example, it is recommended that the industry establish a goal of 25% of all growers being certified under the industry EMS within three years of all components of the programme being introduced. If the EMS guidance material is completed by early 2003 as recommended, the industry should therefore aim to achieve this EMS certification goal by the end of 2006.

As noted above, the implementation component of the industry programme could be strengthened through the temporary addition of two extra field staff. This would result in additional costs in the order of $150,00 p.a. over three years (2003–2005), representing a total of $450,000.

EMS training for industry staff and auditors

To effectively implement the industry EMS, key industry personnel will need to be provided with appropriate training. Industry implementation staff will need to be sufficiently familiar with the components of an EMS to competently explain their operation to growers. These staff will also be responsible for training growers in the specific management procedures required under an EMS (for example, risk assessment, auditing and management review). Industry implementation staff should therefore receive training in the structure and operation of an EMS, and in the delivery of training packages for growers that address risk assessment, auditing, and management review.

Appropriate training packages for industry implementation staff and growers could be developed by an appropriate external accreditation body. Industry implementation staff would be trained by this external body, in both the operation of an EMS, and in the delivery of the training package developed for growers. These training packages could be developed with industry input to ensure the industry’s needs are met. Similar arrangements have been made in the past under the BMP Programme, in relation to the training requirements of industry auditors. Based on the cost of the BMP auditor training courses, addressing the training needs of industry implementation staff, and developing appropriate training packages for growers will cost in the order of $50,000. Training industry implementation staff should be conducted during 2002, in advance of the introduction of the specifics of the industry EMS to growers.

In addition to industry implementation staff, training will also need to be provided for industry auditors. Industry auditors will be responsible for ensuring that growers who are certified under the industry programme are operating in accordance with the required practices and procedures. Industry auditors under the BMP Programme have successfully completed a specialised audit training course. The auditor training required under an industry EMS will build on the knowledge and expertise that auditors have gained through this course, and their own experience. EMS audit training should be provided by an appropriate external accreditation body. Based on the cost of auditor training under the BMP Programme, the cost of further training industry auditors in EMS auditing will be in the order of $50,000. This training will need to be conducted in advance of growers seeking an EMS audit, for example, during 2002 or 2003.

Research and development opportunities

An important characteristic of the cotton industry is its strong support of and involvement in a co-ordinated and strategic research and development effort. The BMP Programme has proven to be an effective extension mechanism, facilitating the collation and communication of research-based information to growers. This role of the programme will continue to be important as the full range of environmental issues relevant to cotton production are addressed.

To effectively implement the proposed environmental programme on an industry scale, a number of information and education needs will have to be met. These requirements relate to ongoing research and development of best management practices, and the education of industry members in the managerial tools and procedures under an EMS.

The industry will need to develop guidance material on best management practices for the following:

- Fuel management (to be completed early 2001)
- Water management (to be completed mid 2002)
- Soil and nutrient management
- Vegetation management (bio-diversity)
- Waste management
- Energy conservation.

The development of most of this guidance material should only involve secondary research such as reviews of technical and scientific literature, government publications and programmes in other agricultural industries.

For example, the SOILpak manual developed by the New South Wales Department of Agriculture contains a wealth of information that could contribute to the development of guidance material in a 'best management practices' format.

The development of best management practice guidance material for water management will rely heavily on current research efforts in this area. For example, current projects relating to water management funded by the Cotton Research and Development Corporation include the following[55]:

- Best management practice for maximising whole farm irrigation efficiency in the Australian cotton industry
- Engineering water use efficiency
- Developing integrated farm water management for cotton production.

Similarly, current projects funded by the MDBC addressing water use include:

- Development of guidelines for the quantification and monitoring of seepage from earthen channels
- Investigating seepage remediation options and the preparation of a manual of best practice for use by the water industry
- Best management practices to minimise below-root zone impacts of irrigated cotton
- Decision support systems for improving water use efficiency in the northern Murray-Darling Basin.

The synthesis of the various research findings and recommendations into a suite of appropriate best management practices for growers will be managed and supported by the Cotton and Research Development Corporation. Implementation of the recommended best management practices would then be led by Cotton Australia with technical support provided by (CRDC funded) Industry Development Officers, and the recently appointed (state funded and based) personnel specialising in water management issues.

Introducing an industry EMS would require the development of guidance material on the various components of the system (eg. the specifications of ISO 14001), including material and/or training packages for growers, on management 'tools' used in an EMS, such as risk assessment, auditing and management review. As with the development and implementation of best management practices, the lead organisations in this aspect of the programme will be the CRDC and Cotton Australia.

Successfully introducing an industry EMS will also require industry implementation staff and industry auditors to be appropriately trained. The industry should arrange for this training to be provided by an external accreditation body that has the relevant expertise. The chosen organisation could also be involved in the development of the proposed EMS training materials for growers. The CRDC and Cotton Australia should oversee the outsourcing of these courses and training materials, with a view to ensuring the relevance of the courses and materials to the specifics of the industry programme.

Cost sharing arrangements

Of a total estimated cost of $6.85M for setting up and operating an industry EMS until 2006, the industry has (assuming current arrangements continue) committed to funding of $4.8M, leaving a shortfall of $2.05M.

The practices to be put in place on cotton farms under the proposed framework will benefit both the cotton industry, and external stakeholders. For example, improving natural resource management on farms can help reduce production costs and the risk of conflict with other land and water users. The same practices can help improve river water quality, benefiting these other users of the natural resource base. Similarly, the industry programme will help improve natural resource conditions in relation to matters that can be traced back to cotton production (for example, traces of some pesticides in rivers), as well as those that have been caused by a combination of factors, not necessarily related solely to the cotton industry (for example, river water salinity, and loss of native vegetation).

The work undertaken by the cotton industry would also be of assistance to other industries considering putting an EMS in place.

As outlined above, developing and implementing the industry programme will involve significant costs. Given the potential benefits that the industry programme will generate for other stakeholders, contributions from external stakeholders are justified. Ongoing support is critical, because, as stated in the recent report *Influencing Improved Natural Resource Management on Farms* “Because many NRM practices involve increased complexity, risk and skill, offer intangible benefits that are frequently captured by someone else, or occur a long way into the future, rapid adoption of new practices does not often occur. Change in sustainable farming systems is not speedy ... while significant change in some farm management practices may be measured in decades or even generations” (Barr and Cary at page 3).

The total estimated cost implications for introducing a comprehensive industry EMS are summarised in Table 5. Note that these costs are indicative only and are intended to act as a starting point for discussion.

Table 6 summarises the suggested responsibilities, costs and timeframes for the actions required to implement the recommendations of this report.

Table 5 Estimated total costs 2001–2006

		2001	2002	2003	2004	2005	2006	Total
Start up costs	**EMS Training course Development and training**							
	for growers	255,000						255,000
	for GSMs	50,000						50,000
	for auditors	50,000						50,000
	BMP Guidance materials	100,000	100,000					200,000
	EMS Guidance materials		75,000	75,000				150,000
	Consultation	20,000						20,000
	Industry Policy Development	25,000						25,000
	Subtotals							**750,000**
Ongoing costs	**Implementation Staff**							
	Existing	650,000	650,000	650,000	650,000	650,000	650,000	3,900,000
	2 additional			150,000	150,000	150,000		450,000
	Audit Office Administration	75,000	75,000	75,000	75,000	75,000	75,000	450,000
	Review of Materials			50,000	50,000	50,000	50,000	200,000
	Audit fees							
	Industry audits	50,000	50,000	100,000	100,000	150,000	150,000	600,000
	External audits			100,000	100,000	150,000	150,000	500,000
	Subtotals							**6,100,000**
Start up and Ongoing costs	**Totals**	**1,275,000**	**950,000**	**1,200,000**	**1,125,000**	**1,225,000**	**1,075,000**	**6,850,000**

Note: All costs are exclusive of printing costs, where relevant.

Current and anticipated industry commitment (2000–2006)

Using the estimated costs as the reference point the cotton industry has the following current and anticipated funding commitments. Areas where no current funding exists are then listed.

Committed (total $4.8m)

Cotton Australia

Cotton Australia has budgeted for the on-going implementation of the BMP Programme — $ 3.9M

Consultation and industry policy development — $ 45,000

Cotton Research and Development Corporation

CRDC has approved funding for[56]:

- Development of BMP modules for land and water management and petrochemical storage and handling — $ 100,000
- Development of EMS module (subject to report and industry consultation) — $ 100,000
- Operation of audit office to April 2002. — $ 55,000

Growers

Audit fees[57] — $ 600,000

Shortfalls (total $2.05m)

EMS training – course development and training (growers, GSMs and auditors)

A grant has been sought from the AAA programme: the result is still pending — shortfall — $ 355,000

BMP guidance materials

CRDC has budgeted $100,000 against an estimated total cost of $200,000 — shortfall — $ 100,000

EMS Guidance Materials

CRDC has budgeted $100,000 against an estimated total cost of $150,000 — shortfall — $ 50,000

Implementation staff

Cost of two additional staff to support existing GSMs over 3 years — $ 450,000

Audit Office administration

CRDC has committed $55,000 to funding the operation of the office until April 2002. A source of funding to continue its operation has not yet been determined. — shortfall — $ 395,000

Review of Materials

No provision has been made for the on-going review of the guidance materials and the operation of the overall programme, essential as part of the cycle of continuous improvement	shortfall	$ 200,000

External Audit Fees

While growers currently bear the cost of audits, external audits may need to be covered by the industry	$ 500,000

Other

No attempt has been made to estimate the likely on-farm costs as this will be unique for every farm, depending on its particular circumstances. However, it is suggested that these costs be monitored as part of the audit programme so that the industry is able to demonstrate the money spent by individual growers participating in the programme.

It is also worth highlighting again that a comprehensive industry-wide audit programme that had full participation would result in direct audit costs to growers of at least $600,000 per annum. Travel and administration costs would also need to be added.

Table 6 **Development and implementation strategy – Action Summary**

Action	Responsibility	Cost	Timeframe
Key stakeholder meeting	Cotton Australia, CRDC, MDBC	N/A	Meeting to take place place by mid 2001
Consult with industry/ growers on proposed EMS framework	Cotton Australia	$20,000 Part of core activities: cost can be met by current funding	Consultation process to run from mid to end 2001
Consult with relevant government agencies	Cotton Australia ACGRA	Part of core activities cost can be met by current funding	Consultation to commence as soon as practicable in 2001
Develop industry environmental policy	ACIC, Cotton Australia	$25,000 Part of core activities: cost can be met by current funding	Develop draft and start consultation by mid 2001 Consulting on the industry environmental policy should be done with the EMS consultation
Establishment of industry roles, responsibilities and structures to administer industry EMS	Cotton Australia CRDC		
(1) Employ 2 additional implementation staff (for three years)	8 staff already employed by Cotton Australia, to implement the BMP programme	Additional $150,000 for three years (current annual budget $650,000)	2003–2005
(2) Ensure operation of the industry audit office	An audit office has already been established for the BMP Programme by CRDC	CRDC will fund the audit office until April 2002, after which time it is expected to become self-funding Ongoing running costs will be in the order of $75,000 p.a. (3 part-time employees)	BMP audit office already established with 3 part-time staff

Table 6 continued **Development and implementation strategy – Action Summary**

Action	Responsibility	Cost	Timeframe
Develop best management practice guidance material for the following:		Total cost for four 'new' modules $200,000	2001–2002
▸ **Fuel management**	CRDC[58]		Complete by mid 2001
▸ **Water management**	CRDC[59]		Complete by mid 2001
▸ **Soil management**	CRDC[59]		Complete by mid 2002
▸ **Vegetation management**	CRDC		Complete by mid 2002
▸ **Waste management**	CRDC		Complete by mid 2002
▸ **Energy conservation**	CRDC		Complete by mid 2002
Implement BMP modules, as developed	Cotton Australia	Current budget ($650,000 p.a.), *plus* as noted above, additional two implementation staff for three years (2002–2003, until 2004–2005) ie. an additional $450,000 over three years	Ongoing
Develop EMS guidance material (If consultation process indicates support for proposed EMS framework):	CRDC	$150,000 (2003)	Complete by 2003

Table 6 continued **Development and implementation strategy – Action Summary**

Action	Responsibility	Cost	Timeframe
Implement EMS guidance material: ▸ **Policy, legal requirements** ▸ **Planning, Operational controls, emergencies** ▸ **Structure and responsibility, training, communication** ▸ **Monitoring, and measuring, non-conformance** ▸ **Documentation and records** ▸ **Audit, management review**	Cotton Australia	As for implementing best management practice guidance material	2003 onwards
EMS training for industry implementation staff (including development of training materials for growers)	Cotton Australia	$305,000	2002
EMS audit training for industry auditors	CRDC	$50,000	2002

Industry milestones

To help assess the industry's progress during the expansion of its environmental programme, it is important to establish a number of implementation milestones. These milestones should relate to grower uptake of the programme, including the extent of adoption of 'core' best management practices, and the proportion of growers certified under the programme.

Table 7 lists the milestones the industry should set itself for the implementation of its expanded environmental programme.

Table 7 Implementation milestones for the industry EMS

Achievement	Responsibility	By when?	How assessed
50% of growers certified under the BMP programme (covering all environmental issues)	Cotton Australia, Audit Office	End 2004	Industry audits: number of certified farms
100% of growers introduced to the 'procedural' components of the industry EMS	CRDC, Cotton Australia	End 2004	Guidance material on EMS components distributed to growers through workshops and farm visits
100% of growers implementing best management practices for all issues identified by the industry	Cotton Australia Audit Office	End 2005	Cotton Australia implementation records, industry audit results
25% of growers certified under the industry EMS	Cotton Australia Audit Office	End 2006	Industry and external audits successfully completed
75% of growers certified under the industry EMS	Cotton Australia Audit Office	End 2010	Industry and external audits successfully completed

Chapter 8 Key Performance Indicators

Summary of main points

Performance goals are important for the effectiveness and credibility of an environmental management programme. Setting performance goals helps provide a long-term focus for day to day activities, and enables an enterprise to readily assess their progress. In an industry EMS, performance goals can be established within an environmental policy, or within the objectives and targets established under an environmental programme or plan.

Performance goals and indicators can be set around management decision-making, operational outcomes, and environmental conditions. In an industry programme, performance goals may be established at the farm and industry levels. Industry and farm performance goals will need to be consistent with those set at the Basin, state and catchment scales.

Performance indicators that could be used in an industry environmental programme include:

- Grower adoption of best management practices for:
    - Pesticide management
    - Water management
    - Soil and nutrient management
    - Vegetation management
- Proportion of growers certified under the industry programme
- Improvements in farm water use efficiency
- Improvements in river water quality in cotton growing areas
- An increase in the area dedicated to native vegetation on cotton farms.

To ensure the effectiveness and credibility of the industry programme, it may be necessary to develop a set of ‘non-negotiable’ objectives, targets and performance indicators that reflect the environmental priorities of external stakeholders, the industry and growers.

Responsibility for monitoring and measuring on-farm performance will generally fall to growers. The responsible industry organisation could collect data from farms to report on the industry’s performance. Monitoring and measuring environmental conditions is generally best done by governments, researchers or community groups.

Chapter 8 Key Performance Indicators

Setting meaningful performance goals is an important aspect of an environmental programme, whether it is based on a systems or other approach.[60] As Tibor and Feldman note, “the success of an environmental management programme depends to a great extent on how well it measures environmental performance … Setting goals and using performance measures are critical to maintaining continuous improvement”[61]. Whilst environmental performance can be included in any environmental programme, whether it be based on an EMS or otherwise, an EMS provides an effective framework in which to establish performance goals.

For example, ISO 14001 requires an organisation to “establish and maintain documented environmental objectives and targets”[62] and to “monitor and measure … the key characteristics of its operations and activities that can have a significant impact on the environment” which “shall include the recording of information to track performance … and conformance with the organisation’s objectives and targets”[63]. Formalising the setting of objectives and targets and the monitoring and measuring of an enterprise’s operations helps ensure attention is constantly paid to environmental performance, facilitates the establishment of micro/macro linkages, and contributes to the credibility of the environmental programme. Further, an EMS requires performance goals to be continually assessed, and where they have been met, to be reset. Thus, environmental management under an EMS does not stop at mere compliance with environmental objectives or targets, but aims at continual improvement of the system and of environmental performance.

However, the following important questions need to be addressed before appropriate performance goals can be set.

- What is to be measured? (ie. what performance goals and indicators are to be used?)
- Who is responsible for measuring the performance indicator?
- How are performance indicators measured?
- What level of environmental performance is to be set?

What is to be measured?

Performance indicators are generally used to measure progress towards performance goals.[64] In relation to an EMS, performance goals may take the form of environmental objectives or targets, or commitments contained in the environmental policy.[65] The performance indicators used will therefore directly relate to the objectives, targets and policy of the enterprise implementing the EMS, and a range of performance indicators can be used in relation to a particular environmental objective or aspect of the environmental policy. For an industry EMS, important performance indicators will be the number of farms involved in the programme (ie. programme adoption), and the number of farms certified under the programme (ie. programme compliance).

Environmental objectives are usually stated in general terms (for example, 'increase water use efficiency' or 'reduce pesticide waste'), whereas environmental targets are usually specific and often measurable goals (for example, 'increase water use efficiency by x% on 1999–2000 performance' or 'reduce pesticide waste by x% on 1999–2000 level'). In the language of ISO 14001, an environmental objective is an "*overall* environmental goal", and an environmental target is a "*detailed* performance requirement"[66] .

ISO 14004[67] recommends that organisations establish "measurable environmental performance indicators" around their environmental objectives and targets[68]. ISO 14031[69] distinguishes three types of indicators for evaluating (ie. measuring) environmental performance. These are[70]:

- Management Performance Indicators (MPIs)
- Operational Performance Indicators (OPIs)
- Environmental Condition Indicators (ECIs).

MPIs are aimed at assessing the steps taken by management to improve the organisation's environmental performance. For example, MPIs that could be used in a cotton industry environmental programme include the (extent of) implementation of best management practices, the number of growers audited under the programme, the number of environmental objectives and targets achieved, the number or proportion of employees that have been trained in environmental issues, and the financial and human resources committed to implementing best management practices or other aspects of environmental management[71].

OPIs "provide information about the environmental performance of the organisation's operations"[72]. OPIs measure inputs and outputs and assess the physical infrastructure of an organisation's operations. For example, OPIs relevant to cotton production could include quantities of resources, energy or materials used in production (water, agricultural chemicals, fuel etc), hours of preventative maintenance to farm equipment and infrastructure, and quantities of waste generated during production[73].

ECIs "provide information about the condition of the environment"[74]. Examples of ECIs relevant to the environmental impact of cotton production include water quality in rivers and streams in cotton growing areas, changes in groundwater level, farm soil conditions, and vegetation condition[75].

As noted above, performance indicators can be used to measure progress towards environmental objectives and targets, and conformance with the environmental policy. The objectives, targets and policy under an industry EMS would reflect the priorities of the industry, growers and external stakeholders such as the MDBC. The chosen performance indicators would similarly relate to identified priority issues. To ensure these priority issues are acted on in a consistent way across farms (including any monitoring and measuring of progress), it may be necessary to establish a set of 'non-negotiable' objectives, targets and performance indicators. Growers seeking certification under the industry scheme would be required to adopt these objectives, targets and indicators in their operations. Outside these priority issues, growers would have greater scope to develop their own objectives and targets, and to use performance indicators where they desired. The use of 'non-negotiable' or core objectives, targets and performance indicators will help ensure consistency across farms in environmental management, facilitating the generation of reliable industry data and ultimately, linkages between farming practices and regional or catchment environmental conditions.

The objectives of the Basin Sustainability (BSP) Programme of most relevance to cotton production are listed in Table 8. Indicators that could be used in an industry EMS to measure progress towards attainment of the BSP objective are also listed.

Table 8 Performance indicators in an industry EMS

BSP objective	Relevant performance indicator in industry EMS
Reducing salt, nutrient, sediment and other contaminating exports from rural sources to streams and rivers	Implementation of best management practices for pesticide management, and soil and nutrient management (MPI) Water quality in streams and rivers in cotton growing areas (measuring in particular, pesticides, sediment and nutrients) (ECI)
Protecting groundwater quality	Implementation of best management practices for water management (MPI)
Ensuring the sustainable use of groundwater resources	Groundwater depth and quality (ECI) Improvements in farm water use efficiency (OPI)
Continuously improving the efficiency and effectiveness of irrigation water use	Implementation of best management practices for water management (MPI) Improvements in farm water use efficiency and drainage management (OPI)
Engaging the irrigation industry at the regional level in establishing river flow regimes that provide an appropriate balance between consumptive and in-stream, wetland and floodplain water requirements	Implementation of best management practices for water management (MPI) Improvements in farm water use efficiency (OPI)
Improving the quality of the water in streams, rivers and groundwater ... by implementing appropriate flow regimes	Water quality in streams and rivers in cotton growing areas (measuring in particular, pesticides and nutrients) (ECI) Groundwater depth and quality (ECI)

BSP objective	Relevant performance indicator in industry EMS
Maintaining/re-establishing viable populations of native species and the integrity of ecological communities within floodplain, wetland, riparian [and] in-stream ecosystems	Implementation of best management practices for vegetation management (MPI) Vegetation condition on farms (ECI)
	River health/ bio-diversity ‘health’ in cotton growing areas (ECI) (Whilst farm and industry action will help meet this objective, the monitoring and measurement of relevant indicators may be outside the expertise of industry organisations and growers)
Maintaining key ecological processes	Implementation of best management practices for water management, and vegetation management (MPI) Vegetation condition on farms (ECI) River health/ bio-diversity ‘health’ in cotton growing areas (ECI) (Whilst farm and industry action will help meet this objective, the monitoring and measurement of relevant indicators may be outside the expertise of industry organisations and growers)

Whatever objectives, targets and performance indicators are used to assess on-farm and industry environmental performance, they should have the following characteristics:

- Cost-effective; the attainment of performance goals and the use of indicators should not incur unreasonable costs to growers or the industry
- Practical; performance goals must be able to be achieved by growers implementing best management practices, and must be closely related to their farming operations; similarly, the use of relevant performance indicators must be within growers' expertise
- Meaningful; performance goals and indicators must have relevance to growers' farming operations; in addition to this, goals and indicators at the farm level should correspond to goals and indicators used at the industry, regional or catchment scale.

Who is responsible for measuring performance indicators?

Responsibility for measuring a performance indicator is closely related to the type of indicator that is being measured. For example, measuring MPIs and OPIs is by its nature the responsibility of individual enterprises. In an industry-wide scheme, there is opportunity for MPIs in particular to be measured at both the industry and farm level. For example, the cotton industry (through the Australian Cotton Industry Council, Cotton Research and Development Corporation and Cotton Australia) has already set itself a target of 100% adoption of the BMP Programme by growers, over five years[77]. This indicator (grower uptake of the BMP Programme) is readily measured through the industry's BMP auditing programme. Growers can similarly assess their management performance through indicators such as financial and human resources committed to best management practices, or the number or proportion of BMP objectives achieved. Growers are also best placed to monitor and measure their production inputs and outputs (ie. OPIs), such as water, pesticide and fuel use.

Environmental conditions can be both local and/or regional in nature. It is therefore possible to use ECIs at both a local (farm) and regional level. Local measuring of ECIs could be undertaken by growers, with regional monitoring being undertaken by governments, researchers and community groups. However, due to issues of practicality and cost, most ECIs are by growers[78].

The Central and North West Regions Water Quality Programme is an example of government/researcher measuring of ECIs. The programme is funded by water users in the north west of New South Wales, and carried out by the NSW Department of Land and Water Conservation.

The programme monitors surface water quality in the Border Rivers, Gwydir, Namoi, Macquarie and Darling River basins, measuring levels of pesticides, nutrients, physico-chemical parameters and biological conditions in these rivers. Established in 1991, the current aims of the programme include[79]:

- Describe the surface water quality of the central and north west rivers of NSW
- Monitor the improvement or otherwise of water quality due to the implementation of the cotton industry's Best Management Practices
- Provide data which assists with the setting of water quality guidelines and community water usability goals.

Under the programme, surface water quality is compared with the water quality guidelines outlined in the Australian and New Zealand Environment Conservation Council Guidelines for Fresh and Marine Waters. The programme is being reviewed in 2001 to determine its future direction.

As noted above, some ECIs are also appropriately monitored and measured at the farm or industry level, and could provide useful data for regional or catchment scale monitoring (for example, soil quality, groundwater levels and vegetation condition). ISO 14031 encourages organisations to consider ECIs, but notes that the "development and application of ECIs is frequently the function of local, regional, national or international government agencies, non-governmental organisations, and scientific and research institutions rather than the function of an individual business organisation[80]". Issues of practicality and cost need to be addressed before growers can be expected to undertake such measurements. At a minimum, requiring growers to monitor and measure ECIs would necessitate industry guidance assisted by government/research input and/or funding.

Table 9 Responsibility for measuring performance indicators

	Management performance indicators	Operational performance indicators	Environmental performance indicators
Growers	yes	yes	yes*
Industry	yes	yes	yes*
External stakeholders	no	no	yes

* Where appropriate, taking issues of practicality and cost into account.

How are performance indicators measured?

To ensure that monitoring results are meaningful, it is vital that there is consistency not only in the particular performance goals and indicators used across farms, but also in the procedures and methods used to monitor and measure the chosen performance indicators.

As noted above, MPIs relate to the action management has taken to address an enterprise's environmental impacts. Examples of MPIs include the number of environmental objectives and targets met, the implementation of best management practices, and the number or proportion of employees trained. Where growers are required to measure MPIs, it will be important that clear industry guidance be provided on the nature of the performance goals, and the 'units' or parameters by which they are measured. Some guidance may also be necessary on the methods or protocols for measuring the chosen MPIs.

However, in most cases, effective measuring of MPIs should be able to be achieved through simple management procedures, and good record keeping. For example, an important measure of performance at both the farm and industry levels (at least initially) will be the extent of implementation of best management practices. Growers should be readily able to monitor and measure their implementation of best management practices, without the need for complex monitoring and measuring procedures. Farm data could be collated by the responsible industry organisation to establish an industry picture BMP implementation.

As with MPIs, responsibility for measuring OPIs will generally fall to growers. Examples of OPIs include water, pesticide and fuel use. To ensure a consistent approach across farms and the generation of reliable industry data, it will be important that industry guidance be provided on both the units or parameters to be used to measure OPIs, and on the methods or protocols that need to be put in place to ensure measuring is accurate and repeatable.

To ensure grower involvement, these methods and protocols should be kept as simple as possible, and should be compatible with farming operations. Where possible, OPIs that are already being measured on-farm should be given consideration for inclusion in the environmental programme.

As noted above, ECIs can be local and/or regional in nature. This suggests the potential for ECIs to be measured both on farms and across a region. However, the measuring of many ECIs by growers is limited by issues of cost and practicality. If growers are to be expected to measure on-farm environmental conditions, the methods to be put in place must be inexpensive and relatively simple.

Also, there must be a clear link between the environmental conditions that are being measured on the farm, and those that are being assessed at the regional or catchment scale[81].

Where growers are required to measure on-farm environmental conditions, guidance will need to be provided to ensure that the methods used (for example, the units of measurement, and protocols for tests), are consistent across farms, as well as compatible with any monitoring and measuring being carried out on the regional or catchment scale.

What level of environmental performance is to be set?

The 'level' of environmental performance is largely determined by the environmental objectives and targets that have been established. As noted above, it may be necessary for the industry to establish a core of 'non-negotiable' objectives and targets that reflect agreed priority issues. Outside these core objectives and targets, growers will have greater flexibility to set their own performance goals. Over time, performance levels should be reviewed and modified according to growers' and/or the industry's ability to meet them. In the context of an EMS based on ISO 14001, the requirement to periodically review the EMS provides an opportunity to review performance goals and indicators, and to make any necessary modifications.

In relation to MPIs and OPIs, the industry and individual growers are generally best placed to determine the appropriate level of performance. The performance goals and indicators used would reflect the industry's and the farm's significant environmental aspects. If a set of 'non-negotiable' objectives is developed by the industry (in consultation with external stakeholders), these will become minimum performance levels. Given the variation in farm sizes and efficiencies, some flexibility may need to be provided in these objectives.

The BMP Programme contains minimum performance levels relating to the implementation of best management practices. The Programme is structured around a series of objectives, each of which can be met through putting certain practices in place. That is, the implementation of specific best management practices is the performance indicator for each objective. Growers are therefore readily able to measure their own progress, and the auditing component of the programme provides an opportunity for progress to be measured at the industry level. Full implementation of (all relevant) best management practices on all cotton farms is already a performance goal for the industry.

As noted above, ECIs are by their nature generally the responsibility of government or researchers to monitor and measure. Thus, the level of performance set in relation to an ECI will in most cases be up to these stakeholders. Once a performance level is set at this broad scale, objectives, targets and practices can be put in place at the industry or farm level that reflect this goal. Whether specific ECIs are measured at the farm level to back up the work being done at the regional or catchment scale will be determined by factors such as the existence or otherwise of a macro/micro link, practicality and cost. Failing an ability to undertake meaningful, cost-effective measurements of specific ECIs at the local level, growers could nonetheless develop and measure MPIs and OPIs that would make a positive contribution towards the achievement of the regional or catchment environmental goal.

The lead role that governments need to take in setting environmental goals is noted by Yencken and Wilkinson: “public policy targets are needed for all the key dimensions of environmental degradation in Australia”[82], and more specifically “targets are needed for the restoration of degraded lands, vegetation and environmental flows, for the protection of biodiversity, ground water, wetlands and soils”[83].

However, a lack of knowledge about environmental conditions can be an obstacle to effective large-scale action. As the 1996 Australia State of the Environment Report suggests: “Australia lacks the integrated national systems and databases to measure environmental quality … Our lack of knowledge and understanding of environmental issues emerges again and again in the report as a major obstacle to sound environmental management”[84].

A lack of specific knowledge about ‘where we are’ in relation to environmental conditions makes setting specific targets about ‘where we want to be’ difficult. Nonetheless, enough is known in general terms about aspects of the environment that principles and practices can be adopted to ensure that environmental impacts are addressed and hopefully improved (cf the precautionary principle).

For example, specific pathways for every farm chemical that has the potential to end up in waterways are not accurately known. Nonetheless, a number of practices relating to pesticide use and farm design recommended in the BMP Manual significantly reduce the risk of pesticides entering waterways or otherwise creating adverse impacts on the environment.

Chapter 9 Legal Issues

Summary of main points

Implementing an industry EMS raises a number of legal issues that need to be kept in mind by the responsible industry organisations. These issues relate to the risk of industry or auditor liability for negligent misrepresentation or trade practices breaches, identifying all of a grower's legal obligations, addressing the requirements of due diligence, and protecting confidential information generated under an EMS.

The risk of legal liability of industry organisations or auditors involved in implementing and auditing farm EMSs is limited to the following cases:

- Negligence where farmers suffer loss as a result of relying on false or inaccurate advice from the industry organisation or auditor
- Under trade practices law if the industry organisation or auditor provided advice that is deceptive or misleading.

These risks can be managed by ensuring that advice to growers is conservative in nature, and accurate in content. Similarly, ensuring that growers are aware of the 'mere' advisory nature of the industry or auditor advice will help minimise the risk of prosecution.

Implementing an industry EMS will require growers to identify all their environmental legal obligations. This establishes legal compliance as a minimum performance standard, and enhances the credibility of the industry programme. Identifying growers' environmental legal obligations is a task best undertaken at the industry level. The guidance material developed by the responsible industry organisation will need to be critically assessed by growers to determine the specific obligations that affect their operations.

Implementing an EMS can take an enterprise beyond legal compliance. Implementing an EMS can help enterprise's improve their environmental performance well beyond what is expected of them under legislation. A properly implemented EMS will ensure growers assess and address all the environmental impacts of their operations, helping them meet their due diligence obligations. The mere existence of an EMS however, does not automatically satisfy legal requirements relating to due diligence. Growers need to ensure that the procedures and practices that are put in place effectively address each particular environmental impact as it exists on the farm.

The industry needs to ensure that sensitive information generated as a result of EMS implementation or auditing is kept secure. Growers will need to ensure that any sensitive information is kept secure through appropriate document control procedures, and that where necessary, audit results and reports remain confidential.

Chapter 9 Legal Issues

A number of legal issues will need to be kept in mind should the industry develop an EMS. Significant legal issues discussed below include the legal liability of industry organisations overseeing the development and implementation of the programme, the need for growers to address all their legal obligations, and the protection of environmental audit information. These issues are discussed in the context of the industry implementing an EMS based on ISO 14001.

Industry liability

Industry organisations responsible for developing and implementing an industry EMS will be providing growers with a range of information relating to environmental management on farms. In the event that a grower relies on this information, and suffers loss as a result of this reliance, the prospect of the 'advising' industry organisations being liable for this loss arises. Similar issues have arisen in the past in relation to the industry's advice to growers on spray and drift management plans. In simple terms, an industry organisation providing advice to growers would only be liable in the following cases:

- For negligence where it provided false or inaccurate information to growers who suffered loss as a result of their reliance on this information. This would most likely arise in relation to technical or practical information (such as that already contained in the BMP Manual) that when applied on-farm, led to damage or loss. Maintaining the BMP Manual as a non-mandatory guide to good practice, and keeping any recommendations relating to their adoption within conservative terms should help avoid such a claim. The disclaimer in the BMP Manual indicates that the practices contained in the Manual as recommendations only, and not guaranteed or comprehensive methods of effective environmental management. It would most likely be difficult to establish negligence around the provision of general information on a management system, such as an EMS, where the detailed practices and work procedures are left to the decision of the grower.
- Under trade practices law if it were to engage in conduct that was "misleading or deceptive" or "likely to mislead or deceive". For example, if false claims were made about the benefits of using the contents of the BMP Manual or of adopting an EMS. As noted above, ensuring that any comments on potential benefits relating to the use of best management practices or an EMS are kept realistic, as well as ensuring a high degree of reliability and accuracy in relation to any recommended practices should mean the risk of legal action of this nature is minimal.

Auditor liability

An industry EMS will require both internal (industry) and external audits to be undertaken of growers' adoption of the programme. The audit criteria to be used in an industry EMS will most likely be the specifications detailed in ISO 14001. Audits of grower adoption of specific best practices are carried out under the BMP Programme and may continue to be carried out to some extent under an industry EMS.

Auditors determine a grower's (or farm's) compliance with the audit criteria, and may also provide advice on how a grower can improve their practices in order to meet the audit criteria, or otherwise meet his or her environmental responsibilities. Similar to the industry organisations providing environmental and agricultural advice, auditors therefore face potential legal liability in the following cases:

- For negligence where farmers suffer loss as a result of relying on an auditor's false or inaccurate advice
- Under trade practices law if they (the auditor) provide advice that is deceptive or misleading.

The industry will need to ensure that internal auditors are aware of their legal responsibilities and the potential for legal liability. The industry will need to ensure that auditors are properly trained and accredited to carry out the tasks expected of them under an industry programme. Internal auditors will be accountable to a responsible industry organisation, and external auditors will be selected from properly accredited organisations.

Identifying legal obligations

ISO 14001 requires an organisation to "establish and maintain a procedure to identify and have access to legal and other requirements to which the organisation subscribes"[85].

The scale of the initial identification of environmental responsibilities militates against growers undertaking this task on their own. As Brown states "in Australia, environmental regulation is extensive and complex. There are numerous statutes at both the State and Federal levels of government as well as local ordinances administered by local councils. There are hundreds of regulations, guidelines and policies relating to these statutes, and these are being increased rapidly as new Acts and regulations are passed into law through every parliament in Australia."[86] It is therefore important that the identification and interpretation of grower legal obligations be coordinated or conducted at the industry level. This will help growers avoid a potentially difficult task, as well as ensuring that all relevant obligations are identified and explained to growers in a meaningful way.

The industry will need to ensure comprehensive coverage of growers' legal obligations, but as Brown notes, it needs to be kept in mind that "there is no point in recording every possible piece of environmental legislation ... unless they relate directly to the organisation's activities."[87]

Whilst ISO 14001 does not require a register to be kept of legal obligations, it would seem sensible, given the potentially large number of legal obligations to which growers may be subject, to develop a register of growers' environmental legal responsibilities. As indicated above, much of this work could be done at an industry level. As Brown notes, "a register of regulatory requirements may … be established by … external advisers (lawyers, consultants [or industry organisations]) who may also be responsible for maintaining and updating the register as required."[88]

It will ultimately be the grower's responsibility to satisfy him/herself that all environmental legal obligations affecting the farm have been identified and addressed. Of course, one grower's legal situation will often differ from another's. For example, larger operations in New South Wales storing significant quantities of pesticides may require a licence, whereas smaller operations keeping lesser quantities of pesticide on-farm, or growers in Queensland who currently have the benefit of a blanket exemption from the corresponding obligations under that state's legislation, will not. Industry guidance material will need to take this into account, and include advice to growers that they need to be diligent in identifying the specific legal requirements that apply to their operations.

Brown notes that "professional advice should always be sought in matters of environmental law … and should be included in procedures developed to implement the requirements of the standards."[89] Growers will obviously be free to seek legal advice on the specific legal obligations affecting their activities. The industry could recommend that growers undertake to do just this, but should also be aware that this may not be a financially viable option for many growers. It may be necessary for the industry to obtain periodic legal advice as a support mechanism for growers adopting an EMS. The information could then be available to growers in summary form.

One option for determining growers' environmental legal obligations would be to conduct a legal compliance assurance programme. This involves an exhaustive review of legislation, licences and all other sources of legal obligations relevant to a cotton farming operation. This would be done at when introducing an EMS to the industry, and due to the scale of such an undertaking, could only be done at an industry level. A disadvantage of having it done at industry level is the loss of site-specific requirements for individual farms.

A process whereby growers could determine the nature and scope of their particular obligations from a more generic analysis would therefore most likely need to be developed.

It needs to be kept in mind that a number of environmental legal obligations are stated in general terms and that a knowledge of a general duty does not necessarily provide practical guidance on how it can be met. For example, “a person must not pollute any waters”[90] and “a person must not carry out an activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm”[91]. It is therefore necessary when determining growers’ legal obligations that such broad statements of legislative intent are reduced to a practical level as far as possible. This can be done through a combination of information from for example, legal advisors, government policy documents, industry best management practices and growers’ experience.

Beyond legal compliance

It is clear that in one sense, compliance with ISO 14001 ensures that the user goes beyond compliance with their environmental legal obligations. As Brown states “in most countries, there is no law that requires implementation of an environmental management system, therefore any organisation that actually implements and conforms to ISO 14001 is already beyond what the law requires.”[92] More specifically, in addition to identifying their legal obligations (and any other obligations to which they voluntarily subscribe, such as industry codes of practice), the standard requires users to go beyond the specifics of legal regulation and expects coverage of areas that are generally not subject to direct regulation, such as the use of energy, water consumption, and the consumption of raw materials[93].

The standard also requires enterprises seeking to be registered to subject themselves to periodic third-party audits, which again is well beyond what is generally required by law, and is certainly beyond what the law requires of cotton growers in relation to their operations. That the results of these audits turn on (among other things) legal compliance, reflects the fact that fulfilling legal obligations is a minimum requirement for the successful implementation of ISO 14001.

However, it is important to understand that the mere existence of an EMS does not automatically satisfy legal requirements relating to due diligence and the management of risk[94]. In addition to having a general system of environmental management to deal with risk, due diligence requires the system to be adapted specifically to the particular circumstances of the organisation, as well as focused attention on any specific risks at hand[95]. ISO 14001 is drafted in broad terms for adoption by a range of organisations in many countries. It is therefore not enough to import the standard “wholesale” without closely considering local regulations and the individual circumstances of the organisation. Similarly, using an EMS as “window dressing”, without fully implementing, monitoring and updating the procedures and practices under it is obviously not sufficient to establish due diligence.

Protection of information

Registration under ISO 14001 requires an audit to be carried out on the management system that has been put in place. This raises a concern over the use of information disclosed during or recorded as a result of an audit, particularly in the event that the information indicates a potential breach of legislation. Brown suggests that an environmental audit report is a confidential document “owned” by the party carrying out the audit, and that “there is no obligation to make the findings or recommendations of an environmental audit report available to the public, or even to government inspectors”[96]. Similarly, ISO 14010: Guidelines for environmental auditing, states that “the relationship between the audit team and the client should be one of confidentiality and discretion. Unless required by law, the audit team members should not disclose information or documents obtained during the audit, without the express approval of the client”[97].

The legal position in New South Wales on the use of audit documents is relatively clear. Under the Protection of the Environment Operations Act 1997, information (“documents”) prepared for the sole purpose of a voluntary audit can not be used as evidence against any person claimed to have breached environment protection legislation[98]. However, no such legislative protection is provided for audit documents in Queensland. Enterprises undertaking to be audited should therefore satisfy themselves in advance as to the confidentiality of any information they provide to an auditor. This is particularly the case given that companies (including many cotton farming operations) cannot claim privilege against self-incrimination[99] and that government inspectors may have significant powers of entry and inspection[100].

In light of the importance of this issue, and the apparent doubt surrounding it in Queensland, the industry should consider seeking formal legal advice to ensure that growers seeking to improve their environmental management are not confronted with the spectre of prosecution, and the use of their own records against them.

A related issue is that of the recording of sensitive information and document control within the enterprise adopting an EMS. As Brown notes “companies [have] to be aware of the need for proper systems of information control.

If access to and circulation of information [is] not adequately monitored, there [is] a risk that information which the company generated as part of the documentation requirements of ISO 14001 could be used in proceedings against it."[101] Industry guidance to growers should be provided on this issue as part of information developed to support the adoption of an EMS.

Notes

1 Auditing is a generic management tool that can be used in relation to a wide range of environmental or quality assurance programmes in a variety of industries. For example, the definition of an EMS audit contained in ISO 14001 implies this generic process-based nature: "*a systematic and documented verification process...*" Brown (3) notes the International Chamber of Commerce's definition of environmental audit: "*a management tool comprising a systematic, documented, periodic and objective evaluation [of performance]*" (page 6). There is therefore great flexibility in the criteria upon which audit and certification can be based. For example, auditing and certification can be based on compliance with a certain set of procedures, a certain quality of product or service, or the implementation of specific practices.

2 Cooperative Research Centre for Sustainable Cotton Production, *A Good News Story*, (undated), page 2.

3 The Australian Cottongrower, 2000, page 50.

4 The Australian Cottongrower, *Cotton Yearbooks*, 1999 (page 4) and 2000 (page 4).

5 The Australian Cottongrower, *Cotton Yearbooks*, 1999 (page 60) and 2000 (page 56).

6 Cotton Australia, *Report to the Industry*, 1999, page 2.

7 The Australian Cottongrower, *Cotton Yearbooks*, 1999 (page 56) and 2000 (page 52).

8 Hassall and Associates, *Socio-economic impact of reduced water availability on the irrigation industry and town of Bourke, NSW, April 1999 (*pages 19–21).

9 Hassall and Associates, *Socio-economic impact of reduced water availability on the irrigation industry and town of Bourke, NSW, April 1999* (pages 19–21).

10 The Centre for Agricultural and Resource Economics, *The Economic Impact of the Cotton Industry in the MacIntyre Valley, November 1993*, pages v, vi, and 34. Since this report was published, cotton production in the MacIntyre Valley has grown from approximately 40,000 ha (1991–92), to approximately 60,000 ha (1999–00) (see page 78 of the Cotton Yearbook 2000). The absolute contribution of cotton production to the MacIntyre Valley economy has therefore significantly increased over this period. Although no figures exist to make the comparison, it is highly likely that cotton production's relative contribution to the MacIntyre Valley economy has similarly increased over this period.

11 Cotton Australia, *Report to the Industry*, 1999, page 3.

12 Australian Bureau of Statistics, *Water Account for Australia 1993–94 to 1996–97*, at www.abs.gov.au.

13 Cotton Research and Development Corporation, *The Performance of INGARD, Cotton in Australia during the 1998-99 Season*, November 1999 (page 2.3), and Cotton Research and Development Corporation, *The Performance of INGARD, Cotton in Australia during the 1999-2000 Season* (draft), (page 3).

14 Bt cotton is genetically modified to produce a protein that kills heliothis larvae but that does not affect beneficial insects or other organisms. Using Bt cotton is a means to reduce the number of pesticide applications.

15 The 1998/99 season was characterised by unusually high insect pressure, and resulting high insect control costs.

16 See Appendix 5 for a detailed discussion of the priority natural resource issues of both the cotton industry and the MDBC.

17 *Irrigated Regions Sub-programme Strategic Plan 2000–2002*, Draft for evaluation March 2000, pages 4–5.

18 *Irrigated Regions Sub-programme Strategic Plan 2000–2002*, Draft for evaluation March 2000, pages 4–5.

19 *Irrigated Regions Sub-programme Strategic Plan 2000–2002*, Draft for evaluation March 2000, pages 4–5.

20 See Appendix 5. A comprehensive industry environmental programme would also cover fuel management, waste management and energy conservation.

21 At page 45.

22 Brown (1) at page 20.6.

23 At page 23.

24 At page 142.

25 Gunningham and Johnstone, at page 132.

26 That is, those features considered necessary to ensure both grower adoption, and environmental outcomes.

27 The BMP Manual was developed in light of the then draft ISO 14001 standard, and as the following analysis shows, the BMP Programme contains a number of the fundamental components of an EMS. The industry has also gained an appreciation of the potential effectiveness of an EMS through the experience of Oakville Pastoral Company, an ISO 14001– certified cotton farm in NSW.

28 Parts of the QAS report are reproduced in Appendix 6.

29 ISO 14001 defines an EMS as "*that part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy*" (page 2).

30 Tibor and Feldman argue that committed implementation of an EMS should result in improved environmental performance, and point out that failure to do so would reflect poorly on the organisation: "*if it turns out that organisations somehow find ways to achieve ISO 14001 conformance … but fail to genuinely improve their environmental performance, the credibility of the process will be lost*" (at page 28).

31 At page 5.

32 Extracts from this report are included in Appendix 6.

33 Rural Industries Research and Development Corporation, *Environmental Management Systems in Agriculture, Proceedings of a National Workshop, May 26–28, 1999*, pages 217–220.

34 Waskom, R.M, and Walker, L.R., *Involving Agricultural Producers in Development of Localised Best Management Practices*, undated.

35 For example, (future) strategies stemming from the MDBC's Integrated Catchment Management policy, the Basin Salinity Management Strategy, NSW catchment management strategies, vegetation management strategies in NSW and Queensland, and management plans for land and water use under NSW and Queensland water legislation.

36 For example, GrainCare and CattleCare are quality assurance programmes developed by the grains and beef cattle industries respectively. The development of an environmental programme is also being investigated by the grains, beef and viticulture industries

37 The cotton industry is represented on the National Farmer's Federation Quality Assurance Working Group that also includes representatives from a number of agricultural industries with similar schemes, and allows regular communication between the various industries.

38 This arguably reflects both the specific nature of the risks of pesticide use, and the level of environmental and occupational health and safety legislation affecting this activity. Environmental issues not associated with the same level of specific risk, nor the same level of legislative control (for example, soil management and vegetation management on private land), are not as amenable to prescriptive controls that are independent of the specific circumstances of the enterprise.

39 For example, many quality assurance programmes are based on ISO 9001 and/or the hazard analysis and critical control point (HACCP) process. Both these models involve adapting a generic set of procedures to the specific operations of the enterprise. ISO 14001 states that *"this International Standard shares common management system principles with the ISO 9000 series"* (page vii).

40 AS/NZS *ISO 14010: 1996, Guidelines for environmental auditing – General principles*.

41 Clause 2.9. An analogous definition of an environmental management system audit is provided in ISO 14001, Clause 3.6.

42 Although BMP audits do not readily fall into one of the traditional categories of audit (ie. 1st, 2nd, or 3rd party), they most closely resemble third party audits of the cotton industry. The term 'industry auditor' is used however, recognising that the auditors are not totally independent. Auditors are neither employees nor clients of growers whose farms they audit: they are private contractors who report to the BMP Audit Office, currently funded by the Cotton Research Development Corporation. A number of checks have been put in place to ensure the objectivity of BMP audits, including external third-party review of these 'industry' audits and auditors. The industry is confident in the levels of independence and rigour with which these audits are being carried out.

43 ISO 14001, page v.

44 Based in the Queensland towns of Emerald, Dalby (2) and Goondiwindi, and in New South Wales, in Moree, Narrabri, Gunnedah and Warren.

45 *Cotton Australia Grower Services Plan 2000/2001*.

46 This information is based on the audit programme's *Cotton Grower Audit Pack, SOD 0015: Grower Audit Pack, Sept 00/03*.

47 *Agency Information Pack – Overview of the BMP Program, AOD 0011: Agency Audit Information Pack Sept 00/03*.

48 *Selection Criteria for Industry BMP Auditors, AOD 0001: Selection Criteria for Industry Auditors Apr 00/01*.

49 *Selection Criteria for Industry BMP Auditors, AOD 0001: Selection Criteria for Industry Auditors Apr 00/01*.

50 Post-audit surveys of growers conducted by the audit office have consistently highlighted the importance to growers of auditors having detailed knowledge of cotton production.

Other issues that arise here include the ability for the industry to maintain control over the audit programme, and the cost of contracting out the functions of the audit office, as opposed to maintaining the functions 'in-house'.

51 *Australian Cotton Industry Council Annual Report 1999*.

52 This figure is for the partial financial year 2001 to April 2002.

53 Appendix 4 contains a detailed analysis of ISO 14001, and outlines the practical requirements of implementing it on farms.

54 A submission has been made by the cotton industry through Cotton Australia for funding under the AAA FarmBis Australia programme for funding to develop such a training programme. A total grant of $110,000 has been sought, with total project costs being $255,000.

55 The Australian Cottongrower, *Cotton Yearbook, 2000*, page 130.

56 An occupational health and safety module is currently being developed at a cost of $50,000.

57 It has been suggested that the audit fee to be increased to $600, with the additional fees being used to fund the operation of the audit office.

58 In progress, CRDC Project AAW 1C.

59 In progress, CRDC Project AAW 1C.

60 The use of performance indicators and the adoption of an EMS are independent. As Tibor and Feldman note: "*it is possible to have environmental performance without an environmental management system, or to measure performance without adopting an EMS*" (at page 33).

61 At page 67. Heinze similarly notes that "*to support credible, long-term environmental sustainability, EMSs should be designed to link to scientifically rigorous biogeophysical indicators, measurement systems and environmental thresholds … In this way an EMS will demonstrate a level of risk management which is credible and will be acceptable to consumers, the financial and legal sectors, regulators and industry itself*" (at page 6). And Yencken and Wilkinson state that: "*all natural resource management programmes, and indeed any programme undertaken related to environmental management, should be judged on outcomes. Process-oriented goals, while important, are not enough*" (at page 247).

62 Clause 4.3.3.

63 Clause 4.5.1.

64 Performance indicators can be used in the absence of specific performance goals. For example, to assess performance against previous years or other enterprises, or to 'baseline' environmental conditions.

65 ISO 14004 states that "*objectives are the overall goals for environmental performance identified in the environmental policy*" and that "*targets can then be set to achieve these objectives and targets*" (clause 4.2.5).

66 At page 2.

67 *Environmental management systems – General guidelines on principles, systems and supporting techniques*.

68 Clause 4.2.5.

69 *Environmental management – Environmental performance evaluation – Guidelines*.

70 ISO 14031 at page 4. The Standard notes that environmental performance evaluation can be used whether an organisation has an EMS in place or not.

71 For more examples of MPIs see ISO 14031 at pages 22 to 24.

72 ISO 14031 at page 4.

73 For more examples of OPIs see ISO 14031 at pages 25 to 27.

74 ISO 14031 at page 5.

75 For more examples of ECIs see ISO 14031 at pages 28 to 31.

76 Extracted from *Irrigated Regions Sub-Programme Strategic Plan 2000–2002, Draft for Evaluation, March 2000*, MDBC, pages 4–5.

77 See for example *Department of Agriculture, Fisheries and Forestry, Portfolio Budget Statements 2000–2001*, page 158.

78 However, exceptions could include environmental conditions that are farm-specific and/or dependent on agronomic inputs, such as soil nutrient levels and physical condition, or those that growers may already be measuring as part of their farming activities, such as ground water level, or those that are able to be done relatively easily and inexpensively, such as vegetation condition.

79 NSW Department of Land and Water Conservation, *Central and North West Regions Water Quality Programme, 1998–99 Report on Pesticides Monitoring,* page 1, and *1998–99 Report on Nutrients and General Water Quality Monitoring,* page 1.

80 ISO 14031 at page 11. The Standard goes on to suggest that "*organisations that can identify a relationship between their activities and the condition of some component of the environment may choose to develop their own ECIs as an aid in evaluating their environmental performance*" page 11.

81 Note that however, some ECIs are purely local in nature. For example, the condition of soils used for cropping. In these cases, micro/macro links will obviously not be possible.

82 At page 317.

83 At page 321.

84 At page ES–5.

85 Clause 4.3.2.

86 Brown (2) at 1108.1.

87 Brown (1) at page 769.

88 Brown (1) at page 781.

89 Brown (1) at page 713.

90 *Protection of the Environment Operations Act (NSW) 1997*, section 120 (1).

91 *Environmental Protection Act (Qld) 1994*, section 36 (1).

92 Brown (1) at page 20.1.

93 Brown (1) at page 20.1.

94 Nonetheless, adopting an EMS (including the requirement to identify all environmental legal obligations) can act as a strong prompt to action, and minimise the risk of environmental harm, as Brown suggests in relation to a 1996 environmental disaster in the Philippines "*a fully implemented EMS, with its required documentation, monitoring and inspection procedures, may well have prevented the [environmental harm] from occurring*" (1) at page 24.3).

95 Brown (1) at page 20.3.

96 Brown (3) at page 44.

97 Clause 4.3.

98 Sections 180–183.

99 See Brown (3) at page 45.

100 See for example Part 7 of the *New South Wales Pesticides Act 1999*, and Chapter 7 of the NSW *Protection of the Environment Operations Act 1997.*

101 Brown (1) at page 20.5.

ACTION SUMMARY
Guidelines for Progression

Appendix 1

Action Summary

The expansion of the cotton industry's BMP Programme into a comprehensive EMS will require a number of discrete actions to be completed. These actions should build on the arrangements that the industry already has in place for the continued development and expansion of the BMP Programme, in a way that is consistent with those arrangements, and which further enhances the effectiveness and credibility of the programme. Similarly, these actions should be carried out at a pace that ensures the constant progression and improvement of the programme, but that is not so rapid as to threaten grower involvement.

Cotton Australia has endorsed the broad concept of developing the BMP programme into an EMS over time; however, Cotton Australia has also emphasised the importance of developing the BMP Programme at an appropriate pace. It is therefore recommended that while development should continue, implementation timelines will need to be continually assessed in light of the adoption rates of the programme.

The following is an outline of the actions required to develop the BMP Programme into a comprehensive EMS, capable of being certified to ISO 14001.

1 Key stakeholders to hold meeting

This report serves as a 'foundation document', through which the issues contained in it can be progressed. The report's recommendations should form the basis for the continued development of the cotton industry's environmental programme. To ensure the recommendations contained in the report are progressed in a way that is acceptable to the major stakeholders, it is suggested that discussions between these groups around the proposed framework continue.

It is recommended that representatives from Cotton Australia, the Cotton Research and Development Corporation (CRDC) and the Murray-Darling Basin Commission's Irrigation Issues Working Group meet, together with the project team, to discuss and refine the proposed actions, timelines and funding arrangements contained in this report. Both Cotton Australia and CRDC have nominated appropriate people within their organisations to be involved in such discussions. Convening this stakeholder meeting should be coordinated by Cotton Australia. The meeting should take place as soon as practicable after the Irrigation Issues Working Group meeting scheduled for late March 2001.

2 Undertake consultation with industry members

To ensure the proposed framework for the industry EMS is acceptable to industry stakeholders (ie. growers and industry organisations), consultation with these groups will need to be undertaken. Consultation on the proposed framework should be coordinated by Cotton Australia and the Australian Cotton Growers Research Association. It is recommended that industry consultation be commenced and completed during 2001.

3 Undertake consultation with government agencies

A number of issues raised in this report require discussion with relevant government agencies. These include:

- The legal status of audit reports in Queensland
- Requirements of the Queensland Environmental Code of Practice for Agriculture
- The potential for the industry programme to satisfy regulatory requirements for natural resource management

The opportunity could also be taken during agency consultation to discuss the type of support that might be available from governments for the programme. Consultation with government agencies should be undertaken by Cotton Australia and the ACGRA. Consultation should commence during 2001, and is likely to be ongoing.

4 Develop an industry environmental policy

An industry environmental policy will articulate the industry's priority environmental issues, and should set long term industry goals for the management of these issues. The industry environmental policy will establish the direction for farm environmental management, and will be a central point of reference for growers implementing the industry environmental programme.

Development of the environmental policy should be led by Cotton Australia and/or the Australian Cotton Industry Council. The policy should build on the work already undertaken by Cotton Australia in this area. The industry should aim to have a comprehensive environmental policy in place by the end of 2001.

An industry environmental policy that meets the requirements of ISO 14001 will need to include the following:

- Commitments to continual improvement and the prevention of pollution
- A commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the industry subscribes (eg. Basin or catchment natural resource management strategies).

5 Establish roles, responsibilities and structures to oversee the implementation and administration of the industry EMS

The successful development, implementation and ongoing administration of an industry EMS will depend on clear industry roles and responsibilities, and appropriate industry structural arrangements. Industry roles and responsibilities and structural arrangements already in place under the BMP Programme should be capable of overseeing the introduction of an industry EMS. For example, the current roles and responsibilities of the CRDC, Cotton Australia and the industry audit office should adequately address the requirements under an industry EMS relating to programme development, implementation and auditing.

Expanding and enhancing the BMP Programme will however, require continued and possibly increased commitments of resources from these organisations. In particular, it is recommended that Cotton Australia increase the current level of industry implementation staff by two, over a period of three years during the initial expansion of the programme. It is also recommended that future consideration be given to enhancing the staffing level of the audit office, from the current three part-time employees, to two full time employees.

6 Develop best management practice guidance material for all relevant issues

To be most effective, the industry EMS must cover the full range of environmental issues relevant to cotton production. To guide growers on the issues that should be addressed on their own farm, and to provide potential methods of addressing these issues, best management practice guidance materials need to be developed. These materials should cover the following topics:

- Pesticide management
- Water management
- Soil and nutrient management

- Vegetation management
- Fuel management
- Waste management
- Energy conservation.

Of these topics, pesticide management, water management, and fuel management have either been developed or are currently being developed by the industry. Soil and nutrient management, vegetation management, waste management, and energy conservation are yet to receive dedicated funding for their development.

The development of guidance material for the required additional topics should be overseen by the CRDC. It is recommended that these guidance materials be completed by the end of 2002.

7 Oversee the implementation of best management practices for all relevant issues

Implementing best management practices for the above-mentioned topics should commence as soon as practicable after the completion of the relevant guidance material. The farm implementation of these practices should be overseen using arrangements already in place under the BMP Programme (ie. through grower workshops and farm visits conducted by Cotton Australia field staff).

Overseeing the implementing best management practices will be an ongoing industry priority. Best management practices will be periodically reviewed and guidance material updated and improved as necessary. Implementation of the full set of best management practices should have commenced by early or mid 2003. It is recommended that the industry establish the goal of having all growers implementing best management practices for all topics, within three years of the full set of guidance materials being completed (ie. by the end of 2005).

8 Develop guidance material for the ‘procedural’ components of the industry EMS

Consistent and effective farm implementation of the industry EMS will require the development of guidance material on each of the ‘procedural’ components of the EMS. This guidance material will be based on the specifications of ISO 14001, and will be integrated with the industry-developed best management practices. Appendix 4 of this report contains a detailed analysis of ISO 14001, and of the practical implications of using the standard for the industry EMS.

EMS guidance material will need to include simple 'training packages' for aspects of an EMS requiring particular skills. Industry implementation staff would then be responsible for ensuring that growers were sufficiently trained to implement and maintain an EMS on their farm. In particular, growers should be provided with training in risk assessment,[117] the fundamentals of EMS audits, and conducting a review of the farm EMS.

EMS guidance material will also need to include advice to growers on their environmental legal obligations. Whilst the industry has developed significant material on this topic in relation to pesticide use, further work in this area may require the industry obtaining professional legal advice.

An ISO 14001-based EMS will also require environmental objectives and targets to be continually established and reviewed. Industry guidance material on environmental objectives and targets should be informed by any relevant performance goals established in Basin, State or catchment natural resource management strategies. These goals would assist the industry to establish appropriate objectives and targets for growers.

The development of the EMS guidance material should be led by CRDC. It is recommended that these materials be completed by the end of 2003. On-farm implementation of these materials should follow as soon as possible after their development. It is further recommended that the industry establish a goal of having all growers familiar with the EMS guidance material by the end of 2004.

9 Provide appropriate training in EMSs for industry implementation staff and industry auditors

To ensure industry personnel have the knowledge and skills necessary to facilitate and/or audit the farm adoption of the industry EMS, they will need to receive appropriate training. Industry implementation staff and industry auditors should receive EMS training appropriate to their roles and responsibilities under the industry programme.

It is recommended that this training be provided by an external accreditation body with relevant expertise. Training industry implementation staff should be accompanied by the development of an EMS training package for growers. This training package should address the management 'tools' used under an EMS, such as risk assessment, auditing, and management review. Industry auditors should receive specialised training to enable them to properly carry out audits under the industry EMS. This training should build on the knowledge and experience of industry auditors, complementing the training already required to be undertaken by auditors under the BMP Programme.

Appropriate training programmes should be completed by all relevant personnel before the commencement of EMS implementation, for example, during 2002 or 2003. Coordination of these training programmes should be led by Cotton Australia and the industry audit office.

10 Oversee the implementation of the industry EMS on farms

Overseeing the farm implementation of the 'procedural' components of the industry EMS should be carried out through the arrangements already in place under the BMP Programme (ie. through grower workshops and farm visits conducted by Cotton Australia field staff). Priority should be given to implementing the EMS components having the closest relationship with components of the BMP Programme (for example, risk assessment, planning, and operational controls).

Overseeing the farm implementation and improvement of the industry EMS will be an ongoing task. The industry should however, establish goals in relation to grower adoption of the industry EMS. It is recommended that the industry aim to achieve at least 25% of growers certified under the industry EMS within three years of its full introduction (ie. by the end of 2006).

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Appendix 2

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PURPOSE

The aim of this survey was to gain an understanding of current farm management practices of cotton growers, and of the impact of the BMP programme on these practices.

This information is considered important to help determine the appropriateness of, and requirements for introducing an industry environmental management system.

GROWER SURVEYS

Appendix 3

Table of Contents

1 Introduction

62 cotton growers were surveyed between March and July 2000 on their current management practices, in order to

- gain an understanding of current farm management practices
- determine the impact of the BMP programme on these practices.

This information is considered important to help determine the appropriateness of, and requirements for, introducing an industry environmental management system.

The survey results have been grouped under four main headings

- Farm type and characteristics, and management priorities
- Human resources, management structure and responsibilities
- Monitoring and measuring
- Record keeping.

Each of these sections includes a brief introduction, a description of the findings and a discussion of the major implications and conclusions drawn from the findings. Various tables and graphs portraying the findings conclude each section. A list of the tables and graphs can be found at the start of each section.

Some of the major findings include:

- Low levels of administration staff, particularly on smaller farms
- Small numbers of hours dedicated to record keeping and administrative tasks
- Common use of informal management styles
- Significantly higher levels of training, planning, and use of written procedures in relation to issues targeted in the BMP Programme
- Significant on-farm actions undertaken as a result of the BMP programme.

The survey results have the following implications for an industry EMS:

- It will need to involve strong industry support, through the development of guidance material, and 'on the ground' advice on implementation
- It will require additional implementation staff to those used in the BMP Programme
- It should be introduced gradually
- It should be consistent with and tied to the BMP Programme.

2 Methodology

To help gain an understanding of existing management practices on cotton farms, farm owners and managers were asked to complete a questionnaire covering topics such as farm size and type, worker numbers and training, work procedures, farm activity monitoring and measuring, and record keeping. These issues were chosen as they reflect the types of practices and procedures that would be required under an EMS. To help determine the impact of the BMP programme on farm management practices the survey included questions on participants' involvement in the programme.

Survey participants were selected with a view to including the full range of farm types and grower management practices. The survey participants represented corporate and family farms, large and small enterprises, and mixed and 'pure' cotton growing operations, as well as growers who have and have not undertaken a BMP audit. Participants were chosen in consultation with Cotton Australia Grower Service Managers, and extension officers from the NSW Department of Agriculture, and the Queensland Department of Primary Industries.

Prospective participants were initially contacted by phone and invited to take part in the survey. An explanation of the purpose and content of the survey was provided to the grower at this time. If growers agreed to participate in the survey, formal arrangements were made to further discuss and complete the questionnaire.

The majority of questionnaires were completed during a 'face to face' interview with the participant. These interviews generally took two to three hours to complete. Where an interview was not possible, a copy of the questionnaire was mailed to participants. A follow up call was made to these participants one week after the questionnaire was mailed, to encourage them to complete the questionnaire.

62 questionnaires were completed.

The results were analysed in quartiles based on the area developed for irrigation on the farm in question, with the following ranges:

1. 0 to 275 hectares (16 farms)
2. 276 to 530 hectares (15 farms)
3. 531 to 1000 hectares (15 farms)
4. Over 1000 hectares (16 farms)

This was done to determine which characteristics relevant to the implementation of an EMS were most affected by the size of the farm. This information is important when determining appropriate guidance material for growers, and implementation strategies.

3 Farm Type, Characteristics and Management Priorities

List of Tables

List of Graphs (all by farm size by quartile)

3 Farm Types, Characteristics and Management Priorities

Introduction

This section looks at the general characteristics of the farms surveyed, such as size, area under irrigation, enterprises other than cotton undertaken, and ownership structure. The broad management practices currently employed, including involvement in the BMP Programme and other environmental or quality assurance programmes was also investigated.

Findings

The majority of survey participants were managing ‘family’, as opposed to ‘corporate’ farms. Although a formal definition was not used in the questionnaire, for the purpose of this report, a ‘family farm’ is taken to be one owned and operated by partners or a small number of shareholders belonging to the same immediate family. ‘Corporate farms’ include both large proprietary companies and public companies, but does not include ‘family farms’ operating under a company structure.

The survey results illustrate a large range in farm sizes for family farms (250ha to 13,000ha by farm size, and 100ha to 4,000ha by area of irrigated cotton). Also, two ‘family farms’ surveyed were dryland operations, and therefore had no land area developed for irrigation. Most corporate farms surveyed were large operations (all but one were farming at least 1,100ha of irrigated cotton).

Cotton is generally grown in rotation or parallel with other crops. Crops other than cotton commonly grown by the survey participants included wheat, sorghum, chickpeas and soybeans. A total of 26 crops other than cotton were grown by participants. These crops were grown for a range of purposes, including cash/profit, soil conditioning, nitrogen fixing, cattle feed, insect attractants and visual barriers. A significant proportion of participants (65%) ran livestock, with 55% of participants running cattle.

The survey results show that the ‘environmental’ issues of highest priority for participants were as follows:

- Pesticide management (77% of participants noted this)
- Water management (63% of participants noted this)
- Soil management (48% of participants noted this)
- Vegetation management (39% of participants noted this).

The importance of pesticide management is also reflected in the high level of involvement in the BMP Programme. For example, 77% of participants had completed the self-assessment component of at least one of the BMP modules, and 55% of participants had implemented action plans addressing pesticide management issues. 27% of participants had arranged an industry BMP audit of their operations.

Participants' level of involvement in industry environmental or quality assurance programmes other than the BMP Programme was also significant. 35% of participants were involved in industry programmes other than the BMP Programme.

Participants' level of specific knowledge of environmental legal obligations was generally low. Few participants accurately identified more than one or two legislative sources of environmental obligations. Similarly, only 47% of participants identified occupational health and safety legislation as being relevant to their operations.

Participants' level of knowledge of environmental management systems and the ISO 14001 standard was relatively low. 37% of participants were aware of ISO 14001 and few of these had more than a general understanding of some of its requirements.

Major Implications and Conclusions

1. Many participants grew crops other than cotton, and/or ran livestock. This high rate of mixed farming has the following implications for the industry programme:

   It must be flexible. The industry programme needs to cater for production systems other than cotton, and be capable of integration with environmental or quality assurance programmes developed by the grains or livestock industries. The industry programme should therefore contain: (1) generic processes for the assessment and mitigation of environmental impacts; (2) advice on 'generic' farm best practices and principles that have relevance to a wide range of farms; (3) advice on farm best practices tailored to the specific concerns and issues associated with cotton production.

   An industry EMS with a suite of best management practices addressing pesticides, water, soil, vegetation, waste and energy should provide this balance of 'process', and general and specific best management practices. The procedures required under a certified EMS include those relating to assessment, planning, monitoring, audit and review, that can be applied to any enterprise. These generic procedures should be compatible with the performance goals and management practices required under other agricultural programmes.

Similarly, many industry-recommended best management practices will have application in production systems other than cotton. For example, best management practices contained in the 2nd edition of the BMP Manual address a number of generic issues associated with pesticide storage and handling that are relevant to any farm where pesticides are used. However, the BMP Manual is unlikely to cover every farming situation. Where specific advice is not provided, growers can be directed to other sources of information, or to general principles that they can apply to their operations. Of course, cotton-specific issues and practices will continue to be provided to address the significant aspects of cotton production.

2. The environmental issues of highest priority for participants reflects those planned to be addressed through an expanded industry environmental programme. Although there was considerable variability in the specific issues identified by participants, the development of best management practices for pesticides, water, soil and vegetation will help address identified grower concerns. This supports the proposed industry approach, and suggests that industry consultation on the EMS should include an opportunity for growers to identify in greater detail the natural resource issues relevant to their operations.
3. The level of grower involvement in the BMP Programme was relatively high, and suggests that the implementation and audit components of the programme are both effective and well run. Expanding the industry's environmental programme will need to build on the success of the BMP programme, and should continue to focus on practical guidance delivered 'on the ground'.

4. The low level of grower awareness of both their legal obligations and environmental management systems indicates that greater focus should be given to both of these aspects of the programme. Helping growers understand and comply with their legal obligations is of obvious importance, and ensuring that growers are familiar with the concepts surrounding environmental management systems will result in a meaningful consultation process. The 2nd edition of the BMP Manual attempts to address these issues in part, by emphasising growers' legal obligations regarding pesticide use, and providing an introduction to environmental management systems. This effort needs to be backed up by grower education and support at both the implementation and auditing stages.

Graph 1 Farm type

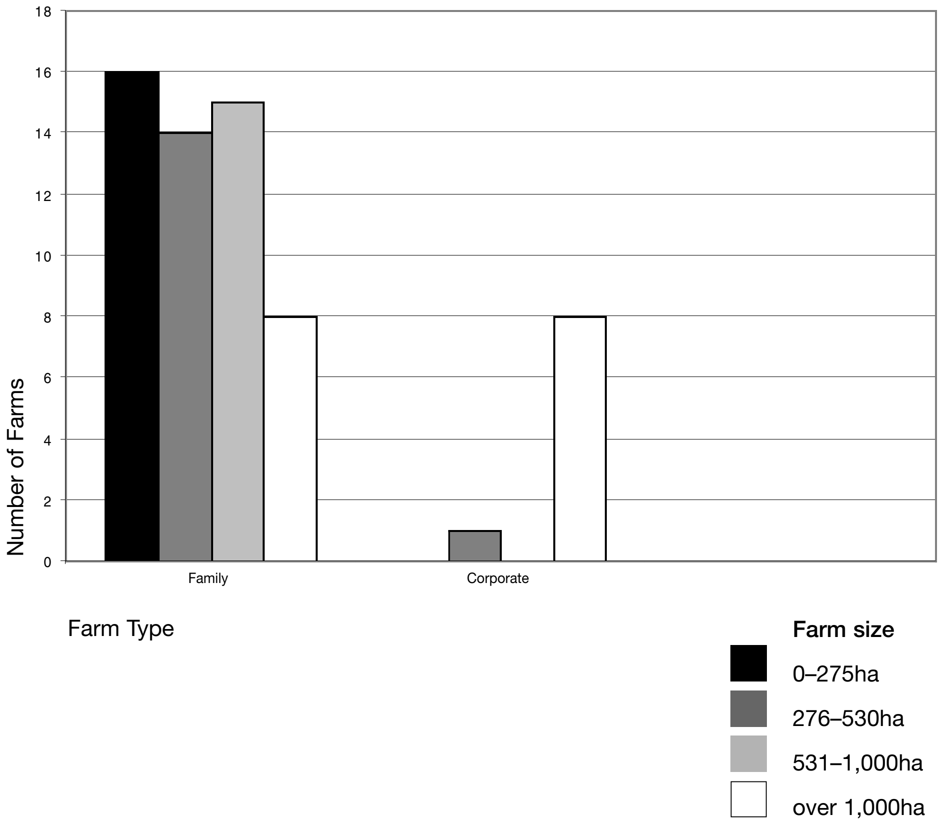


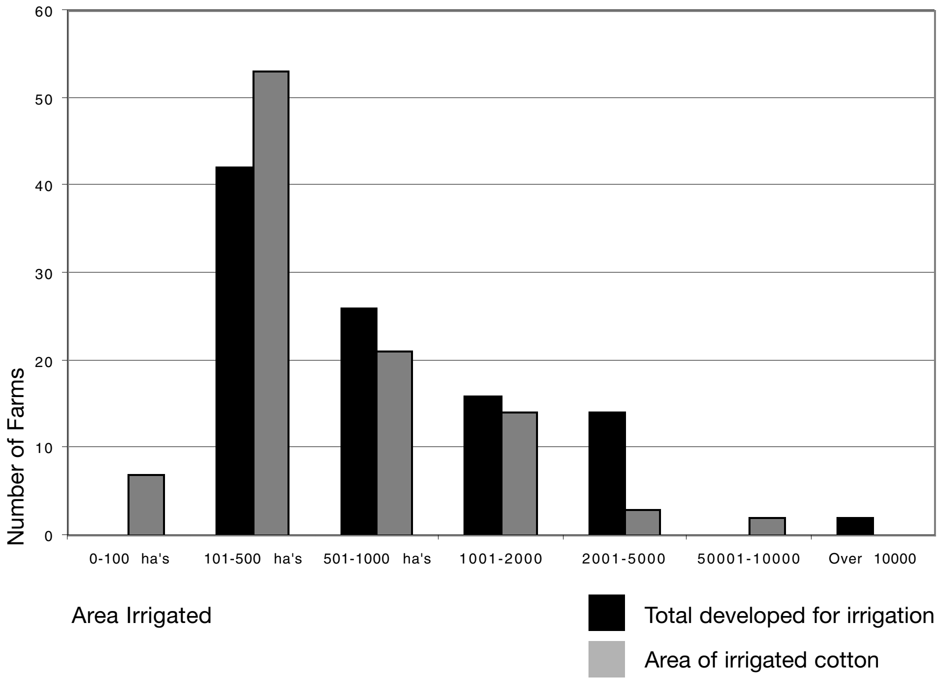
Table 1 Family vs Corporate farms

Farm Type	% of farms
Family Farm	84
Corporate Farm	16

Table 2 Farm localities

Area	Number of Farms Surveyed
Central Queensland	7
Darling Downs	8
Macintyre Valley	5
Gwydir Valley	8
Lower Namoi Valley	7
Walgett	5
Bourke	1
Upper Namoi Valley	12
Macquarie Valley	8
Hillston/Tandou	1

Graph 2 Total area developed for irrigation and area of irrigated cotton[1]



[1]Note that the two columns for "Total area developed for irrigation" and "Area of irrigated cotton" do not compare the same farms, but merely indicate the frequency of farms with the ranges noted.

Table 3 Area developed for irrigation

Area in hectares	0 –100	101 –500	501 –1,000	1,001 –2,000	2,001 –5,000	5,001 –10,000	10,001 or more
% of farms	0	42	26	16	14	0	2

Table 4 Average area of cotton grown for the last three years

Area in hectares	0 –100	101 –500	501 –1,000	1,001 –2,000	2,001 –5,000	5,001 –10,000	10,001 or more
% of farms	7	53	21	14	3	2	0

Graph 3 Crops other than cotton grown on farms

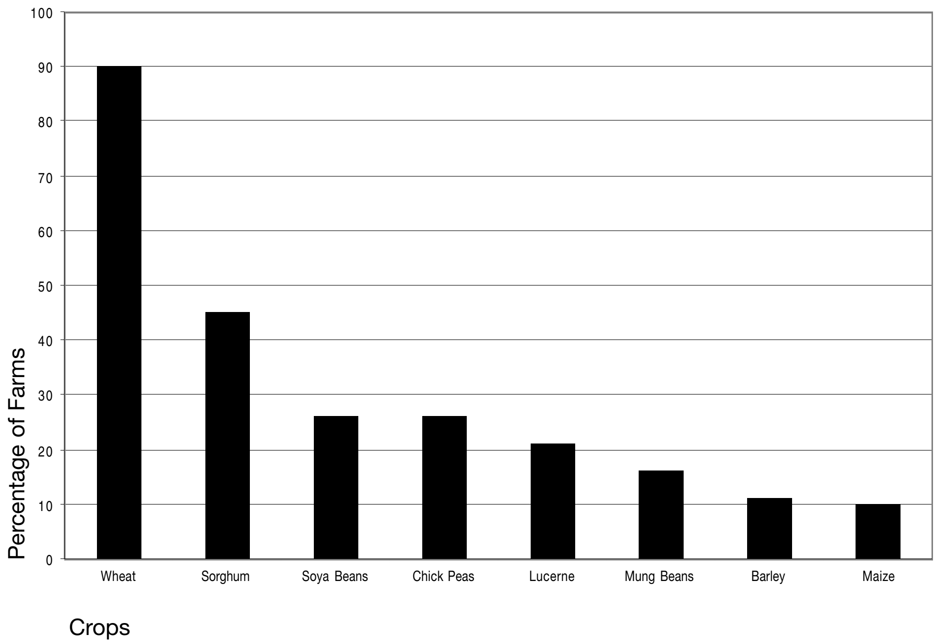


Table 5 Crops other than cotton grown on farms

Crop	% of farms
Wheat	90
Sorghum	45
Soya Beans	26
Chick peas	26
Lucerne	21
Mung Beans	16
Barley	11
Maize	10

Table 6 Farms with livestock

Livestock kept	% of farms
Cattle	55
Sheep	11
None	39

Table 7 Priority issues for growers

Priority issue	% of participants identifying
Pesticide management	77
Water management	63
Soil management	48
Vegetation management	39

Table 8 Possession of a BMP manual

% participants who have a BMP manual
100

Table 9 'Environmental' audits completed

Type of audit	% of farms
Cotton Industry BMP audit	27
Endosulfan label audit	65

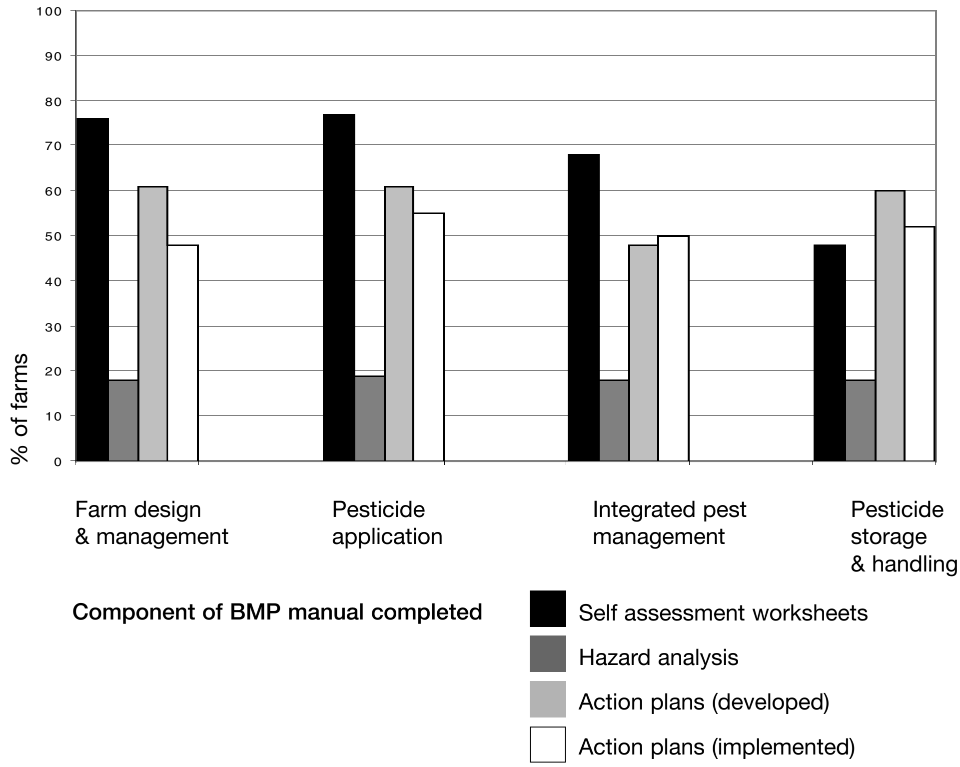
Table 10 Farms involved in environmental/quality assurance programmes, other than the BMP Programme

% of farms that are involved in 'other' audits	% of farms not involved in 'other' audits
35	65

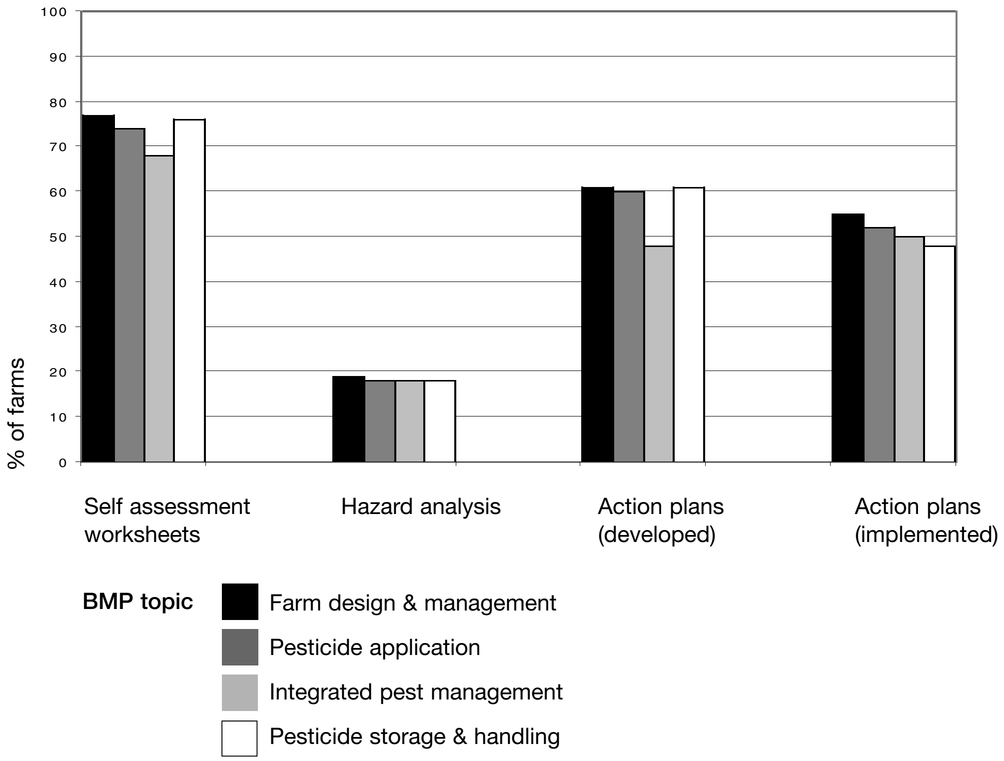
Table 11 'Other' programmes growers are involved in

Type/name of programme	% of farms	Type/name of programme	% of farms
Cattlecare	24	Quality Assurance	2
OHS	5	Feedlot accreditation	3
EU cattle	5	NSCA	2
ISO 9000	2	Ausmeat	2

Graph 4.1 Components of BMP manual completed – by module



Graph 4.2 Components of BMP manual completed – by process



4 Human Resources, Management Structure and Responsibilities

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List of Graphs (all by farm size by quartile)

4 Human Resources, Management Structure and Responsibilities

Introduction

This section describes the numbers of staff, and the type of employment, (ie. full-time, part-time or casual) on the surveyed farms, in the areas of production, administration and maintenance. Staff management practices, training and the use of contractors were also surveyed.

Findings

The survey results reveal that as a general rule, human resource requirements increase with the size of the farming operation. For example, 81% of participants in the top quartile (by area developed for irrigation) had six or more full-time production staff, whereas 69% of participants in the lowest quartile had only one or two full time production staff. 61% of participants in the top two quartiles (by area developed for irrigation) hired two or more casual production staff. The use of part time production staff was however, generally low across all farms: 56% of participants employed part time production staff and 32% of participants hired just one person for production on a part time basis.

This relationship between staffing levels and farm size was also found in relation to administrative tasks. 75% of participants in the top quartile had full-time administration staff, compared with 29% of participants in the bottom two quartiles. Across all participants, only 47% had full-time administration staff, 45% had part-time administration staff, and 18% had casual administration staff. These figures suggest that, particularly on small family farms, growers and members of their family are carrying out many of the administrative tasks.

The use of maintenance staff was low across all farms. 73% of participants did not employ full time maintenance staff. 93 and 95% of participants did not employ part time or casual maintenance staff respectively. Of the 27% of participants that did employ full time maintenance staff, 76% of these were in the top half of farms (by area developed for irrigation).

The survey results illustrate the importance of contractor and consultant services in the cotton industry. 100% of participants used contract services, and 87% used the services of a cotton consultant (agronomist). Services most commonly provided by contractors included aerial and ground applications of pesticide, cotton picking and module transport.

The survey results indicate that most participants use informal management styles to run their operations. For example, only 45% of participants had developed any written procedures for their operations. The positive impact of the BMP Programme in this area is nonetheless apparent; of the written procedures that had been put in place, spray and drift management procedures, and stormwater management procedures were the most common. These issues are an important focus of the BMP Programme. The use of informal management styles is also reflected in the finding that only 27% of participants held formal meetings with staff, and 89% held informal meetings.

Also, of the 27% of participants who reported holding formal meetings, 67% were in the top quartile of participants suggesting that the larger the farm workforce, the more appropriate are formal management styles. Notes or minutes of either informal or formal meetings were rarely taken. Issues discussed at farm meetings generally centred on forward planning and day to day farming activities. However, 63% of participants indicated that environmental issues were discussed at farm meetings.

Despite the common use of informal management styles, the levels of management and staff training in relation to chemical handling, emergencies and farm management were quite high. For example, 100% of participants indicated that a member of farm management or staff had been trained in chemical handling. Corresponding figures for emergencies and farm management were 69% and 66% respectively.

Major Implications and Conclusions

1. There were significant differences between farms in the levels of human resources used for both farming and administrative tasks. Not surprisingly, large farms generally had more employees in both these areas than small farms. On small farms in particular, it was not uncommon for the farm owner/manager to be involved in many of the operational and administrative tasks. Given that implementing and maintaining an EMS requires a significant commitment of human and financial resources and time, the relative cost of putting an EMS in place is likely to be higher for small farms, than for large farms. The cost of implementing an EMS may prove to be a large disincentive for adoption for many growers on small to medium-sized farms. The industry can address this issue in a number of ways, including the following:

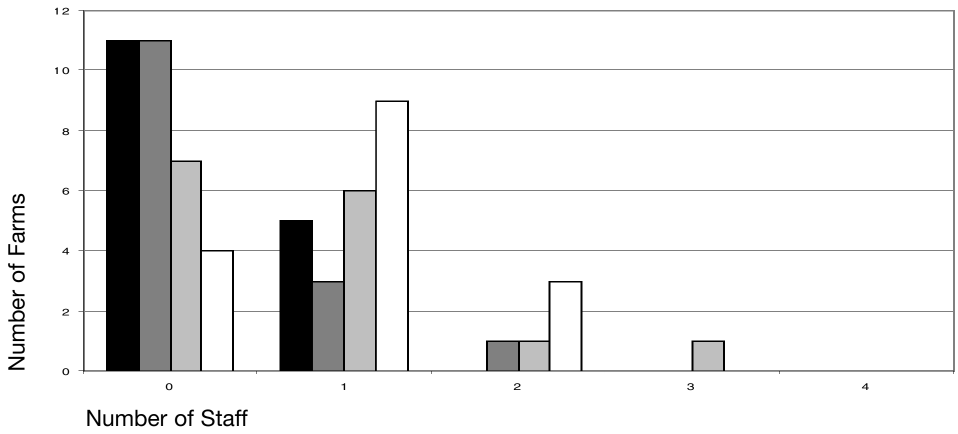
    - Developing and promoting financial benefits for implementing an EMS and best management practices; for example, Cotton Australia is currently investigating ‘industry partnerships’, to involve industry service providers in the BMP Programme, and to provide tangible financial benefits to growers involved in the programme; this and similar strategies highlighting the benefits of best management practices could provide important incentives for growers to become involved in the programme

- Introducing change gradually; a ‘step-by-step’ approach to the introduction of best management practices and the components of an EMS will help minimise the impact that changes to farming practices and management styles could bring; close industry guidance, through workshops and farm visits will also help growers adapt to new practices and procedures

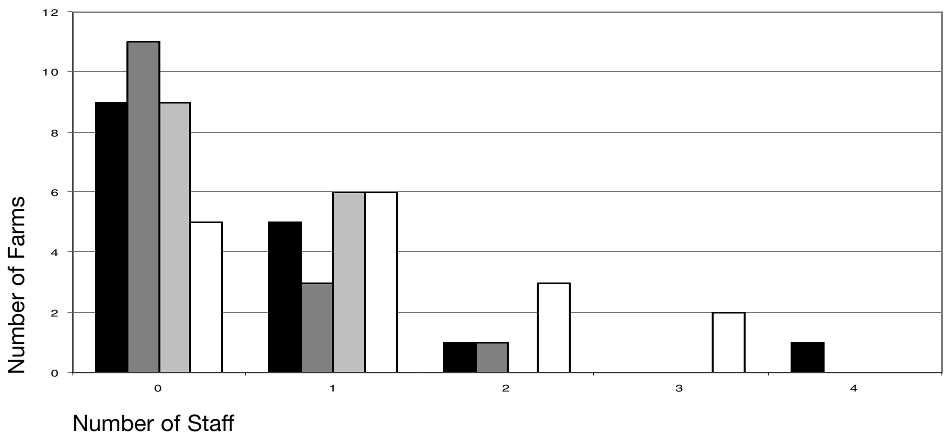
- Ensuring that the overall structure of the industry programme is designed so as to minimise costs to growers wherever possible

- Keeping recommended practices and procedures simple and focused on farming;close industry guidance for growers will need to be maintained during the introduction of best management practices and the components of an EMS; guidance material that is clear and simple, with a clear purpose will be minimum requirements for grower adoption; similarly, practices and procedures should be relevant to current farming operations, and should not compromise profitability.

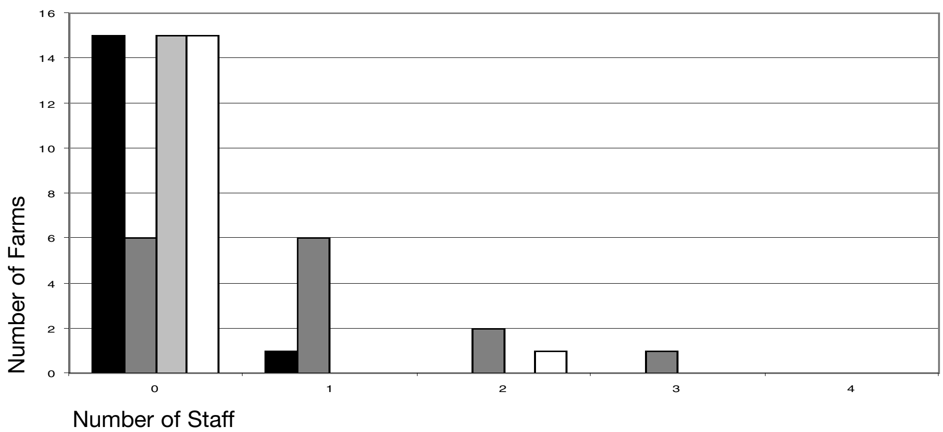
Graph 5 Full time administration staff



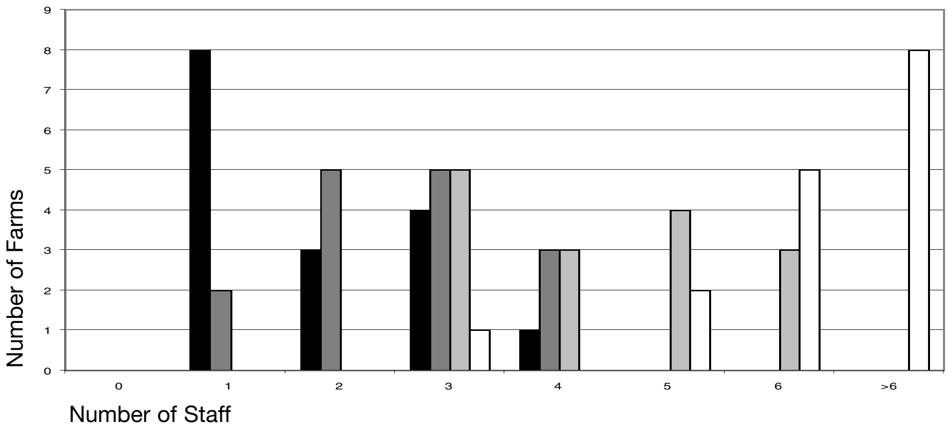
Graph 6 Part time administration staff



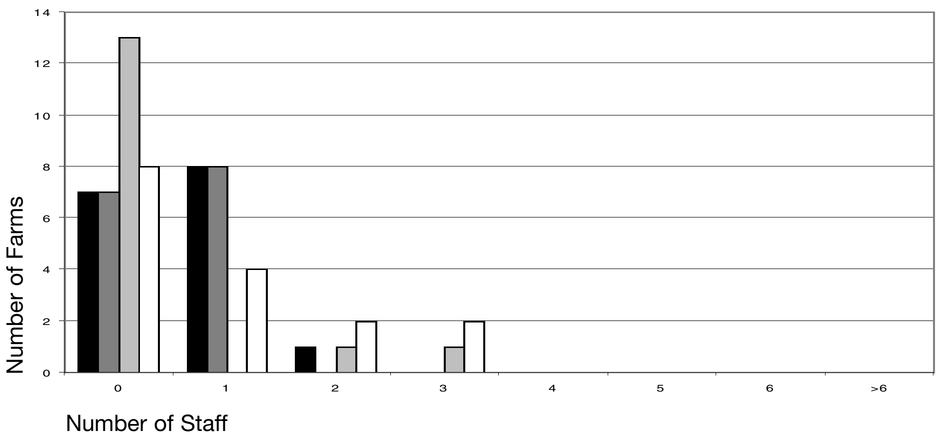
Graph 7 Casual administration staff



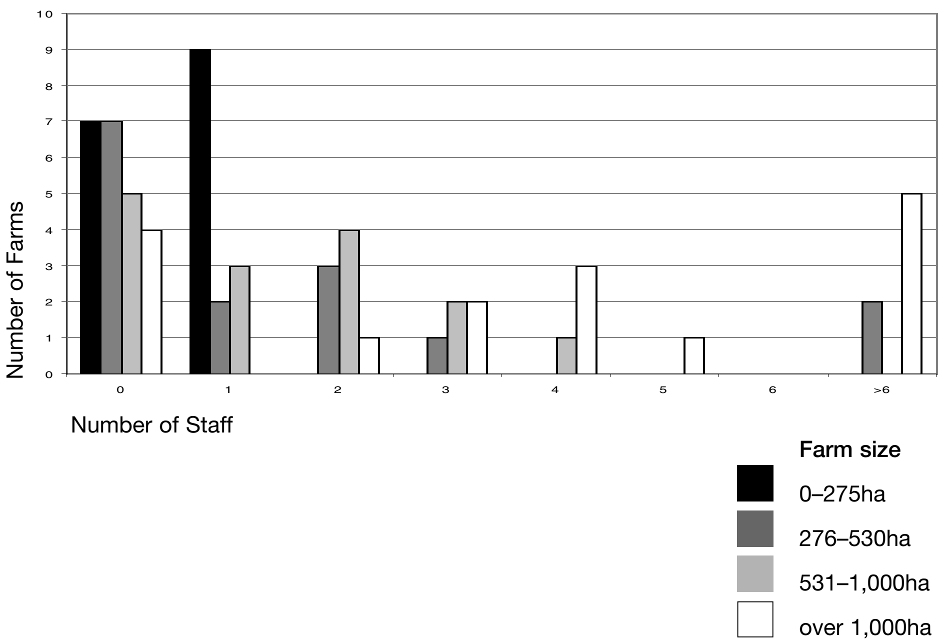
Graph 8 Full time production staff



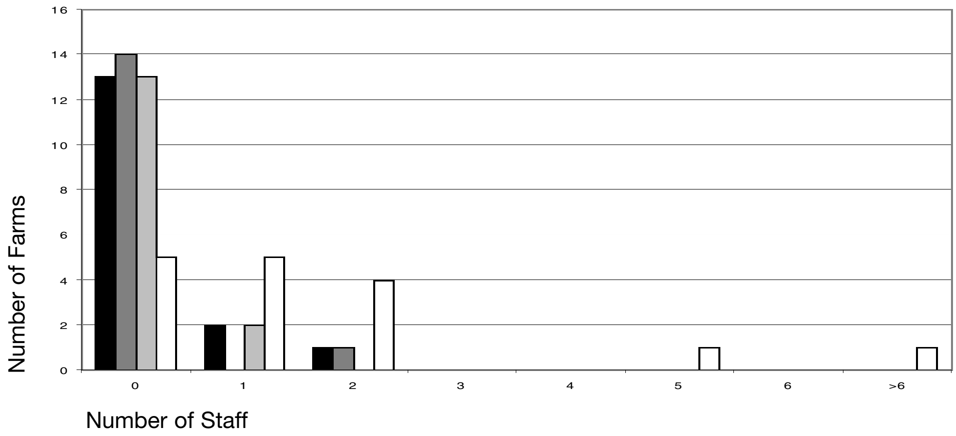
Graph 9 Part time production staff



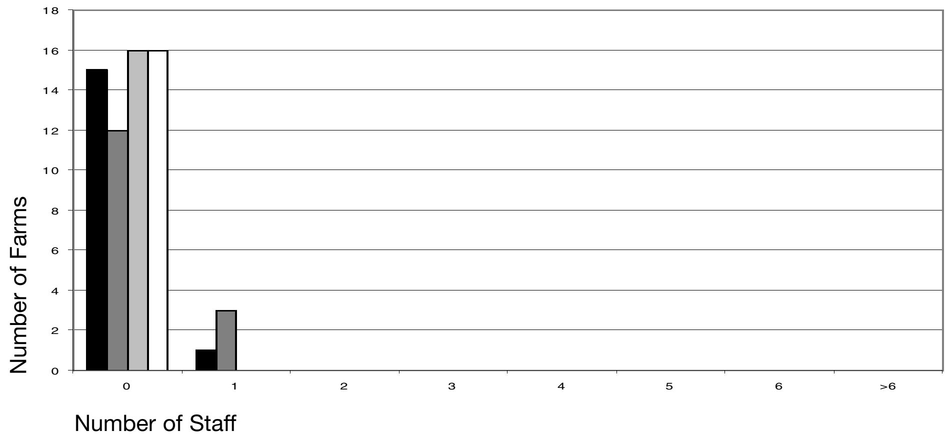
Graph 10 Casual production staff



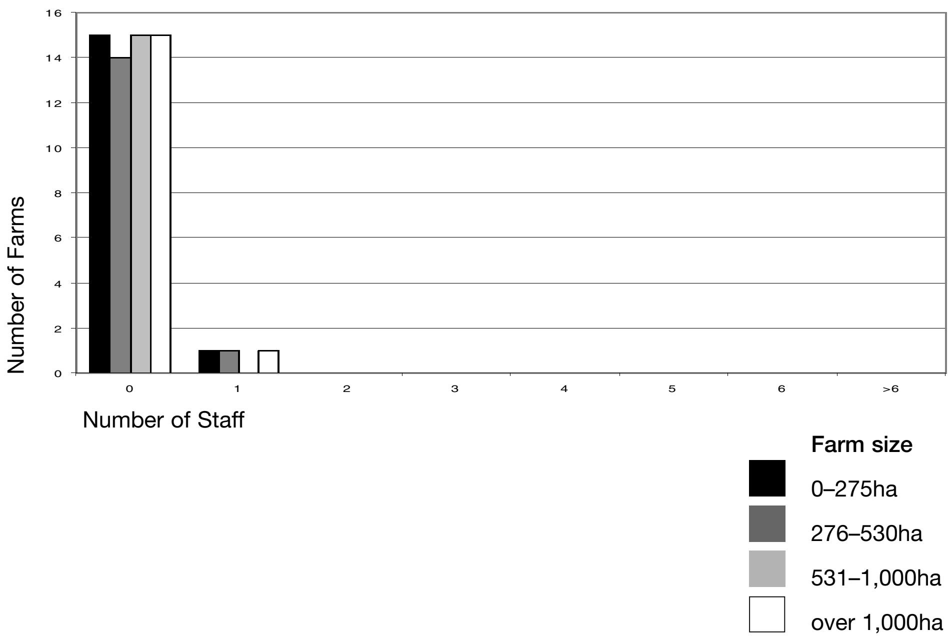
Graph 11 Full time maintenance staff



Graph 12 Part time maintenance staff



Graph 13 Casual maintenance staff



2. The vast majority of growers used contract and/or consultant services. This finding has significant implications for an industry EMS. For example, ISO 14001 explicitly requires relevant practices and procedures to be communicated to contractors whose work relates to the enterprise's significant environmental aspects (cl 4.4.6). This requirement is addressed in the BMP Programme in relation to pesticide applications, where growers establish communication procedures with contractors and consultants to ensure each party is aware of their responsibilities, and the grower's (and their neighbours') concerns. This theme will need to be expanded to cover all significant farming operations undertaken by contractors and consultants, and possibly made more explicit during the development and implementation of the industry EMS.

Table 12 Use of agronomic services

Agronomist used	% of farms
Employed on farm	29
Hired 'External' consultant	87

Table 13 Use of contract services

% of farms using contractor services
100

Table 14 Types of contract services used on farms

Services provided by external contractors	% of farms	Services provided by external contractors	% of farms
Aerial application of insecticides	94	Mechanics	44
Ground application of insecticides	61	Slashing/ mulching	42
Aerial application of herbicides	39	Root cutting	37
Ground application of herbicides	37	Pre-planting preparation	16
Module transport	85	Welding	11
Chipping	76	Planting (cotton)	8
Harvesting (cotton)	68	Planting (other crops)	8
Harvesting (other crops)	44	Cultivation	6

3. A majority of growers used informal management styles and practices. However, introducing an EMS requires a number of specific management practices and procedures to be developed (written down), implemented and periodically reviewed. Therefore, in many cases, growers will be required to ‘formalise’ their management styles. Similar to point 1 above, this will place significant demands on growers’ time, and farms’ human resources. If changes to grower management practices and styles are introduced too rapidly, or too inflexibly, the rate of grower adoption of the programme is likely to be low. To address this potential issue, recommended practices and procedures will need to be flexible (where possible), simple, farm-focused, and introduced gradually with close industry assistance. Also, best management practices and EMS components should be introduced in order of industry priorities and grower management strengths. For example, many growers have developed farm plans, often through the BMP Programme. EMS components relating to plan development (eg. assessing environmental aspects, developing objectives and targets, and assigning responsibilities and time-frames) should therefore be introduced early in the programme. This will help remove perceptions that the programme has altered significantly, and will effectively build on existing arrangements. Similarly, many growers have undertaken or arranged training for their workers. EMS requirements relating to training can therefore be easily built into current farm practices, and should also be introduced relatively early in the EMS programme.

Table 15 Written procedures

% of farms with written procedures in place	% of farms with no written procedures in place
45	55

Table 16 Types of written procedures used on farms

Farming operation covered by written procedure	% of farms	Farming operation covered by written procedure	% of farms
Pesticide application	35	Tree planting (Landcare)	3
Stormwater emergencies	27	OHS	3
Chemical handling and spills	16	NH_3 application	2
Employee induction	11	Cattle management	2
Irrigation	8	Disease management	2
Tractor operation	8	Weed management	2
Emergencies/first aid	8	Rotation strategy	2
Cotton harvesting	6	Land development	2
Contract services	5	Workshop use	2

Table 17 Types of meetings held

Types of meetings held	% of farms
Informal (no set agenda, time, or place)	89
Formal (set agenda, time, or place)	27
Meetings are not held	3

Table 18 Meeting participants

Person with whom meetings are held	% of farms
Farm workers	85
Agronomist	84
Owner	63
Manager	50
Contractors	45
Administrative staff	23

Table 19 Meeting topics

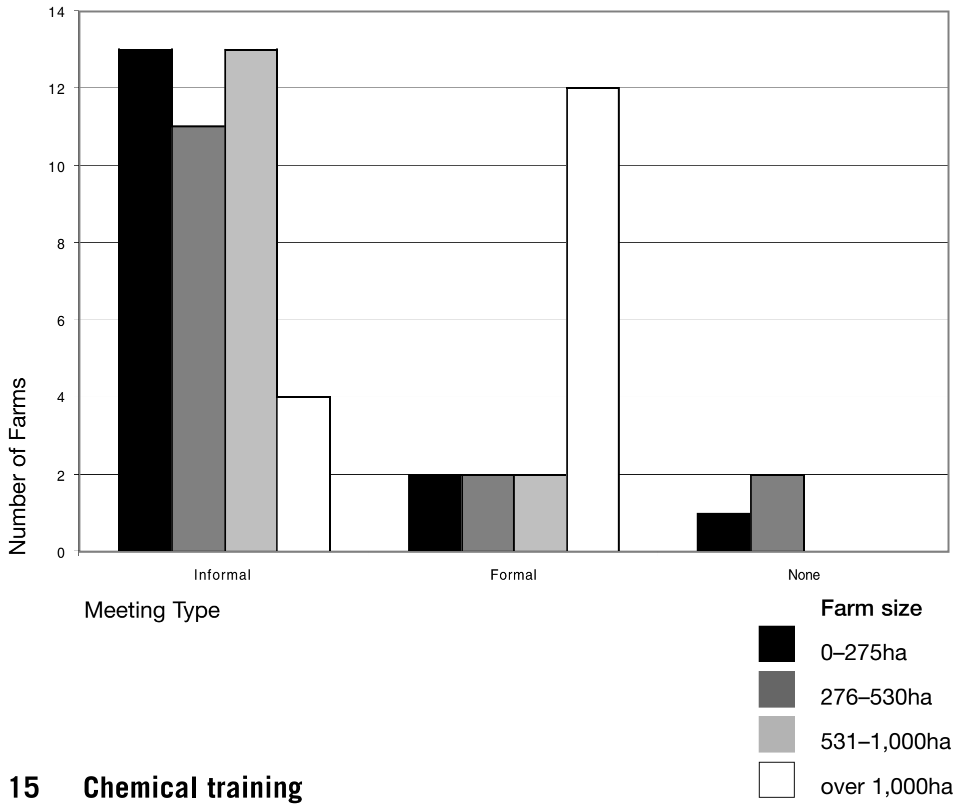
Topics discussed at meetings	% of farms
Forward planning	90
– Weekly	63
– Monthly	51
– Six monthly	37
Irrigation	87
Agronomy	87
Environmental issues	63
Human resource management	60
OHS	55
Farm budget	39

Table 20 Staff training

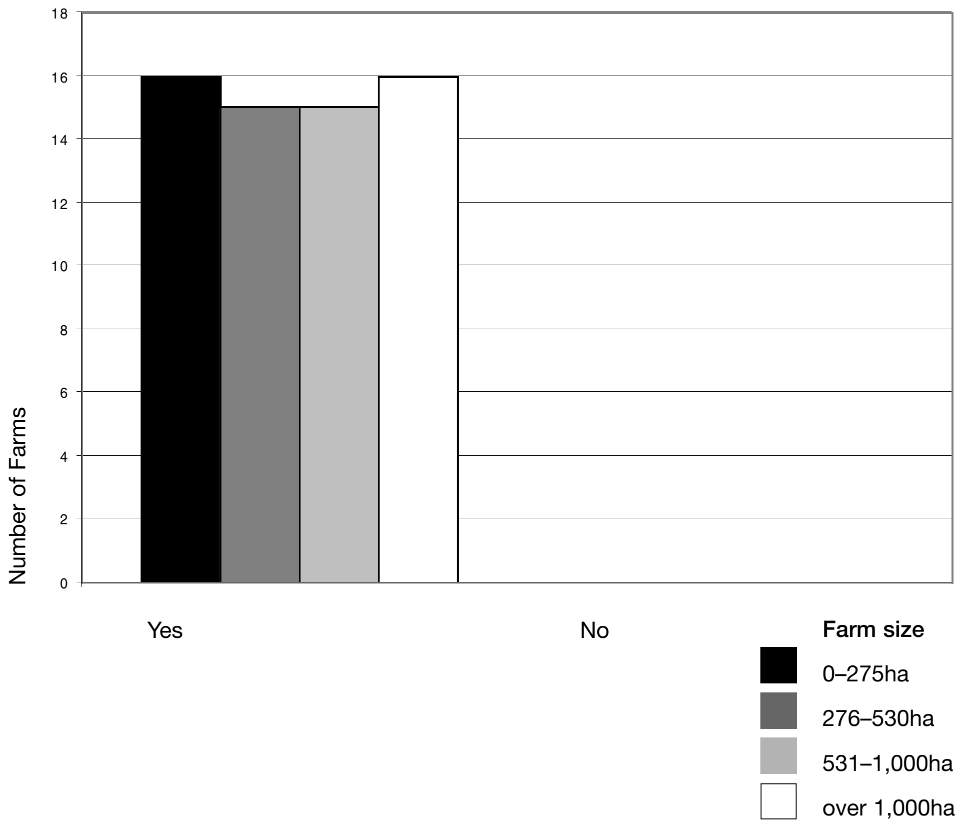
	Staff member/% of farms[2]					
Training completed	**Owner**	**Manager**	**Foreman**	**Admin**	**On-farm**	**Other**
Chemical management	77	53	48	6	11	48
Farm management	45	32	10	10	3	2
Emergency procedures	47	27	19	3	10	21
BMP Programme	63	40	23	11	8	15
Computer skills	53	21	11	39	6	3
OHS	21	18	10	3	5	15
Rural Training Council of Aust.	8	5	2	0	2	3

[2]The percentage refers to the number of farms with an indicated staff member trained in the areas listed; thus 6% of farms have at least one administrative employee with chemical management training.

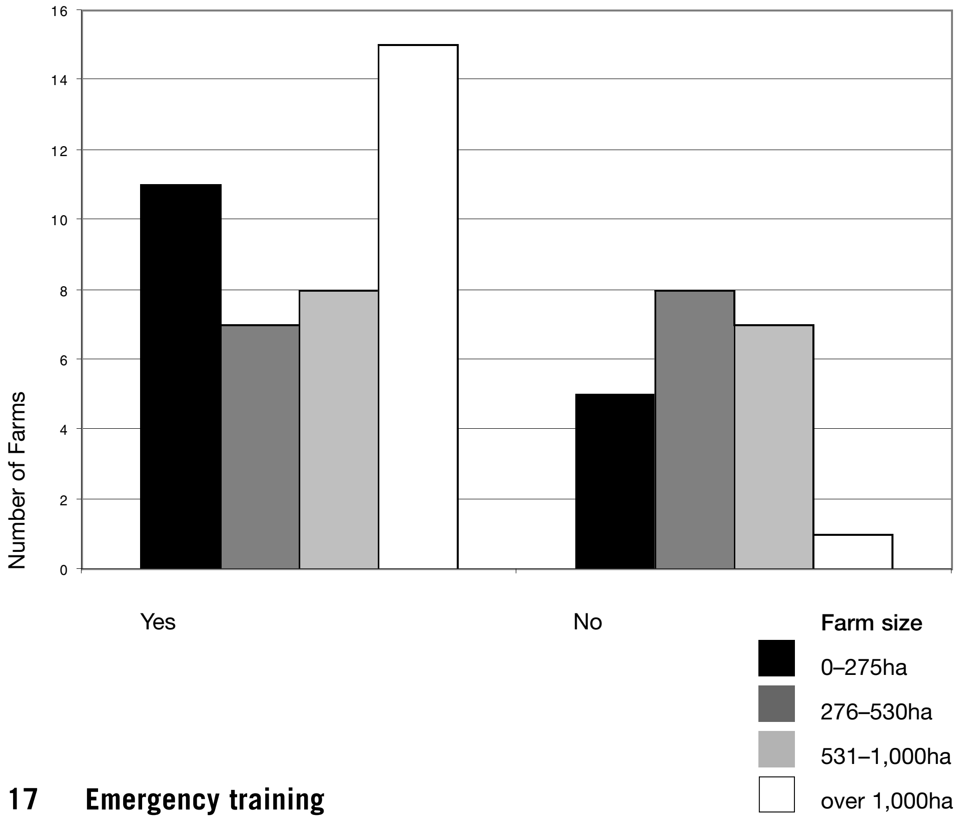
Graph 14 Types of meetings held



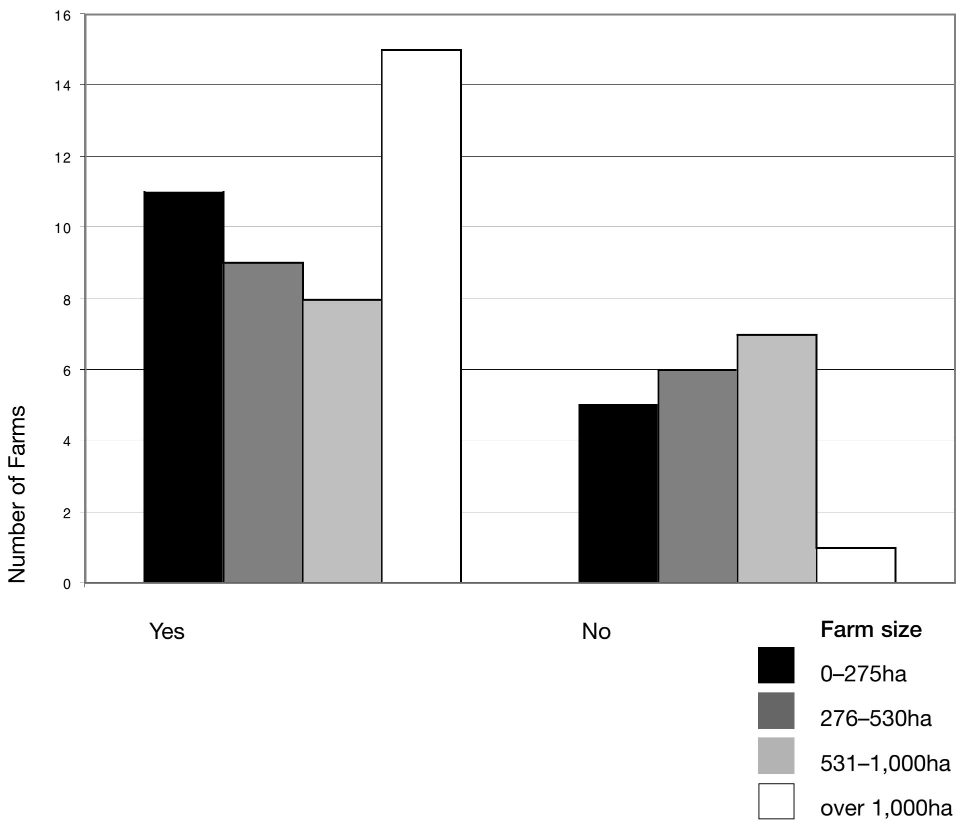
Graph 15 Chemical training



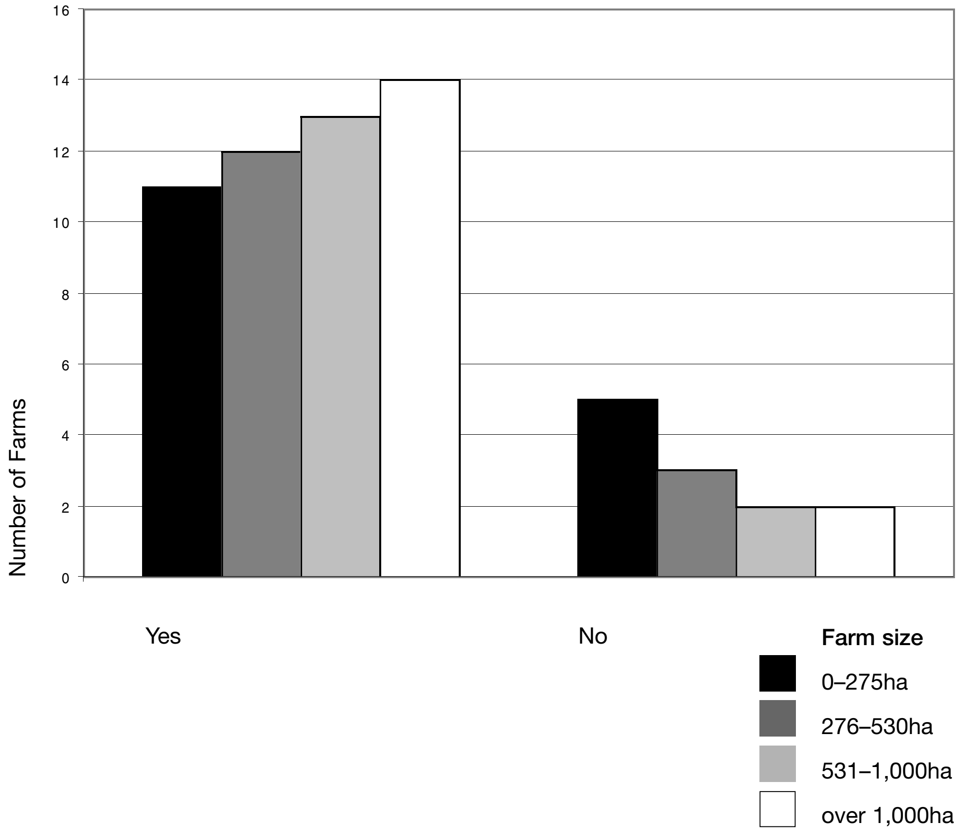
Graph 16 Farm management training



Graph 17 Emergency training



Graph 18 Environmental (BMP) training



5 Monitoring and Measuring

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List of Graphs (all by farm size by quartile)

5 Monitoring and Measuring

Introduction

The farms were surveyed on the types of practices and environmental or agronomic 'indicators' that were subject to monitoring and measuring. The frequency of monitoring was also assessed.

Findings

All participants reported undertaking some form of farm monitoring and measuring. Most monitoring and measuring was carried out in relation to agronomic issues, as opposed to those concerned with 'environmental' conditions. For example, 100% of participants undertook monitoring and measuring relating to crop checking, soil sampling and weather conditions. Similarly, farm inputs such as chemicals and fuel were monitored (in stocktakes) by most participants (79% and 73% of participants respectively).

However, only 2% and 5% respectively of participants reported monitoring and measuring pesticide and nutrient levels in river water, and only 3% of participants monitored and measured ground water for pesticides. 37% of participants reported monitoring and measuring ground water levels. 35% of participants monitored soil salinity levels.

The frequency with which monitoring and measuring was undertaken related closely to the aspect of the farm operations that was being monitored and measured. For example, the frequency with which crop checking was undertaken was high (100% of participants undertaking crop checking either daily or weekly throughout the life of the crop). Regular and frequent crop checking is particularly important in cotton production to ensure effective control of pests and disease. 71% of participants monitored and measured soil conditions annually. Most participants undertook a chemical stocktake at least six monthly, and a fuel stocktake at least monthly.

Major Implications and Conclusions

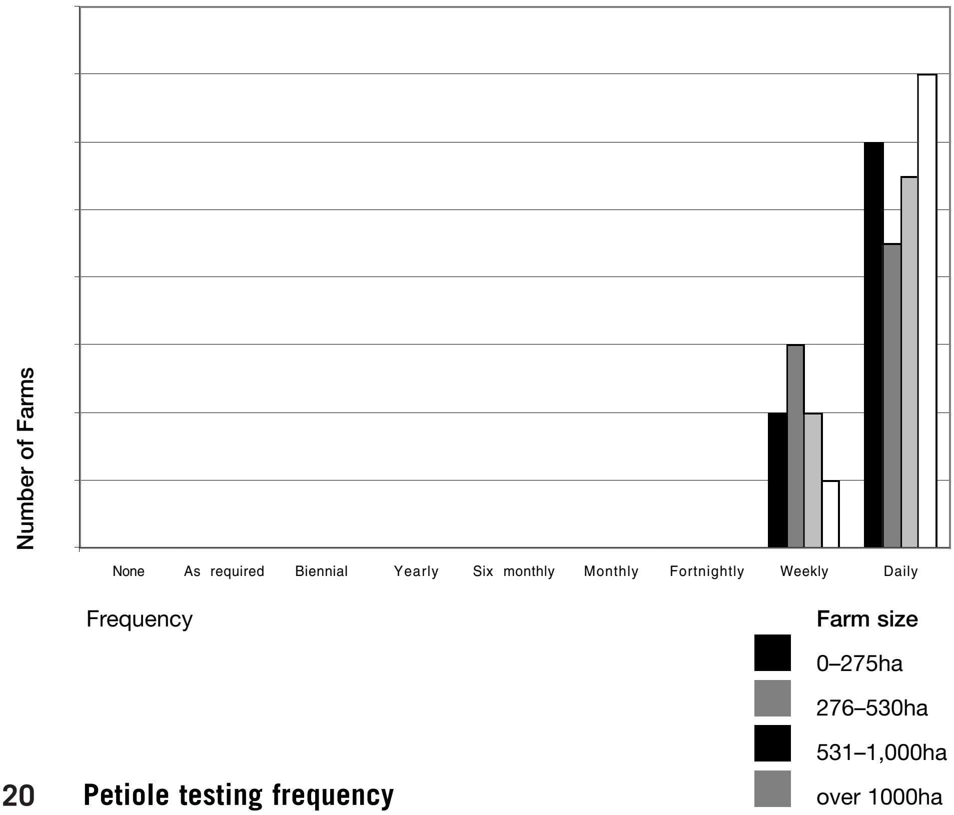
1. Growers generally monitored and measured practices and/or parameters that were directly related to their farming inputs (such as, pesticides, water and nutrients), or profitability (for example, crop checking for insect levels is closely related to yield). In an effort to focus on grower management strengths, these practices should be targeted for monitoring and measuring under an industry EMS. This will help growers keep track of, and improve farm efficiencies relating to the use of water, pesticides and nutrients. The implementation of best management practices, operational controls, and progress towards objectives and targets will also be included in EMS monitoring and measuring procedures.

2. The low rates of monitoring and measuring in relation to farm outputs and environmental conditions (for example, pesticide and nutrient levels in river and ground water) suggest that these practices are beyond the expertise or means of many growers, or are considered by growers to be low priority. Where appropriate, simple and cost effective practices for monitoring and measuring important farm outputs may be introduced on an industry scale. However, as noted earlier in this report, monitoring and measuring environmental conditions is generally best done by governments, researchers and community groups.

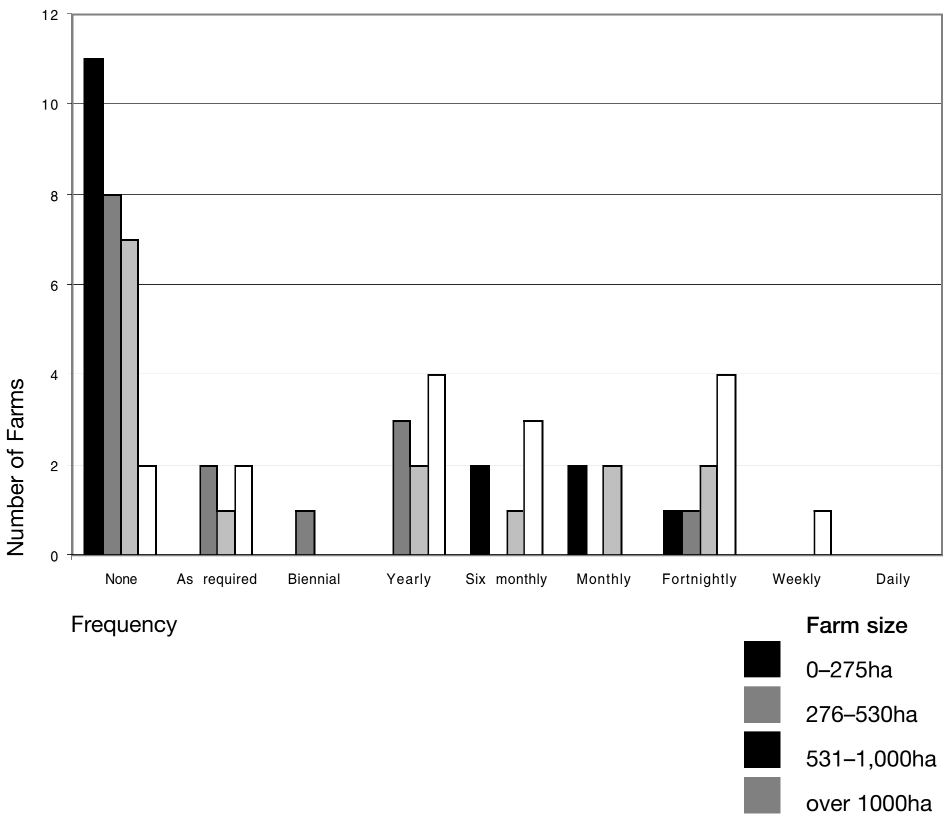
Table 21 Farm monitoring

Practice/issue	% of farms monitoring	Practice/issue	% of farms monitoring
Crop checking	100	Petiole testing	61
Soil sampling	100	Groundwater levels	37
Weather	100	Soil salinity	35
Rainfall	98	River water – nutrients	8
Chemical stocktake	79	River water – pesticides	2
Fuel stocktake	73	Groundwater – nutrients	21
Soil moisture	74	Groundwater – pesticides	3

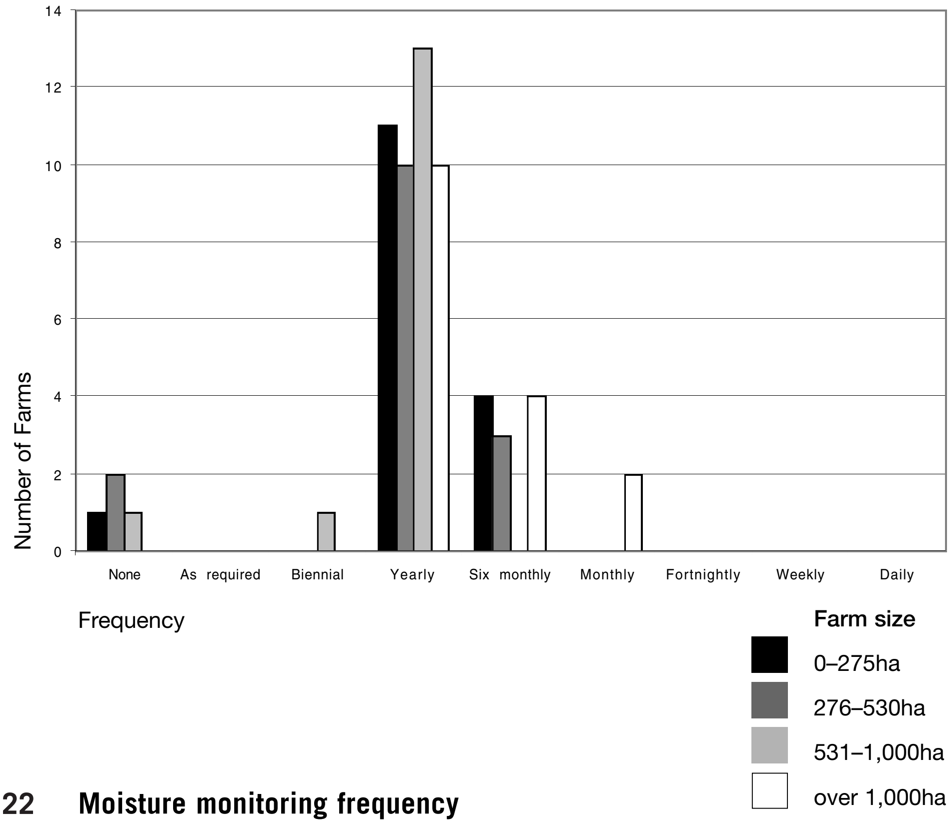
Graph 19   Crop checking frequency



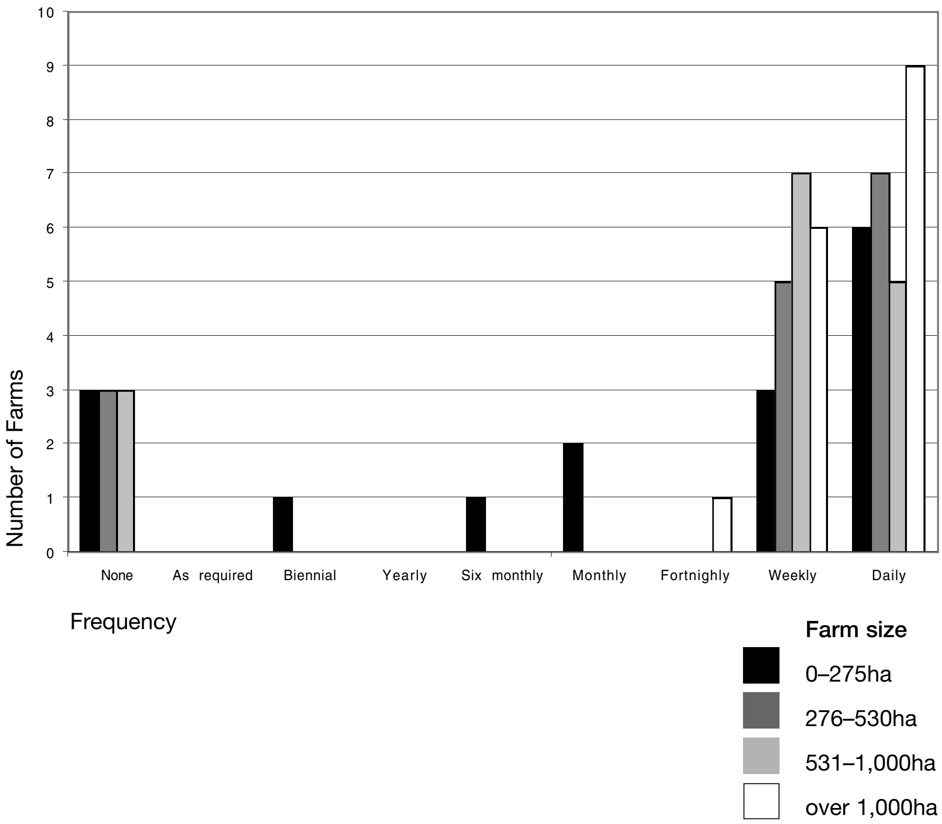
Graph 20   Petiole testing frequency



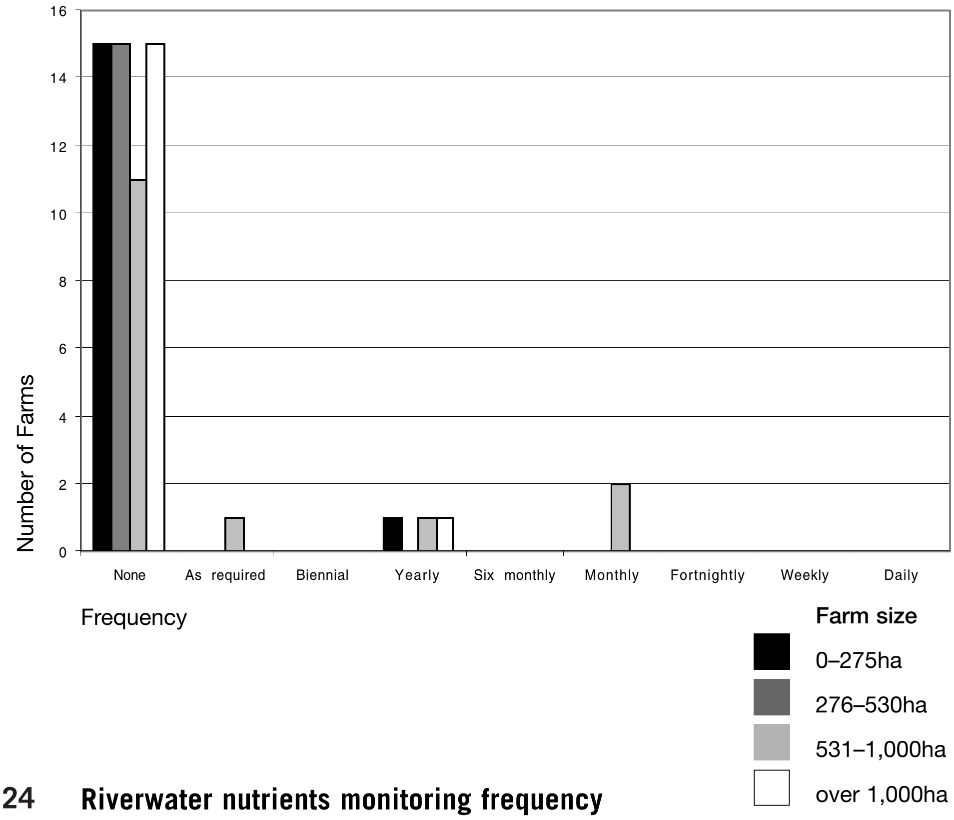
Graph 21 Soil monitoring frequency



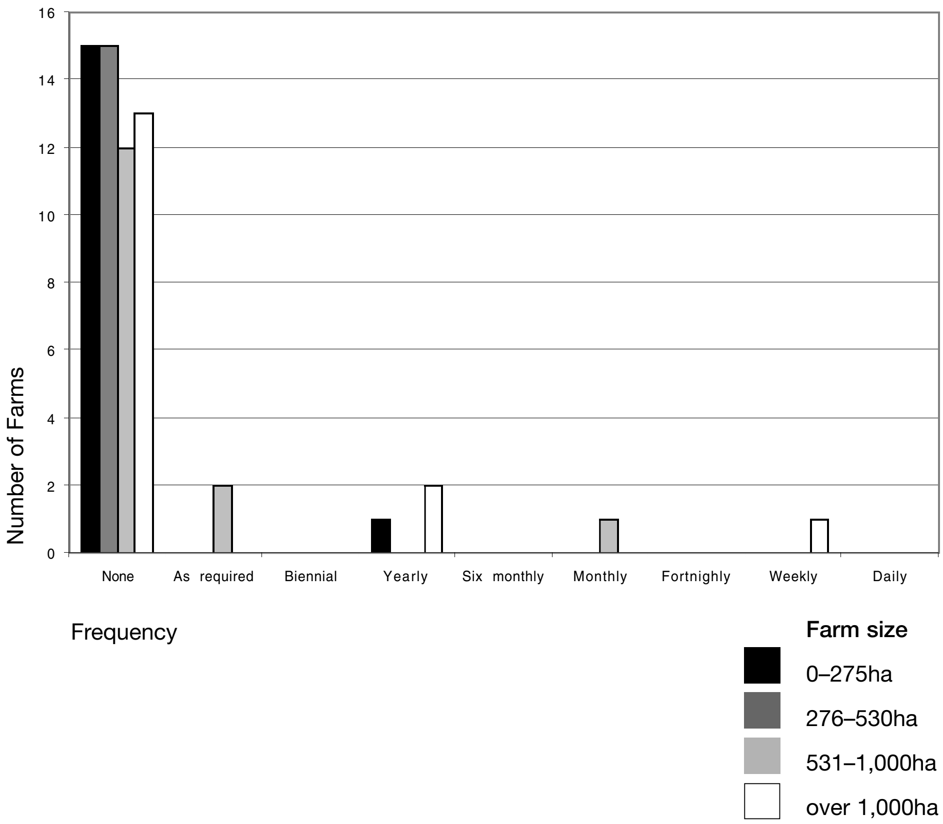
Graph 22 Moisture monitoring frequency



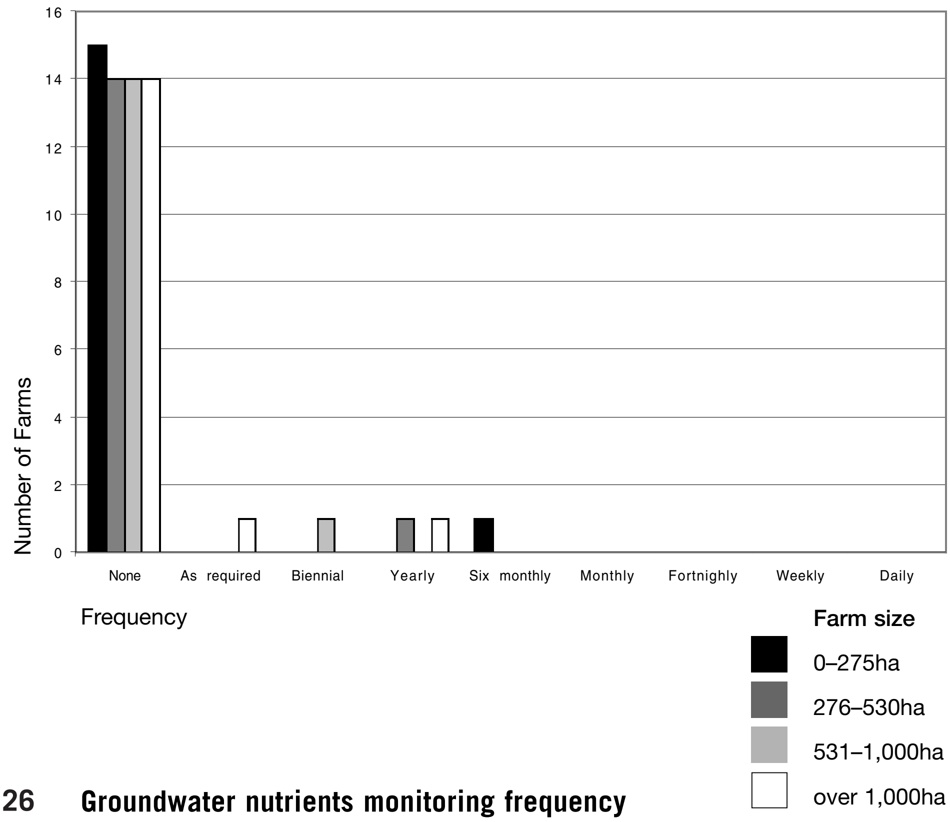
Graph 23 Riverwater pesticides monitoring frequency



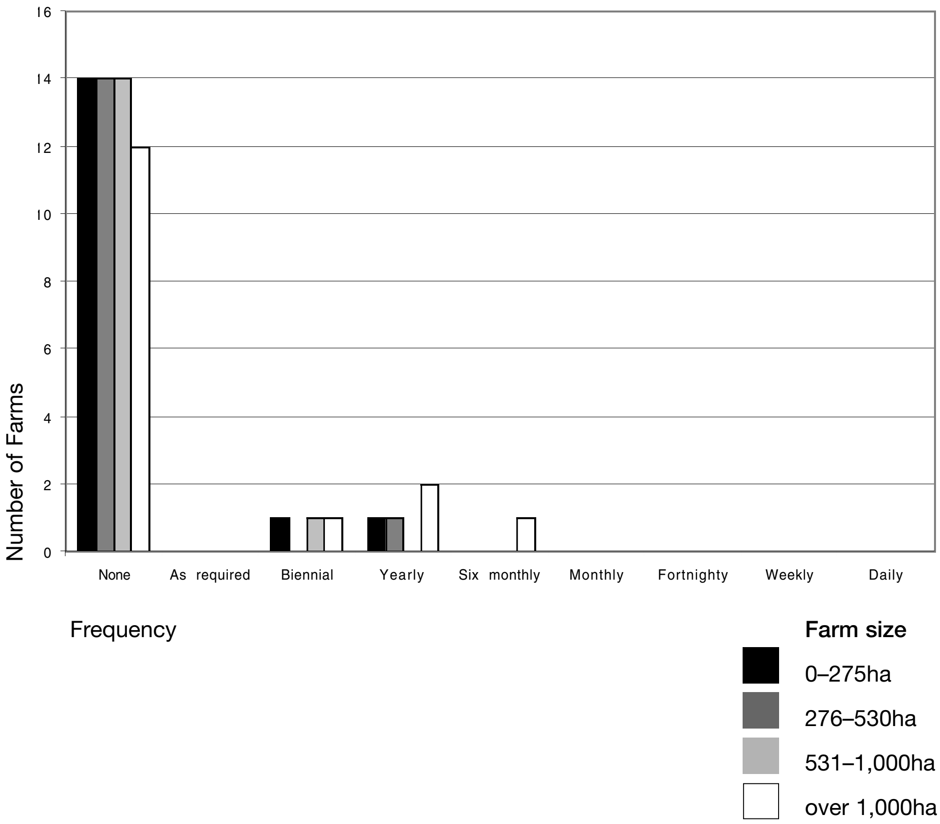
Graph 24 Riverwater nutrients monitoring frequency



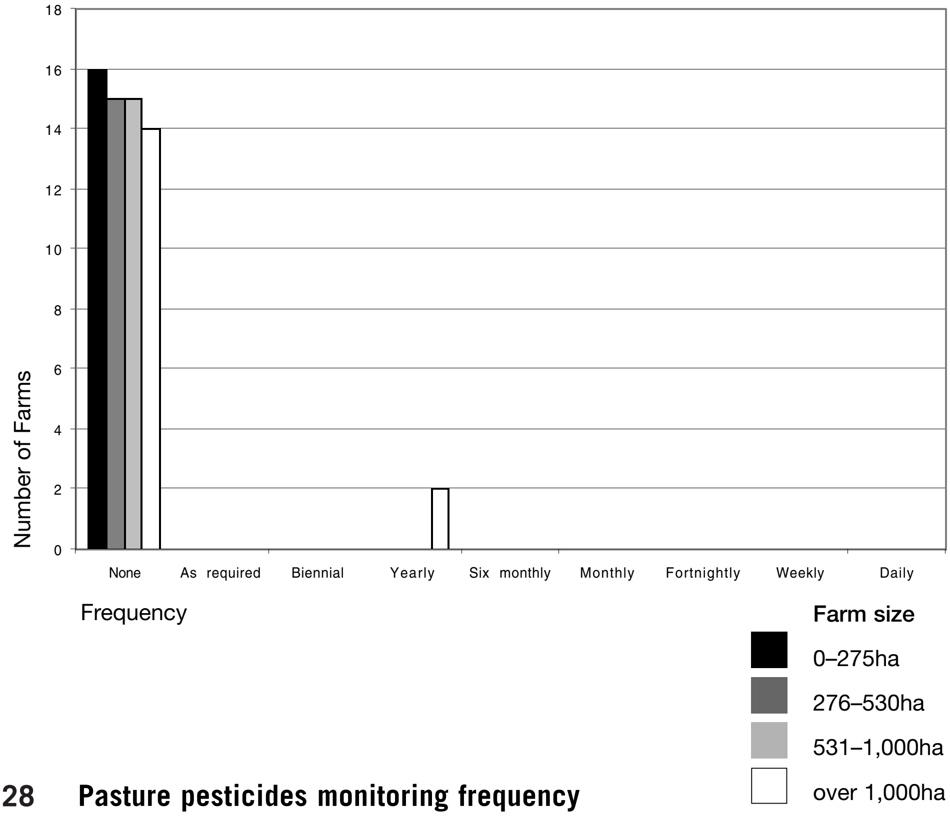
Graph 25 Groundwater pesticides monitoring frequency



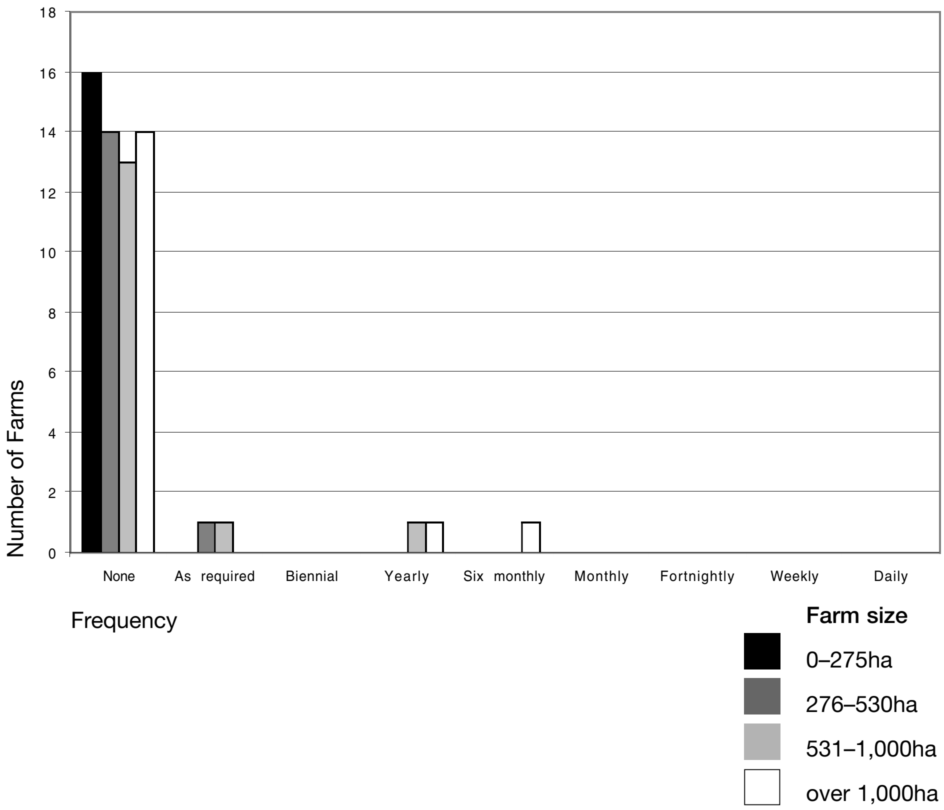
Graph 26 Groundwater nutrients monitoring frequency



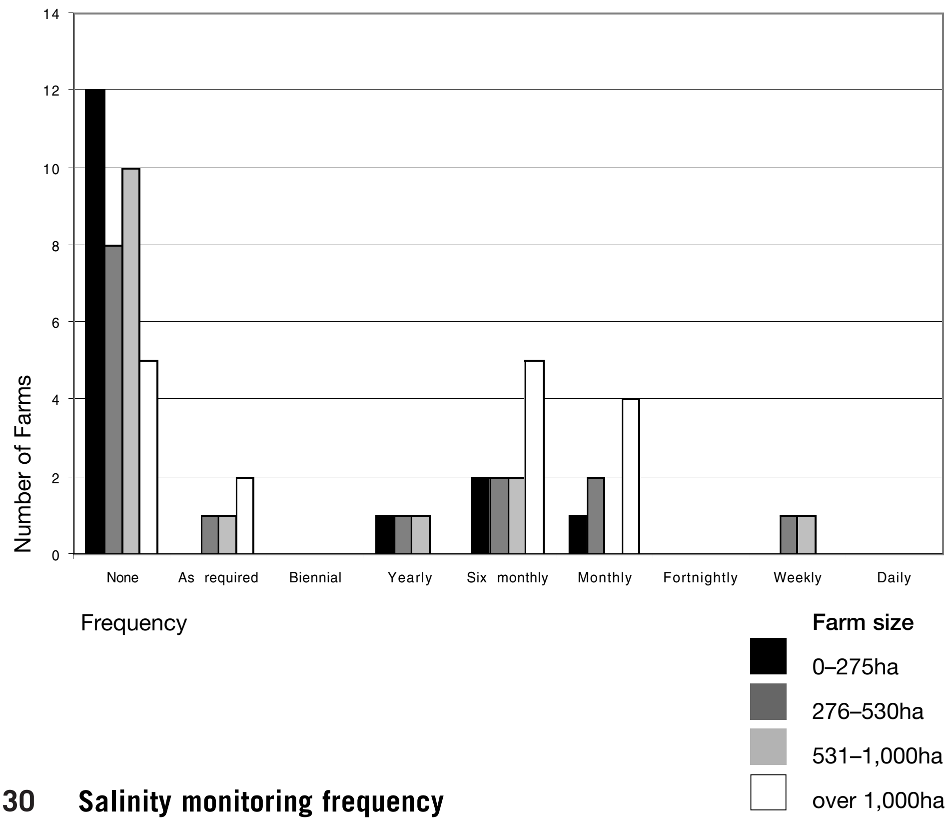
Graph 27 Overland pesticides monitoring frequency



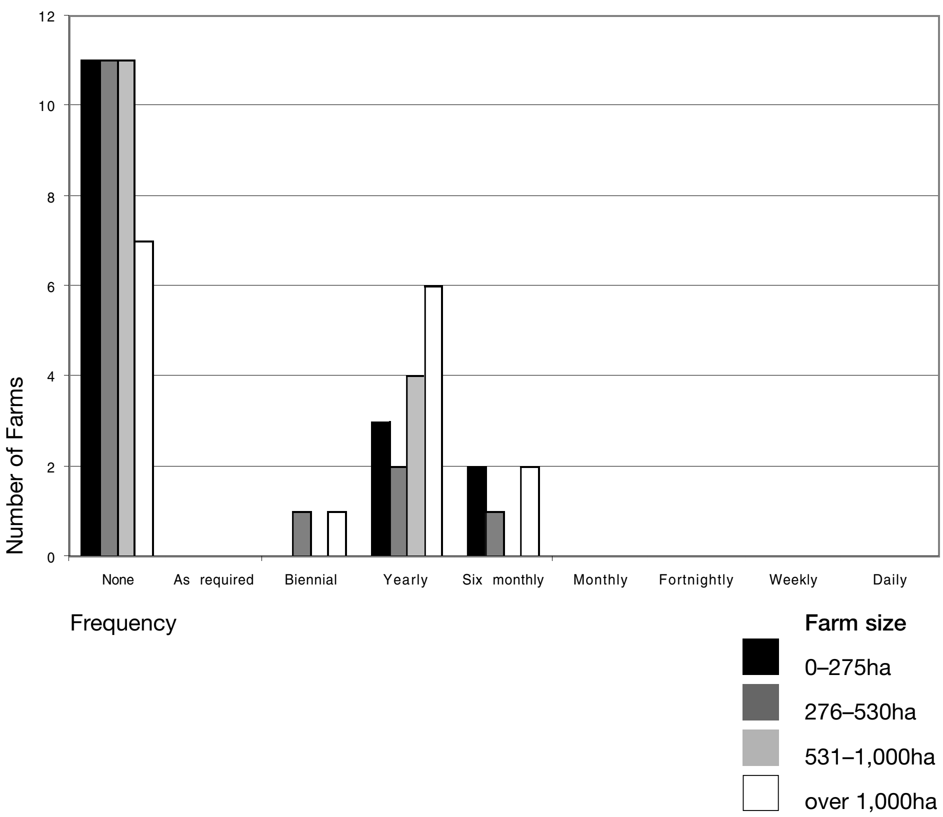
Graph 28 Pasture pesticides monitoring frequency



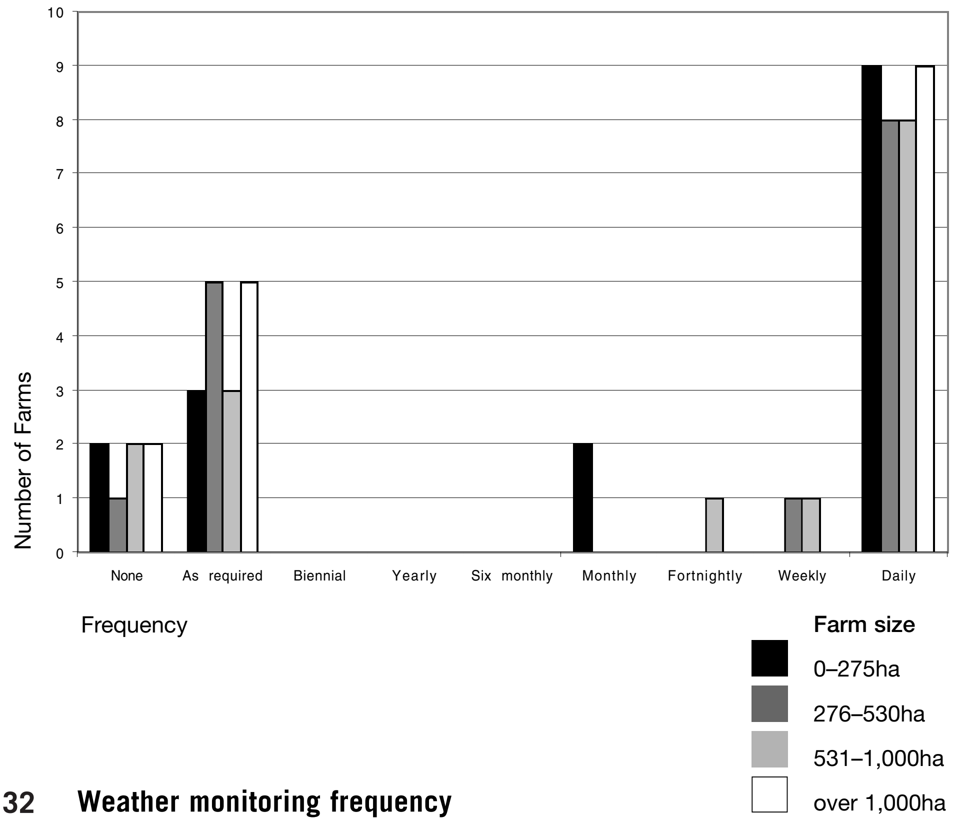
Graph 29 Groundwater level monitoring frequency



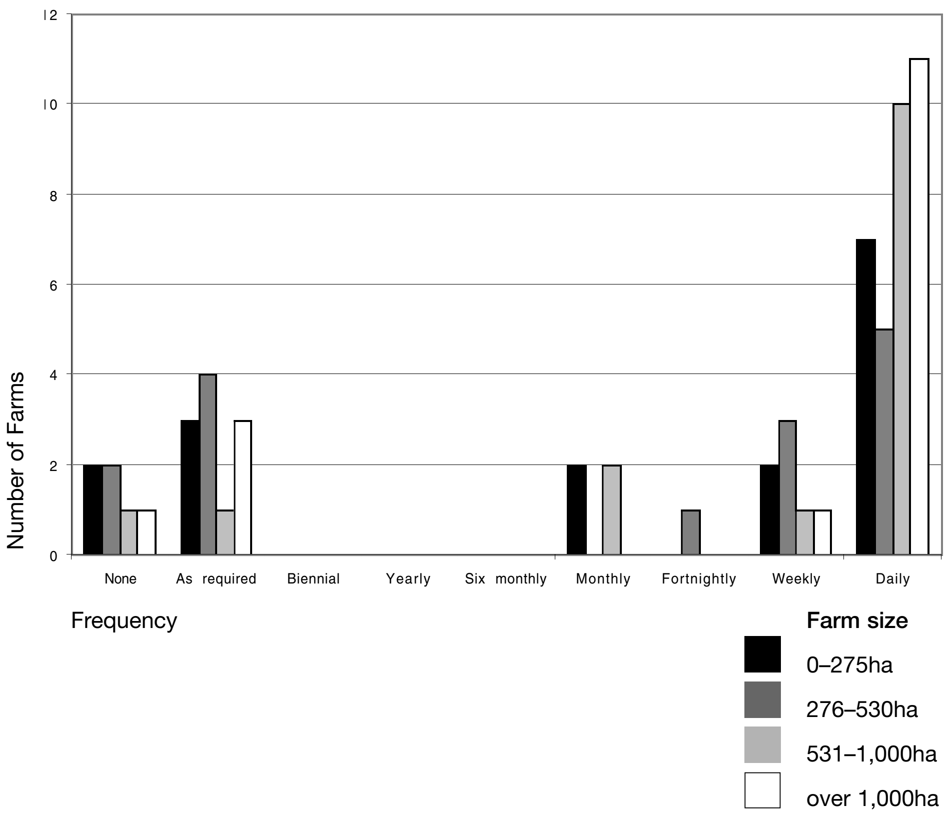
Graph 30 Salinity monitoring frequency



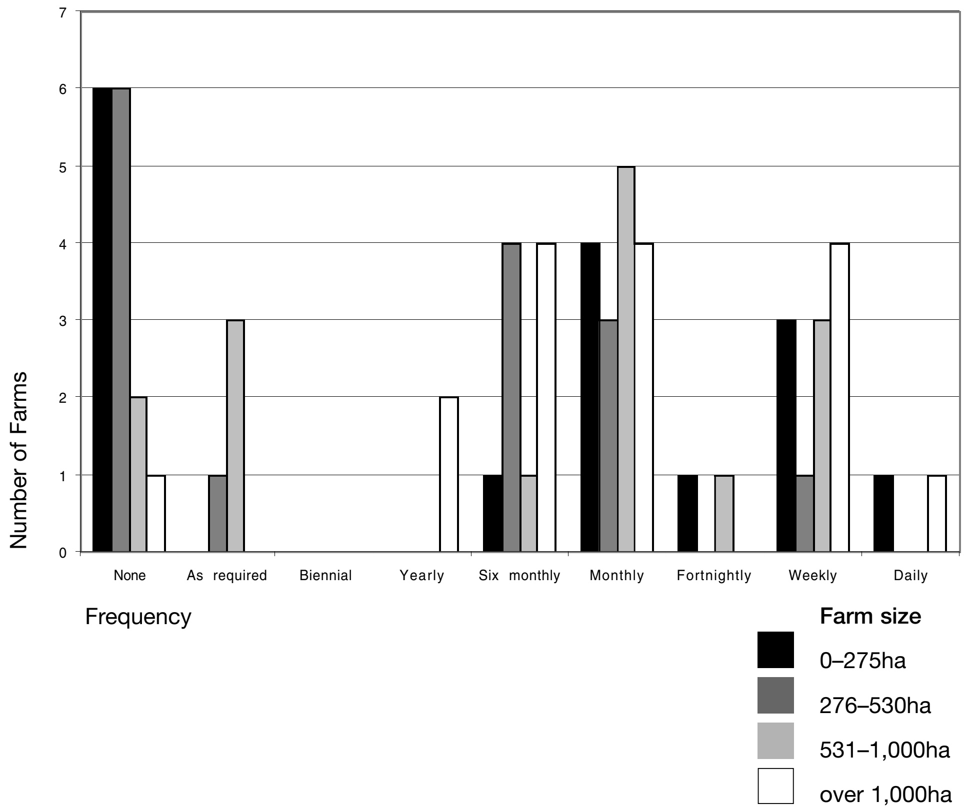
Graph 31 Rainfall monitoring frequency



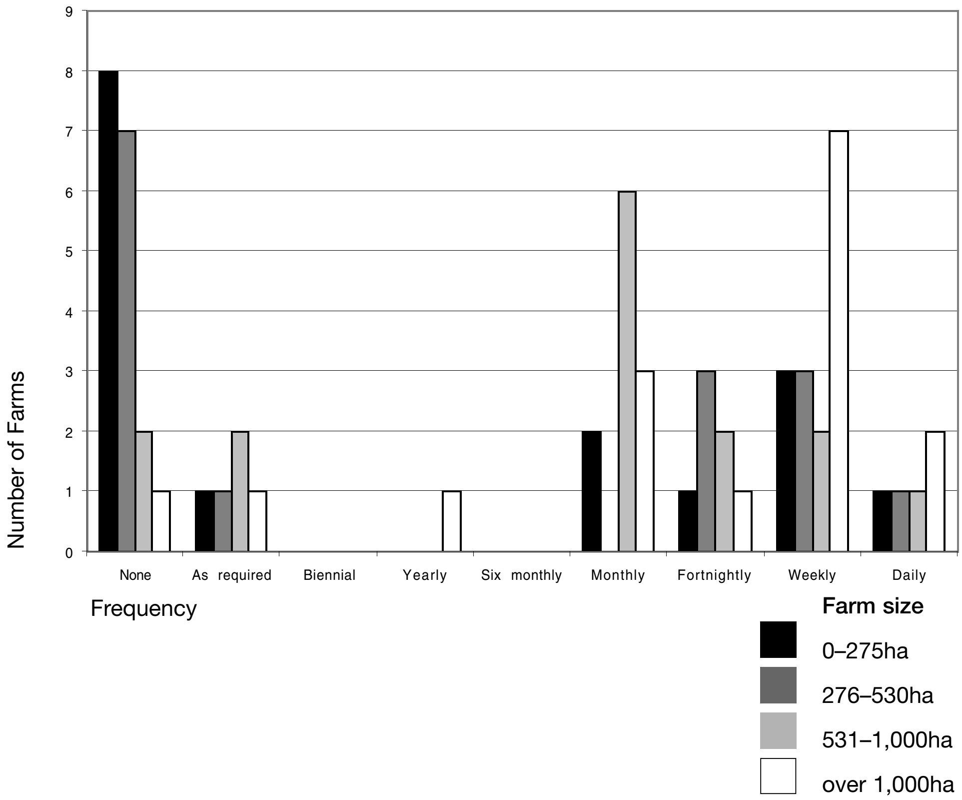
Graph 32 Weather monitoring frequency



Graph 33 Chemical stocktake frequency



Graph 34 Fuel monitoring frequency



6 Record Keeping

List of Tables

List of Graphs (all by farm size by quartile)

6 Record Keeping

Introduction

Survey participants were asked to indicate what records were kept, and how, and how often, those records were kept. An estimate of the time spent record keeping was also sought.

Findings

All participants kept some form of record relating to their farming operations. Most participants kept records on chemical applications, soil testing, irrigation, worker training and general administration. 92% kept at least some of these records in electronic form, 86% used a farm diary, and 84% used a paper filing system.

Most participants indicated that the farm owner or manager was responsible for keeping records relating to farming operations, and 53% indicated that the farm owner had some responsibility for maintaining administrative records. 47% had a secretary or 'administrator' carrying out these tasks.

There was a wide range in the frequency with which records were updated. This variability was found across the types of records kept, and between farms. Records of chemical applications were updated by most participants at least weekly, or when an application took place. However, training records were generally updated only once or twice a year. 77% of participants updated administration records at least fortnightly, and 65% updated these records at least weekly.

There were significant differences across farms in the estimates of hours spent each week maintaining records. Time spent on record keeping generally increased with farm size (by area of irrigated cotton). For example, 75% of participants in the top quartile (by area of irrigated cotton) spent 16 hours or more on record keeping each week, whereas 94% in the bottom quartile spent 10 hours or less each week on record keeping.

Major Implications and Conclusions

1. Most growers kept records around the major issues likely be addressed in an industry EMS (eg. pesticide application and water use). However, implementing and maintaining an EMS requires substantial documentation and record keeping, across all significant aspects of the farming operation. This component of the industry programme will need to be carefully managed, particularly in light of the potentially large number of different record keeping responsibilities that owner/managers may have, and the small numbers of hours that many owner/managers dedicate each week (themselves or through staff) to record keeping. Close industry assistance and a gradual approach to implementation will be necessary.

For example, guidance material on the components of an EMS will need to be developed at the industry level, for growers to adapt to the specifics of their own operations. Record keeping requirements will form a part of this guidance material, demonstrating that the recommended practices and procedures are in fact being carried out on the farm. That is, record keeping will be introduced as a 'constant' for each issue and EMS component introduced. It will important that these record keeping requirements be kept relatively simple and focused on farming practices. EMS documentation and record keeping should support the practices and procedures being put in place, as opposed to being the driving force behind them.

Table 22 Record keeping

% of farms where some type of record is kept of farming operations
100

Table 23 Types of records kept

	% of farms keeping records							
Method of record keeping	Chemical application	Crop	Weather	Admin.	Irrigation	Yield	Training	Soil
Filing system (paper)	66	50	37	35	52	58	56	81
Computer	65	60	45	82	45	56	11	19
Diary	48	48	35	24	55	24	161	16

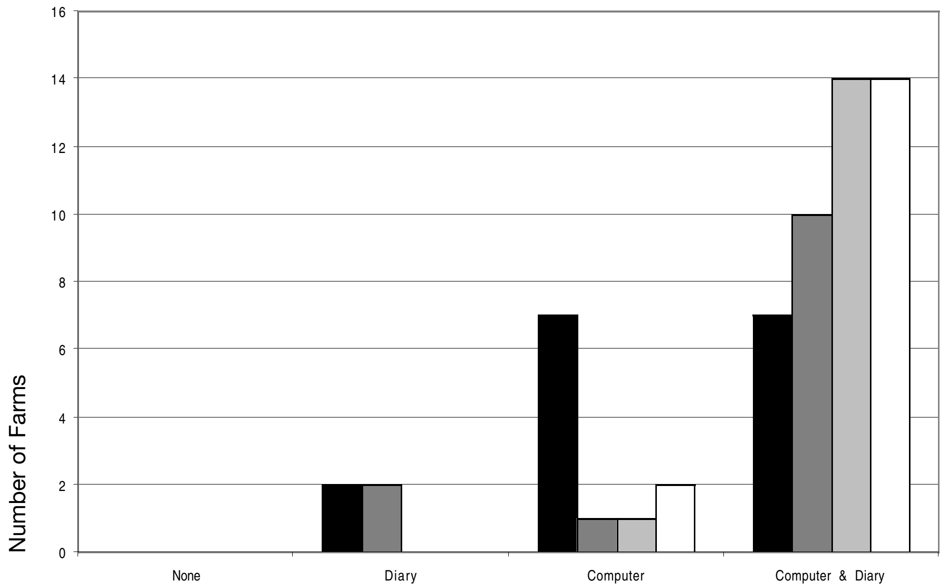
Table 24 Responsibility for maintaining records

	% of farms							
Responsibility	Chemical application	Crop	Weather	Admin.	Irrigation	Yield	Training	Soil
Owner	69	56	56	53	52	69	27	63
Manager	31	35	23	11	34	26	13	18
Agronomist	27	16	11	0	11	8	1	18
Secretary/ admin.	3	5	3	47	2	10	12	6
Foreman	11	15	6	0	23	2	2	2

Table 25 Time spent on record keeping

Hours spent each week on record keeping	0–2	3–5	6–10	11–15	16–20	21–25	26–30	31–40	Over 40
% of farms	24	13	29	8	10	5	6	3	2

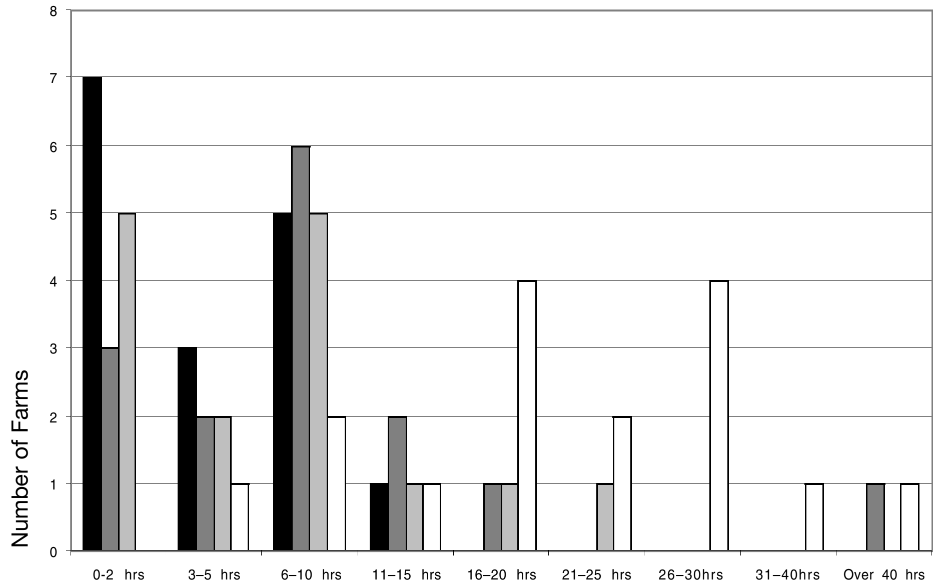
Graph 35 How records are kept



Type of record keeping

Farm size
- 0–275ha
- 276–530ha
- 531–1,000ha
- over 1,000ha

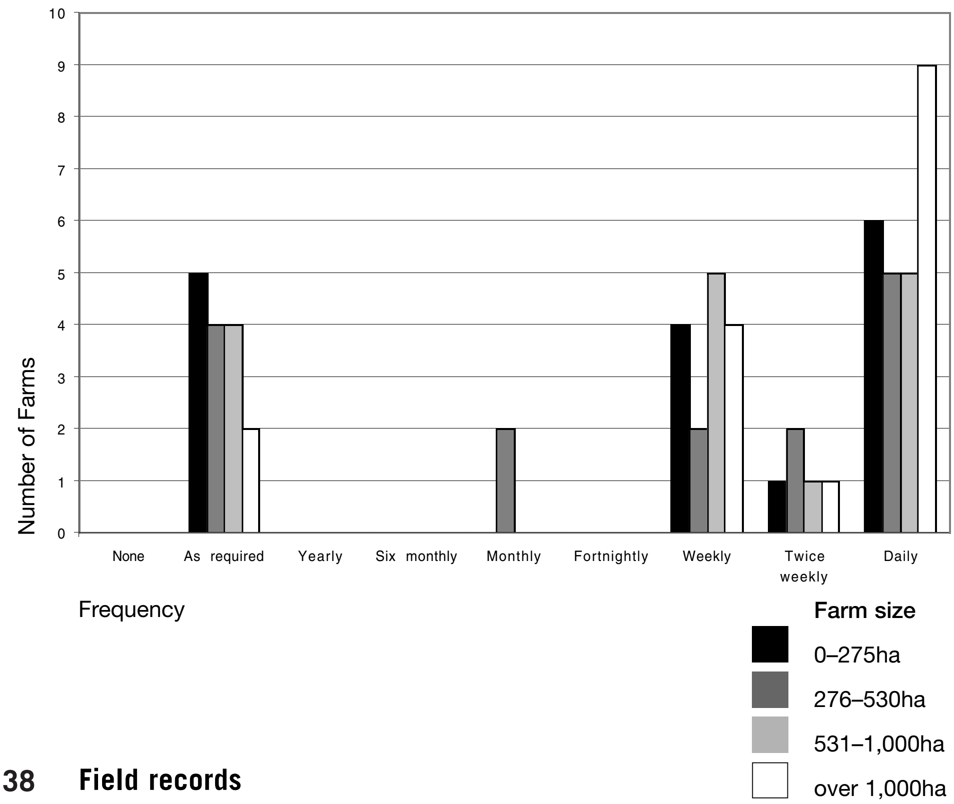
Graph 36 Hours spent record keeping



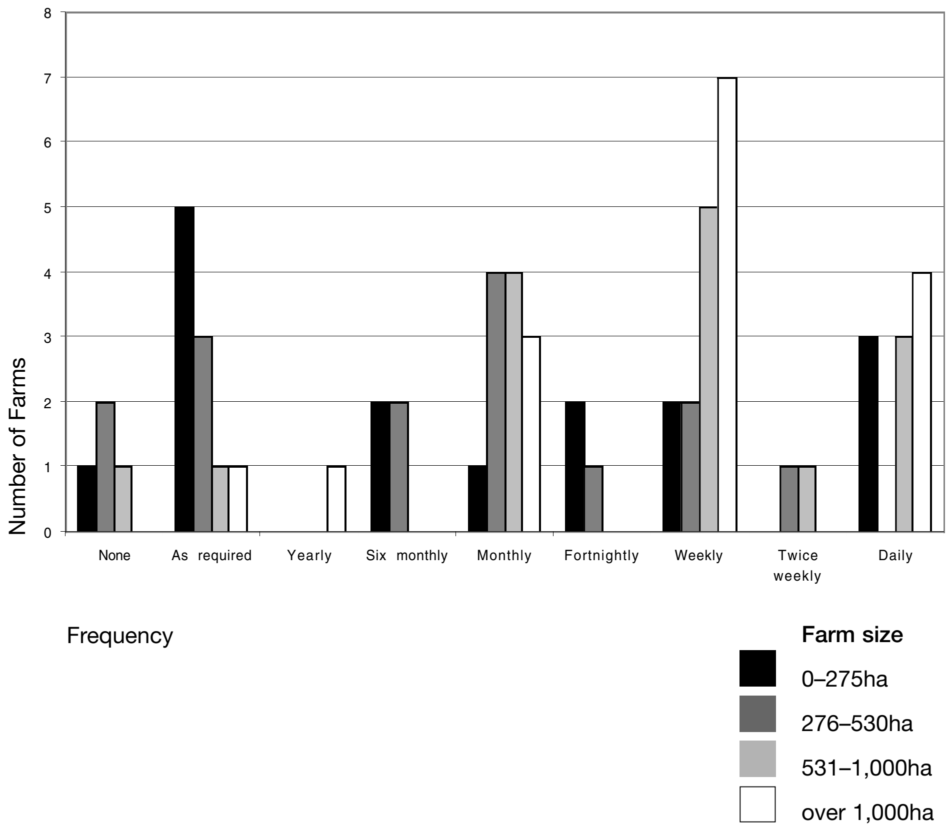
Hours spent

Farm size
- 0–275ha
- 276–530ha
- 531–1,000ha
- over 1,000ha

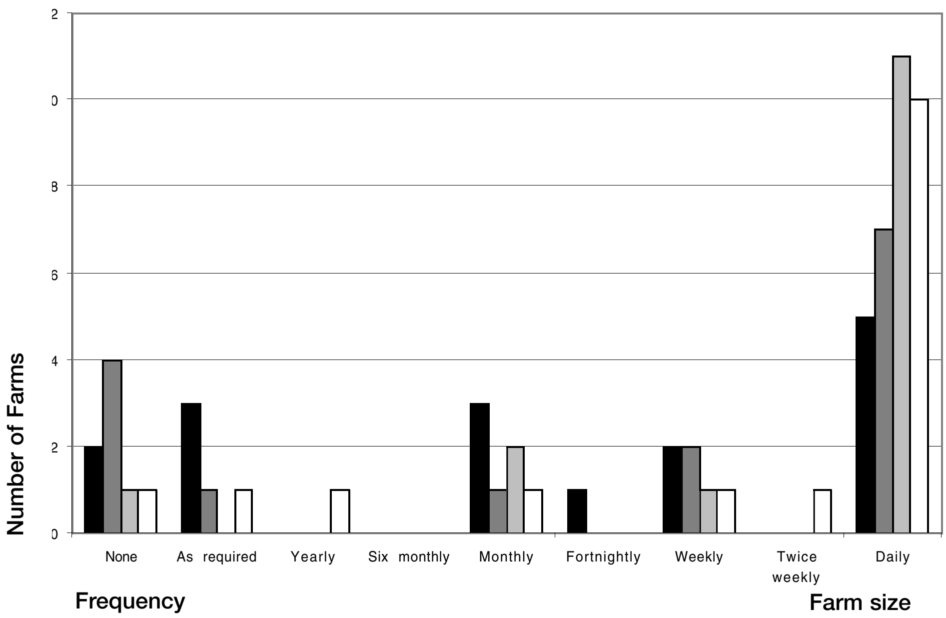
Graph 37 Chemical application records



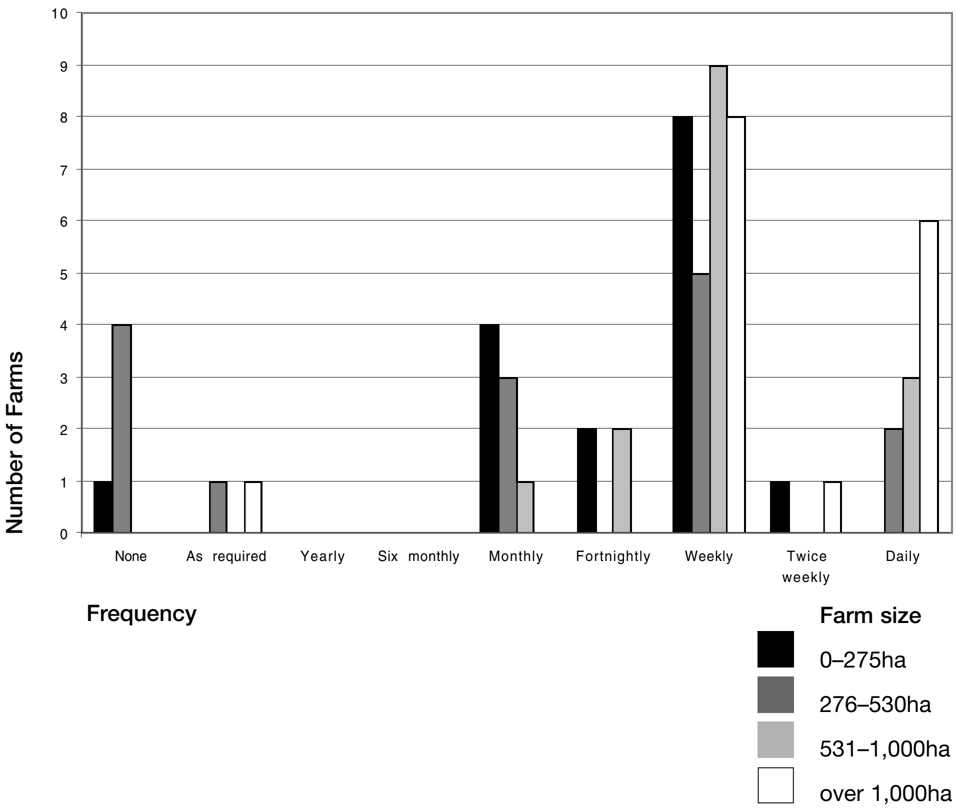
Graph 38 Field records



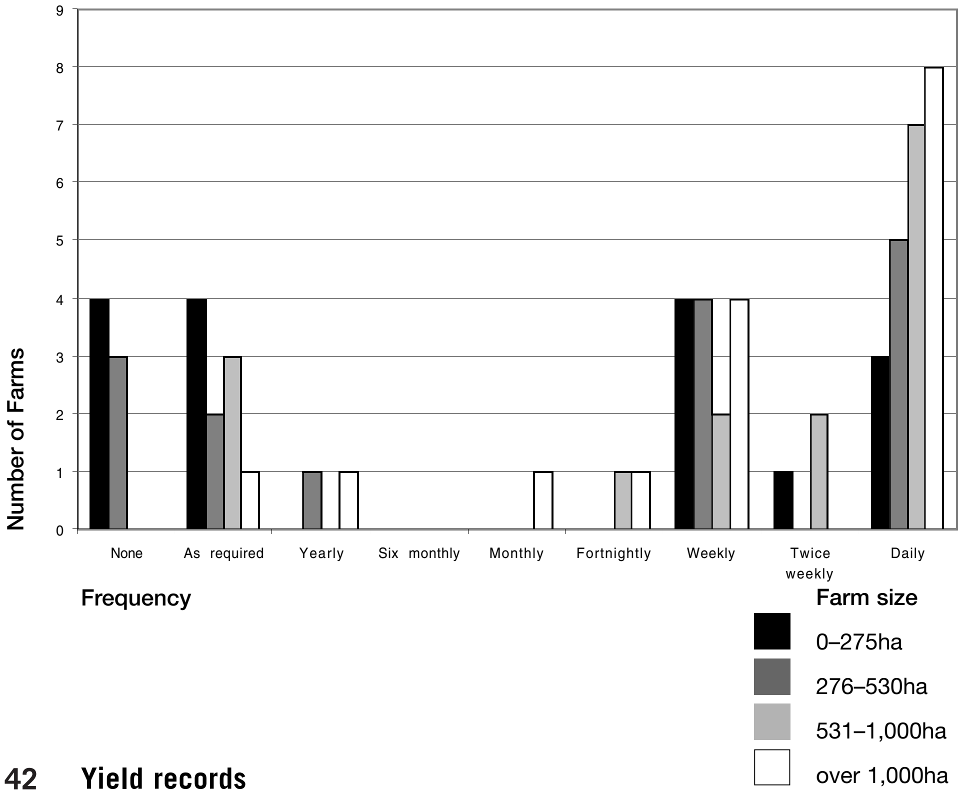
Graph 39 Weather records



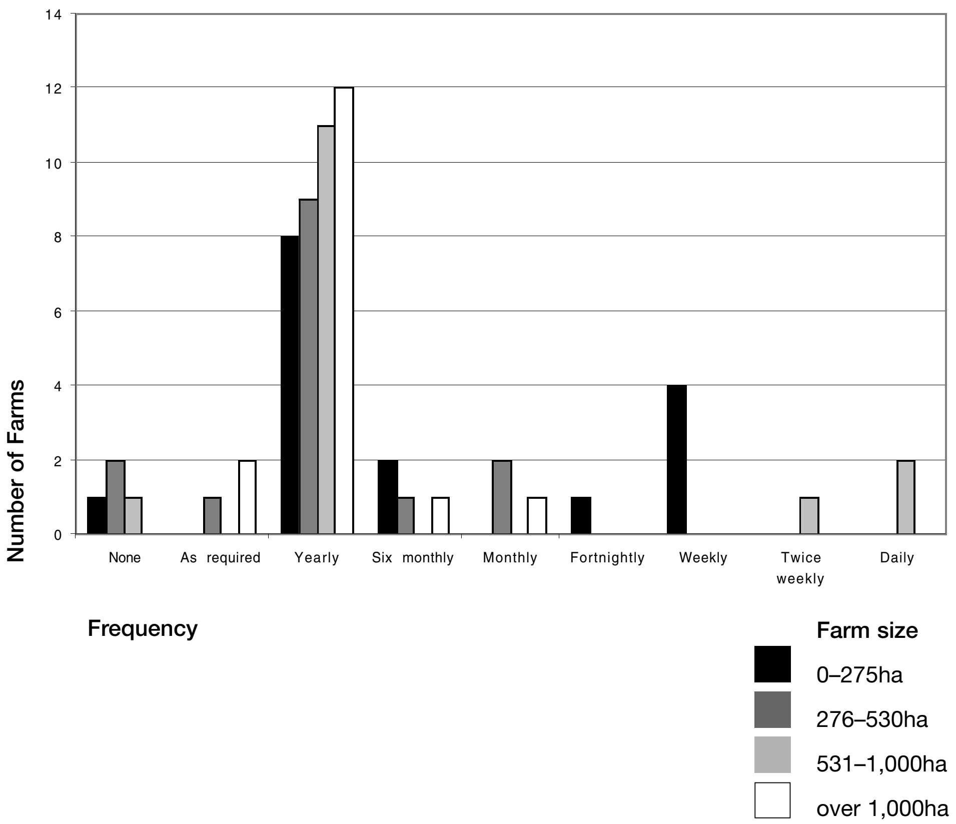
Graph 40 Administration records



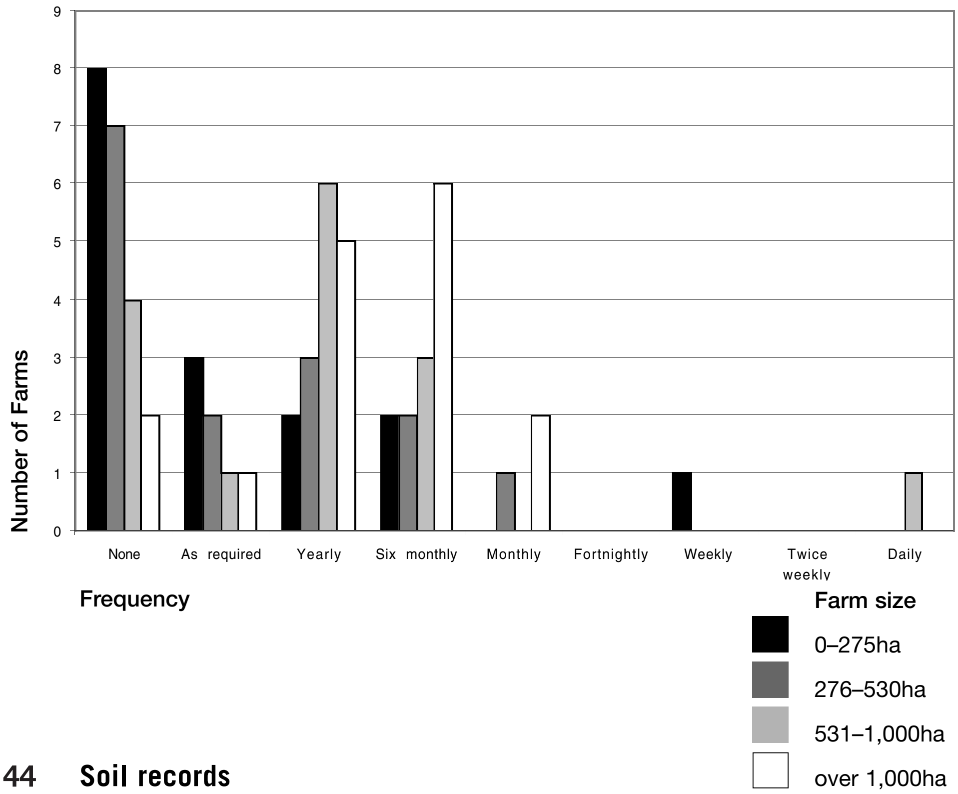
Graph 41 Irrigation records



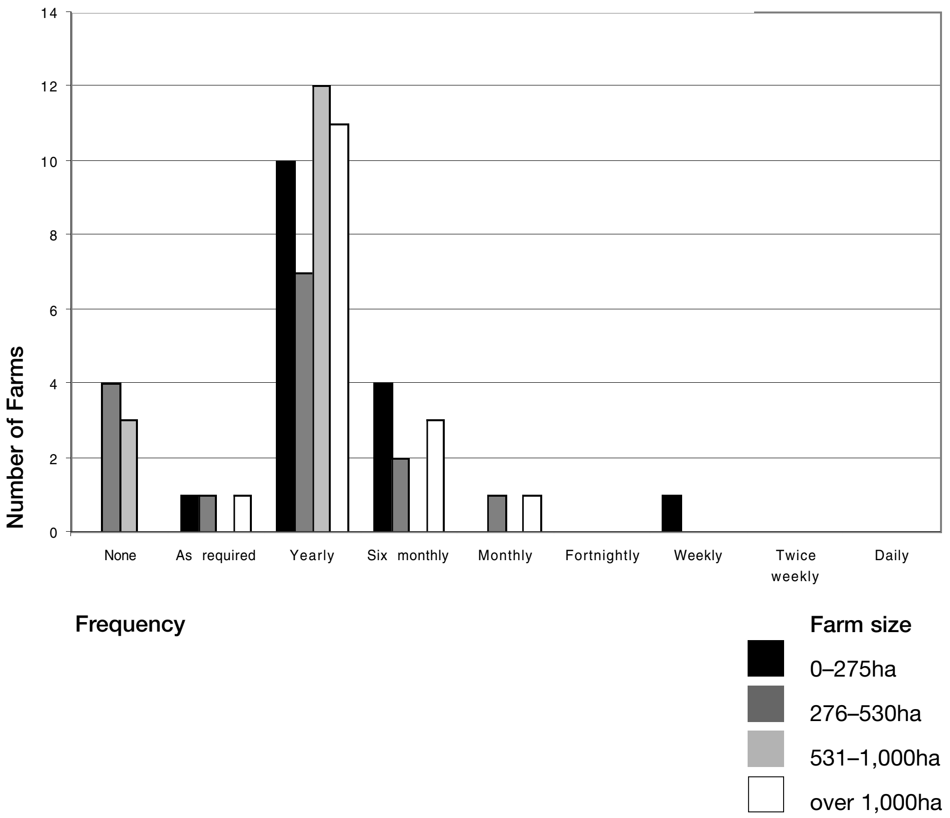
Graph 42 Yield records



Graph 43 Training records



Graph 44 Soil records



INTRODUCTION

This Section considers each clause of the ISO 14001 Standard in detail, and

1. **Discusses the practical implications of implementing the Standard on a cotton farm**
2. **Compares the requirements of the Standard with those of the BMP Programme**
3. **Lists the actions necessary, on an industry level, to comply with the Standard.**

DETAILED ANALYSIS OF ISO 14001

Appendix 4

List of Tables

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Clause 4.1 General Requirements

The organisation shall establish and maintain an environmental management system, the requirements of which are described in this section.

Discussion of Implications

This clause simply means that to comply with ISO 14001, every element (clause) of the Standard must be satisfied.

Ensuring growers are aware of and understand each component of the EMS has obvious importance. Any expansion and modification of the BMP Manual to enable it to support ISO 14001 certification would need to include guidance that clearly identifies each element of the Standard and how it is addressed in the BMP Manual.

The Standard notes that the management of occupational health and safety issues can be integrated with the EMS[1], but states that "the certification/registration process will only be applicable to aspects of the environmental management system". Given the close relationship between environmental and occupational health and safety issues particularly in relation to pesticide use, growers may wish to use elements of the management system outlined in the Standard to address OHS matters. The industry should encourage growers who wish to extend their management system in this way, but should also ensure that growers doing so are aware of the limit to certification noted above.

A related issue is the scope of application of an EMS. Tibor and Feldman note "the requirements of ISO 14001 allow the organisation flexibility in defining the scope of its EMS. An EMS can be designed at the site or facility level, across several facilities or to encompass the entire enterprise … An organisation need not introduce an EMS everywhere at the same time. It can take an incremental approach to EMS implementation" (at p46)[2].

In relation to cotton farms, it will be appropriate that the Standard be applied to farms in their entirety rather than to limited physical areas or particular operational units or crops. This will help establish consistency of approach between farms, as well as providing full coverage of farms' significant aspects, maximising the potential for environmental gains and removing the potential for obvious 'absences' in any farm's EMS that could adversely affect its effectiveness or credibility.

The BMP Manual does not currently define the scope of its application (although it is implied to be confined to pesticide management on cotton farms). In order to comply with ISO 14001, the BMP Manual will need to clearly define the boundaries of its operation – for example that all components of the farming operations are subject to the requirements of the Standard. It is also important from an auditing perspective that the scope of the EMS is clearly defined, so that the auditor can clearly identify those areas that need to be assessed.

Clause 4.2 Environmental Policy

Management shall define the organisation's environmental policy and ensure that it

a) is appropriate to the nature, scale and environmental impacts of its activities, products or services;

b) includes a commitment to continual improvement and prevention of pollution;

c) includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organisation subscribes;

d) provides the framework for setting and reviewing environmental objectives and targets;

e) is documented, implemented and maintained and communicated to all employees;

f) is available to the public.

Rationale

The environmental policy serves as the starting point for the development of the EMS. It leads to the development of more specific objectives and targets, and perhaps most importantly, is the public demonstration of the commitment being made. It states the organisation's commitment to responsible environmental management and establishes the environmental priorities and principles of the organisation.

Discussion of Implications

The Standard envisages the environmental policy as belonging to an organisation, with its development led by management, and communicated to all staff. It is important that the environmental policy have practical meaning for the enterprise responsible for its implementation.

Given that the cotton industry may develop a 'dual' scheme that places responsibilities on both industry organisations and individual growers, it may be necessary to develop an industry policy that growers can either adopt 'wholesale', or adapt to their own operations. Farm policies will need to be consistent with the industry policy, and will need to include any 'non-negotiable' terms that the industry considers relevant to all farms, or that are required by the Standard. For example, the Standard requires that the environmental policy include commitments to continual improvement, pollution prevention, and compliance with legal and other obligations to which the organisation is subject or subscribes.

It should be noted that a broad, general policy might not be sufficient to meet the requirements of the Standard. As Brown (1) notes, "each clause of the environmental policy should be a meaningful statement from which objectives and realistic targets can be derived" [at pages 2–1520 and 3–3335] and "it [the environmental policy] must not be a series of platitudes, but should represent **a serious commitment** (emphasis added) in which every word and phrase will be carefully thought through and its implications fully understood". Thus the nature of the industry policy will influence whether a grower will be able to adopt it 'wholesale' or whether it needs to be modified by each farm for their own particular situation.

Development of the industry environmental policy should be undertaken early in the development of the industry EMS. This should be done in a consultative manner, involving all relevant industry organisations and growers. For example, development of the policy could be done through the Australian Cotton Industry Council and Cotton Australia. The policy will reflect the environmental priorities of the industry, and where appropriate external stakeholders.

Current Situation

The cotton industry does not as yet have a detailed, written environmental policy that could satisfy the requirements of the Standard. The BMP Programme does not include specific advice for growers who may want to develop an environmental policy, though it does list three goals of best management practices, namely:

The development of an industry:

- Whose participants are committed to improving farm management practices
- Whose participants have developed and follow policies that minimise the risk of any adverse impacts on the environment or human health
- Which can credibly demonstrate to the community stewardship in the management of natural resources and farming operations.

Also, a number of industry organisations have policies or mission statements that include goals relating to responsible natural resource management and sustainability. For example, Cotton Australia has developed draft environmental policies for the industry that cover sustainable farming practices and a number of specific natural resource issues. This work can be used as a starting point for the development of a comprehensive industry environmental policy that satisfies the requirements of the Standard.

Requirements

A process to develop an industry environmental policy needs to be agreed upon. This process could be overseen by the Australian Cotton Industry Council, and would require extensive consultation with industry organisations and growers.The industry environmental policy would build on the work undertaken by Cotton Australia.

Guidance material will need to be developed for growers to adopt or adapt the industry policy to their farm. Farm policies will need to be consistent with the industry policy, and both need to satisfy the specific requirements of the Standard.

Clause 4.3 Planning

Clause 4.3.1 Environmental Aspects

The organisation shall establish and maintain (a) procedure(s) to identify the environmental aspects of its activities, products or services that it can control and over which it can be expected to have an influence, in order to determine those which have or can have significant impacts on the environment. The organisation shall ensure that the aspects related to these significant impacts are considered in setting its environmental objectives.

The organisation shall keep this information up-to-date.

Rationale

This is the first step in setting environmental objectives and targets; ie. it is the starting point for the development of action plans to bring about the improved environmental performance sought through the implementation of the EMS. As noted by Gilbert and Gould "the impact analysis … is at the heart of the management system ... it takes you into new areas. It establishes where the effort should be spent to improve environmental performance" (p123). This process will help ensure appropriate objectives and targets are established by growers, and that action plans can be prioritised to address the areas of greatest significance and importance.

Discussion of Implications

Although this clause addresses one of the fundamental components of the Standard, a number of commentators have noted that it is also one of the most difficult to come to grips with. Tibor and Feldman note that "it can be an imposing task to develop, evaluate, and maintain the list of aspects and determine which aspects are significant" while Brown states that "the determination of environmental aspects, impacts and effects is one of considerable difficulty and sometimes confusion in the establishment of an EMS to the Standards" (Brown (1) p675).

It would be critical therefore that an industry scheme seeking ISO 14001 compliance include strong support for growers in this area. This would involve the provision of extensive guidance material (and training) to enable cotton growers to identify and evaluate environmental aspects on their farm[3]. The guidance material would need to address the relevant technical aspects (e.g. pesticide use) and the process aspects (ie. risk assessment). A significant challenge would be balancing the need for simplicity and usability against the loss of rigour that may result if the process becomes no more than a 'tick and flick' exercise at the farm level. One way of achieving this balance would be to provide specific training to cotton growers on how to perform risk assessment.

This clause establishes the need to develop a list of the activities undertaken on a cotton farm in order to identify the **environmental aspects**[4] of those activities. Second, risk assessment needs to be undertaken in relation to the identified environmental aspects to determine which activities of the organisation have significant[5] **environmental impacts**. Note also that the fact that an aspect is subject to government regulation means it should automatically be evaluated as significant. See Table 1 for examples of activities, aspects and impacts that could be identified on a cotton farm.

FIRST STEP

The first step is to develop a list of the activities performed on a cotton farm. The process by which this list is developed needs to be clearly identified for the certification requirements of the Standard. Various sources for this list already exist, including:

- Cotton growers who have undertaken 'risk assessment' under the BMP Programme
- The 'industry' Environmental Audit, conducted in 1991
- Cotton Farms with ISO 14001 certification.

An issue that will require careful consideration when drafting the industry-developed list of activities, aspects and impacts will be the need to avoid duplication. A number of distinct activities will have common aspects and impacts. For example the activities of seed-bed preparation, cultivation and harvesting will all in-field machinery use as a common aspect, and soil compaction and air contamination as potential impacts. The challenge will be to ensure a thorough list, but one that does not repeat issues under different activity headings. It is also important to keep the aspects broad in nature to avoid complication and confusion during later planning and implementation (Brown (1) at 3–0780).

This broad-brush approach is strongly supported by Brown (1), who states that [at page 3–0790] "experience has indicated that an organisation should be cautious with regard to the amount of detail included in its assessment of activities, products or services. Wherever possible activities should be grouped together where they combine to provide a common result, such as the … emission of a common stream of pollutants into the air or water. Detailing every single "activity" that contributes to a process can be extremely counter-productive. Taking a global view of activities, products and services may assist to provide a much more meaningful result than trying to work with hundreds of individual items."

SECOND STEP

The critical second step is the evaluation of the identified environmental aspects to determine those that can result in a significant environmental impact.

Table 1 Examples of activities, aspects and impacts

Activity	Aspect	Impact
Seed bed preparation	Cultivation of soil Tractor use	Soil compaction Contamination of air
Insect control	Application of insecticides	Contamination of air, water & soil
Irrigation of crops	Application of water Discharge of tailwater	Waterlogging Contamination
Machinery maintenance	Changing of oil	Contamination Waste production
Weed control	Application of herbicides	Poisoning of non-target plants

The following considerations are suggested in AS/NZS ISO 14004 (page 9) when evaluating the significance of impacts:

Environmental concerns:

- the scale of the impact
- the severity of the impact
- probability of occurrence
- duration of impact.

Business concerns:

- potential regulatory and legal exposure
- difficulty of changing the impact
- cost of changing the impact
- effect of change on other activities and processes
- concerns of interested parties
- effect on the public image of the organisation

A number of methods exist for the determination of significance[6]; Two complementary methods are outlined on the following pages[7].

(a) Classification of Significance

This approach can be undertaken as a flow chart decision making process, or as a series of questions posed for each environmental aspect to determine its significance. An affirmative response to any of the questions indicates that the impact is significant. The critical issue here is determining the questions to be asked. To ensure that the risk assessment process is thorough, it is suggested that all identified impacts be subjected to this process to screen out those that are easily determined to be significant; the remainder would then be subjected to the Failure Modes Effects Analysis process outlined below.

The types of questions that can be asked include the following:

- Does legislation or regulation exist that covers this impact?
- Does a Code of Practice exist for managing this issue?
- Is there scientific evidence indicating risk?
- Is there a history of complaints about the practice?
- Are there any health or safety implications?
- Do stakeholders consider it significant?

(b) Failure Modes Effects Analysis

This approach distills the above considerations into three parameters that are each assigned a rating on a short scale. The parameters are then factored together to produce a single figure out of 100. The 3 parameters are:

- the chance of an incident
- the ‘sensitivity’ of the issue (this includes concerns of interested parties)
- the seriousness of its consequences (includes scale, severity and duration).

In order to obtain a rating, the likelihood of occurrence is added to the sensitivity and multiplied by the severity, ie.

Relative Ranking = (Likelihood + Sensitivity) x Severity

While it is suggested that any result greater than 50 requires further attention, it may be more appropriate to initially use the resulting scores to help determine priority.

Table 2 Failure Modes Effects Analysis (after Gilbert and Gould 1998)

LIKELIHOOD		SENSITIVITY		SEVERITY	
Criteria	**Rank**	**Criteria**	**Rank**	**Criteria**	**Rank**
Very high	5	Very high	5	Very high	10
High	4	High	4	High	8
Moderate	3	Moderate	3	Moderate	6
Low	2	Low	2	Low	4
Very low	1	Very low	1	Very low	2
None	0	None	0	None	0

In light of the potential difficulties that many cotton growers would experience in fulfilling this requirement to identify and assess environmental aspects, thorough guidance on risk assessment must be provided by the industry body responsible for overseeing the development of the EMS.

There will however be a limit on the extent to which a generic, industry-based list of significant impacts will cover all the significant aspects on an individual cotton farm. Whilst such an industry list will provide an excellent starting point[8], it would be unrealistic to expect it to be able to identify every issue on every farm. To support the use of an industry developed list of environmental aspects, it will therefore be necessary to develop appropriate processes to help growers assess their own operations.

Solutions include the provision of training in risk assessment to augment the use of generic guidance material (for example as contained in the current 'risk assessment' section of the BMP Manual) and/or an inspection of the farm by a third party.

Implementation of this component will result in a register of environmental aspects and impacts associated with cotton farming that will include the following information:

- the scope of the evaluation
- who performed the evaluation
- why a particular impact is significant
- how the significance was determined
- when it was determined
- when the evaluation is due for review.

Current Situation

The BMP Manual contains a guide to risk assessment that could be used to cover activities and issues outside pesticide use. However, the current risk assessment guide would need to be modified in conjunction with the development of an appropriate risk assessment training programme. It is critical that whatever decision-making process is used to evaluate aspects (determine risk), it is clearly documented. A good starting point for identifying aspects is provided in the 1991 environmental audit of cotton farming, conducted by Gibb/Arbor International.

Requirements

In order to satisfy this requirement, the industry will need to develop the following:

- A process to develop an industry-based list of activities and their associated environmental aspects that take place on a cotton farm
- A process to systematically assess all environmental aspects on an industry basis and on individual farms
- A training programme to educate cotton growers how to undertake a risk assessment of their farming operations[9].

Table 3

Guidance on the meaning of 'Significance' (from the USA Council on Environmental Quality Regulations)

- Context: the significance of an action must be analysed within the context of society as a whole, the affected region, the affected interest, and the locality, as appropriate. Both short-term and long-term effects are relevant
- Intensity:
  - The degree to which the proposed action affects public health and safety
  - Proximity to historical or cultural resources, parklands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas
  - The degree to which the effects are likely to be highly controversial
  - The degree to which the possible effects are highly uncertain or involve unique or unknown risks
  - The degree to which the action might establish a precedent or affect future considerations
  - The implications for cumulatively significant impacts
  - The degree to which the action might adversely affect districts, structures, or objects listed in, or eligible for, listing in the National Register of Historical Places
  - The degree to which the action might cause loss or destruction of significant, cultural, or historical resources
  - The degree to which the action might adversely affect an endangered or threatened species or its habitat
  - Whether the action threatens a violation of federal, state, or local law, or requirements imposed for the protection of the environment.

Taken from Brown, paragraph 3–0850

Clause 4.3.2 Legal and Other Requirements

The organisation shall establish and maintain a procedure to identify and have access to legal and other requirements to which the organisation subscribes, that are applicable to the environmental aspects of its activities, products or services.

Rationale

A minimum standard of environmental performance should include compliance with relevant legal obligations. This can only be achieved if the applicable legal requirements are identified, known and understood.

Discussion of Implications

This clause requires cotton growers to have access to the relevant legal information, as well as the establishment of a procedure for ensuring that new developments and requirements are accessed in a timely manner.

This requirement is on its face formidable – as noted by Tibor and Feldman, "... it is a daunting task. Environmental management is one of the most heavily regulated disciplines". Requirements to be identified in an EMS for Australian farmers will come from three jurisdictions – federal, state and local.

The burden on growers of identifying their legal obligations can be significantly reduced through the development of guidance material at the industry level. It is a task highly suited to be done in a centralised way[10] and in the case of the cotton industry, by the industry body responsible for overseeing the environmental programme. The responsibility of the industry body would be two-fold. First, ensuring that information on the most recent legislative and regulatory requirements are on hand, and second, communicating those requirements (in plain English) to growers.

Whilst the need for a register is not an explicit requirement of the Standard (the critical issue being the maintenance of current information on legislative obligations), a register or manual of legislative and regulatory requirements would most likely need to be maintained to ensure that this clause is complied with[11].

Sources of information for the industry body include legal services, legal advisors[12], government agencies and departments (all Australian legislation can now be found via the Internet, as can most Hansards, usually within a matter of days of the parliamentary session in question).

The issue of over-reliance by cotton growers on a centralised information source is again relevant here, as there may be, for example, specific licence conditions that are applicable to the licence holder, or local shire zoning requirements.

As these specific legal requirements will probably be outside the scope of the responsible industry body to identify and keep updated, a process will need to be included that allows growers to determine whether they are subject to any of these specific requirements, and to guide them on how to keep up to date in relation to these requirements.

A suggested ‘Compliance Assurance Programme’, simplified from Brown (page 774) is as follows:

Table 4 Legal compliance assurance programme

	Industry	Individual grower
Step 1	Compile list of all relevant Legislation	Determine if any specific requirements apply (based on indicative list of potential areas)
Step 2	Review in detail and develop plain English version	
Step 3	Determine practical requirements to comply with legislation	Determine practical requirements to comply with legislation

It is likely that industry support will need to be provided to help cotton growers comply with new legislative requirements, particularly when substantial changes are introduced. Whilst it is not easy to predict the exact nature of the support likely to be required, measures could include provision of guidance material explaining or demonstrating how to meet the new obligations, and advice on providers of technical information or relevant products and services.

Explaining environmental legal obligations to growers would be undertaken on the ground by the Cotton Australia Grower Services Managers. Whilst the focus of their role at the moment is on introducing cotton growers to the BMP Programme, this role will mature once the majority of cotton growers have been introduced to the concepts in the BMP Manual, into providing ongoing support for cotton growers implementing best management practices. The changes to the endosulfan label for 1999/00 provided some practical experience in this role, with the cotton industry running an extensive education programme (through the Grower Services Managers) on the requirements for cotton growers in complying with the new label conditions.

Codes of Practice

Whilst the majority of the work involved in complying with this clause will relate to statutory requirements, three codes of practice are also directly applicable. They are the "Environmental Code of Practice for Agriculture", developed by the Queensland Farmers' Federation (QFF), and which applies to Queensland cotton growers, and the respective codes of practice for the storage and handling of agricultural chemicals for New South Wales (Code of Practice for the Safe Use and Storage of Agricultural Chemicals) and Queensland (Code of Practice for the Storage and Use of Chemicals at Rural Workplaces).

While not mandatory, failure to follow the Queensland Environmental Code of Practice for Agriculture may be viewed by a Court as a failure to meet the general environmental duty of care owed by all Queenslanders. Conversely, complying with the Code provides a means of defence against a claim that the duty has been breached. The Environmental Protection Act (1984) also allows for the development of industry-specific codes[13], which need to be approved by the Minister. Compliance with an industry-specific code would provide the same legal defence as that afforded by the QFF Code of Practice. Thus any EMS developed by the cotton industry should be developed so as to fulfil the requirements of an approved code of practice under the Queensland legislation. This would mean that a common document would be meeting common needs, thereby avoiding duplication of effort and documentation. In any event, an industry EMS, whether based on ISO 14001 or another standard would undoubtedly require consideration of the environmental issues outlined in the QFF Code.

The Queensland Environmental Code of Practice for Agriculture outlines principles which rural land managers should adopt in order to comply with their general environmental duty. These principles are called Expected Environmental Outcomes, and are as follows:

"All reasonable and practical measures should be adopted, within the constraints of a sustainable agricultural system:

- To conserve representative samples of native species and ecosystems
- To conserve the productive characteristics and qualities of the land and its soil
- To conserve the integrity of waterways and the quality of water
- To manage waste from on farm activities
- To conserve the quality of air through minimising the release of contaminants
- To minimise the impacts of noise on environmentally sensitive places at sensitive times."

A more detailed list of the types of issues that should be considered under each of these Expected Environmental Outcomes is included in the Code.

The Queensland Environment Protection Agency ("QEPA") has detailed the procedural requirements for gaining approval for an industry code. The QEPA would be involved in any expansion of the industry programme and the issue of approving an industry code could be dealt with at this time.

The codes of practice relating to the storage and handling of agricultural chemicals may be more problematic. While they also advocate a process of risk identification and assessment for the protection of human health and safety that is consistent with the risk assessment process required for environmental management, experience to date with the BMP Manual has been that this area is often the one most likely to require substantial improvement, and is also one of the most complex. Also, these codes focus on occupational health and safety concerns. Whilst there is significant overlap between environmental and occupational health and safety issues relating to pesticide use, the two areas are not coterminous.

The New South Wales and Queensland codes are very similar, making it possible to develop documentation that will satisfy the requirements of both codes. The second edition of the BMP Manual covers the main areas identified by both codes.

Current Situation

The BMP Manual identifies growers' legal obligations in a number of ways. It identifies legislation applying to a particular issue (eg. pesticide storage and handling), and outlines specific legal obligations and ways to comply with them in both the self-assessment worksheets and the best practices booklets. The Standard however appears to require a more rigorously documented procedure for the identification of legal responsibilities.

Requirements

In order to satisfy this requirement, the industry will need to develop the following:

- A process to identify and maintain a register of, all relevant environmental legal obligations
- A process for communicating these requirements to cotton growers in an easily understandable form
- A BMP Manual that includes the issues required to be considered under the Queensland Code of Practice for Agriculture, and the use of the QEPA process that allows the Manual to become an approved Code under Queensland environmental legislation
- Guidance materials to assist cotton growers comply with the codes of practice relating to storage and handling of agricultural chemicals.

Clause 4.3.3 Objectives and Targets

The organisation shall establish and maintain documented environmental objectives and targets, at each relevant function and level within the organisation.

When establishing and reviewing its objectives, an organisation shall consider the legal and other requirements, its significant environmental aspects, its technological options and its financial, operational and business requirements, and the views of interested parties.

The objectives and targets shall be consistent with the environmental policy, including the commitment to prevention of pollution.

Rationale

Setting environmental objectives and targets enables an organisation to establish its goals for environmental performance. Objectives and targets should be directed at meeting the environmental policy, and addressing the organisation's legal responsibilities and significant environmental aspects.

Discussion of Implications

Objectives and targets flow directly from the determination of legal requirements and significant impacts and aspects (clauses 4.3.1 and 4.3.3). Objectives and targets should be consistent with the environmental policy. Assuming that the policy is a general high-level commitment, then the **environmental objective** is a broad plan to help achieve that policy, while the **environmental target** is a detailed performance requirement or practical goal that measures the success of obtaining the objective. "… (T)he environmental policy outlines the environmental principles and overall goals …, the objectives and targets translate these into specific and measurable terms" (Tibor and Feldman, p52).

Farm Level

The following considerations need to be taken into account when establishing objectives and targets:

- Legal and regulatory requirements
- Significant environmental aspects
- The technological and financial situation of the enterprise
- Views of interested parties.

Environmental objectives are usually stated in general terms (for example, 'increase water use efficiency' or 'reduce pesticide waste'), whereas environmental targets set more specific and often measurable goals (for example, 'increase water use efficiency by x% on 1999–2000 performance' or 'reduce pesticide waste by x% on 1999–2000 level').

In the language of ISO 14001, an environmental objective is an "*overall* environmental goal", and an environmental target is a "*detailed* performance requirement"[14].

While ISO 14001 does not specify the need for a procedure to be developed to establish objectives and targets, Brown (at 3-3250) states that "it is advisable for organisations to have standardised methodologies for doing so." Other commentators also stress the need for involvement in the process of setting objectives and targets by the people who will be responsible for achieving them as "this will ensure that the targets are practical and will give the personnel more of a stake in meeting them" (Tibor and Feldman, p53).

The need to ensure a consistent approach across farms favours strong industry guidance on establishing objectives and targets at the farm level. A suggested likely approach is to combine farm-specific environmental risk assessment with a core of 'non-negotiable' objectives (and in some cases targets) that must be incorporated into farm plans for the grower to be certified under the industry programme. The BMP Programme already requires that each objective in a given topic area be addressed before a farm can be audited and recognised as a 'BMP farm'.

'Non-negotiable' objectives would most likely be developed at the industry level in consultation with growers and other interested parties, such as governments. Where possible, more specific targets for action would also be developed to provide growers with detailed guidance on how to meet the relevant objective. These could be in the form of specific 'best management practices', (similar to the use of a number of 'target' practices to establish a given objective in the current BMP Programme), or the recommendation of other relevant performance indicators.

Setting objectives and targets requires consideration to be given to the enterprise's significant aspects. Importantly, an enterprise's significant aspects are limited to those "which it can control and over which it can be expected to have an influence"[15]. It follows that the objectives and targets set by an enterprise be within its capacity to achieve. Although an obvious point, it is an important one in relation to agricultural activities where environmental impacts may be diffuse and difficult to measure or attribute to any one farm or activity. Whilst objectives and targets at the farm level will reflect industry and external stakeholder environmental priorities, it will be vital that growers have a sense of ownership of these goals.

The objectives and targets should therefore be based on specific farm practices, inputs and outputs over which the grower has control. It will not be constructive to set farm-level objectives and targets that relate to environmental conditions over which the grower has little direct control.

Setting realistic goals is important for two reasons. First, if the objectives and targets are unrealistic, growers will be likely to fail in meeting them, or may simply ignore them. Second, the performance of the industry programme will depend to a large extent on individual growers' achieving the objectives and targets for their farm. Growers will "not be expected to go beyond reasonable limits in achieving objectives and targets. The objective is not to eliminate all adverse environmental effects, but to improve performance and minimise adverse environmental impacts while meeting all regulatory requirements"[17].

Table 5 provides an example of objectives and targets, and how they relate to an enterprise's environmental aspects and impacts.

Table 5 Examples of farm-level objectives and targets

Aspect	Impact	Objective	Target
Potential for spills when handling pesticides	Soil contamination Water contamination	Eliminate spills	Train all personnel in storage and handling techniques Establish closed transfer systems for all pesticide handling

As illustrated in Table 5, objectives are general goals, and targets are the detailed means by which the goal is met. Each target will need to have:

- Clear ownership and responsibility for achieving it
- A specified completion date
- A clear measure of success.

Targets should relate to specific outcomes. This will help ensure that growers are clear as to what it is they are working to achieve, as well as providing a clear focus for auditing purposes. These outcomes should be measurable and/or be such that they are readily verified. Brown notes that: "targets should be set with measurable, not generalised outcomes. This means that each target should have a numerical or measurable result, preferably with an indicator against which the result can be judged"[17]. The use of performance indicators to assess progress, or the achievement of targets is therefore an important consideration.

Industry level

While most of the discussion above is relevant to the setting of industry level objectives and targets, careful thought is required before establishing targets and objectives at the industry level that are to be adopted by growers. For example it may be difficult to establish specific targets at the industry level that are meaningful to every farm. There are also a number of practical and logistical issues that need to be considered, including:

- the relevance of performance data where natural cycles determine or influence the values being recorded (for example, a target to reduce the number of pesticide applications, whilst a good concept, will be heavily influenced by the pest pressure in any particular season. A better target would to introduce the elements of an integrated pest management programme)
- the confidence in any correlation between the performance indicators used, the target that has been set, and the environmental aspect that is being sought to be managed
- the cost-effectiveness of monitoring tools
- the timeliness of information generated by monitoring
- the ability and cost to collate data into a meaningful form
- the level of involvement required from a region to be able to provide meaningful information
- the effects of practices of non-cotton growers on any targets set.

Performance Indicators

Performance indicators help assess an enterprise's environmental performance. For example, indicators can be used to:

- Assess progress towards environmental objectives and targets
- Check conformance with the environmental policy
- Determine an enterprise's significant aspects
- Assess local or regional environmental conditions.

While not a requirement of ISO 14001, the use of performance indicators is recommended by ISO 14004: "When objectives and targets are set, the organisation should consider establishing measurable environmental performance indicators."[18]. Tibor and Feldman similarly note that: "objectives and targets should be linked to environmental performance indicators so that continual improvement can be monitored"[19].

Performance indicators should where possible, relate directly to environmental objectives and targets, or the environmental policy. This will help maintain growers' focus on the objective, target or policy, and gives the performance indicator context. In an industry EMS, performance indicators could be used to measure progress towards objectives and targets set at the farm and industry levels, as well as to track improvements in local or regional environmental conditions.

The use of appropriate performance indicators could help establish the credibility of an industry EMS. It may be necessary to establish a set of performance indicators that relate to a set of 'non-negotiable' objectives and targets, reflecting the priority issues determined by the industry and other stakeholders. The types of performance indicators that can be used are discussed in Chapter 8 of this report under "Key Performance Indicators". It needs to be kept in mind that typical targets under the industry programme will (initially) be the implementation of best management practices. Thus, the farm 'performance indicator' of these targets will be whether particular practices have been put in place. Related targets at the industry level would be the extent of implementation of best management practices across farms. The following is an example of how objectives, targets and performance indicators could be used in an industry programme.

Table 6 Examples of farm-level and industry objectives and targets

Objective	Reduce dependence on pesticides
Target (Grower)	To implement the specific aspects of an industry-based IPM programme by DD/MM/YY
Target (Industry)	X number of growers will be implementing IPM by DD/MM/YY
Performance indicator (Grower)	Whether IPM practices implemented
Performance indicator (Industry)	Actual Number of growers implementing IPM

Consideration will need to be given to the use of targets and performance indicators that relate to farm inputs, outputs, and local environmental conditions. Unlike targets and performance indicators based on the uptake of specific farm practices, these targets and indicators generally require the collection and collation of 'scientific' data. Where growers are responsible for monitoring and measuring performance indicators relating to for example, water use efficiency, groundwater depth or on-farm water quality, industry guidance will most likely be necessary to ensure a consistent approach across farms. Clear links between the measurements taken on farms and the relevant regional or catchment environmental values will need to be established to ensure that the collection of farm data has purpose and focus.

Grower participation in monitoring and measuring performance indicators will be limited by issues of cost and practicality. While there are a number of environmental indicators that can potentially be measured, the feasibility of growers undertaking this task is still uncertain, particularly given the large costs involved. For example, measuring the level of pesticides in water entering and/or leaving the farm requires expert analysis of the samples. A simple test for a single pesticide may cost $80–100, and not be available for 4–6 weeks, by which time the information is of little use for making immediate management decisions. While the information may be useful for modifying future management plans and/or decisions, the danger is that immediate costs are more difficult to bear if the gain is longer term and/or difficult to quantify.

Monitoring and measuring performance indicators at the farm level should be kept as simple as possible. Generally, growers do not have the resources nor expertise to undertake sophisticated monitoring and measuring of environmental conditions, and as discussed in Chapter 8 of this report, this is generally the role of governments, community groups or research organisations. Growers are best placed to monitor and measure their 'management' performance and the inputs and outputs of their operations.

Determining appropriate performance indicators will need to be done through a consultation process involving growers and external stakeholders. Appropriate objectives and targets will need to be decided upon (in a similarly consultative manner) before performance indicators are considered.

Current Situation

The BMP Programme includes objectives and targets relating to the implementation of best management practices. Many of these objectives and targets would be included in the core 'non-negotiable' objectives and targets likely to be established under an industry EMS. These objectives and targets were developed in consultation with industry organisations, growers and relevant government departments, and address farms' significant environmental aspects and legal requirements relating to pesticide use.

Requirements

A process for the establishment of environmental objectives and targets at the industry and farm levels that:

- Address the priority issues of growers, the industry and external stakeholders (taking into account growers' legal obligations and the environmental impacts of cotton production)
- Are realistic and capable of being 'owned' by those responsible for meeting them
- Incorporate appropriate indicators where possible, to measure performance or progress.

Clause 4.3.4 **Environmental Management Programmes**

The organisation shall establish and maintain (a) programme(s) for achieving its objectives and targets. It shall include

a) designation of responsibility for achieving objectives and targets at each relevant function and level of the organisation;

b) the means and time frame by which they are to be achieved.

If a project relates to new developments and new or modified activities, products or services, programme(s) shall be amended where relevant to ensure that environmental management applies to such projects.

Rationale

Environmental management programmes provide important detail relating to the ‘who, how and when’ of achieving objectives and targets, and are thus vital for the ‘doing’ of the action plans. This clause explicitly states that a responsible person and a designated timeframe for achievement are required for each of the objectives and targets. “The final planning step requires establishing and maintaining an environmental management system that can achieve the … objectives and targets” (Tibor and Feldman).

Discussion of Implications

Whilst there is no explicit definition of an environmental management programme in either ISO 14001 or 14004, this clause simply requires that responsibility for achieving the objectives and targets has to be clearly assigned, and that there needs to be a clear link to the resources required to achieve them. There is little point in setting an objective and/or target that requires the purchase of new equipment, for example, but not allocating money in the budget, or assigning someone to investigate the purchase.

An environmental management programme needs to contain the following:

- Responsibilities for achieving objectives and targets
- The means to achieve objectives and targets
- Time frames for achieving objectives and targets.

Programmes can help prioritise objectives and targets, and provide the detail necessary for meeting them. Programmes need to be reviewed and updated if circumstances change. A programme can address broad or specific issues, and can be an aggregation of environmental objectives, targets and strategic plans, or limited to a single objective and target.

Guidance on developing environmental management programmes will need to be provided to growers by the responsible industry organisation. To be most effective, these programmes will need to be farm-specific. Growers will therefore need to determine for themselves, appropriate responsibilities, time frames and means of achieving objectives and targets.

‘Programme’ corresponds to the ‘action plans’ (or to the aggregation of all the action plans) developed by growers under the BMP Program. Given the flexibility of ISO 14001 (environmental programme is not defined, although responsibilities, means for achieving and time frames are listed requirements under clause 4.3.4), the scope of an environmental programme is not vital. That is, an environmental programme can address broad or very particular issues, and the means used to accomplish objectives and targets under the programme is at the discretion of the enterprise. ISO 14001 also notes that “one or more” environmental programmes can be used, and that these “may be subdivided to address specific elements of the organisation’s operations” (page 8). For example, a number of objectives or action plans relating to the same environmental aspect (e.g. pesticide use) could sit under the one ‘programme’, or each could be considered a ‘programme’ in its own right. The Standard also suggests that environmental programmes should flesh out how objectives and targets are to be achieved, taking into account factors such as planning, design, construction and disposal (see ISO 14001, page 8).

Table 7 Examples of farm-level objectives and targets with responsibilities and time frames

Aspect	Impact	Objective	Target	Responsibility	Due Date
Pesticide use	Soil contamination Water contamination	Eliminate spills	Train all personnel in storage & handling techniques	Farm Manager	February 00
			Establish closed handling systems for all pesticide applications	Farm Foreman	August 00

Current Situation

A central aspect of the BMP Programme is the development of farm action plans for the implementation of best management practices. These action plans are directed at achieving a stated objective (the implementation of a particular best management practice), and growers are guided to include detail on responsibilities for implementing and reviewing the plan, as well as a time frame for its completion. The current structure of the BMP Programme therefore fits very well with the ISO 14001 requirement to develop environmental management programmes.

Requirement

To ensure compliance with the Standard, guidance material will need to be provided on the development of environmental management programmes that are consistent with the structure and language of ISO 14001. This should not involve significant change from the current structure of the BMP Programme.

Clause 4.4 Implementation and Operation

Clause 4.4.1 Structure and Responsibility

Roles, responsibility and authorities shall be defined, documented and communicated in order to facilitate effective environmental management.

Management shall provide resources essential to the implementation and control of the environmental management system. Resources include human resources and specialised skills, technology and financial resources.

The organisation's top management shall appoint (a) specific management representative(s) who, irrespective of other responsibilities, shall have defined roles, responsibilities and authority for

a) ensuring that environmental management system requirements are established, implemented and maintained in accordance with this International Standard;

b) reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system.

Rationale

This clause recognises that for the EMS to be effective, the commitment of the management of the organisation must be translated into commitment from the staff responsible for putting the system into practice. This commitment needs to be supported with appropriate resources and authority. To effectively implement an EMS, the statement of commitment in the environmental policy needs to be translated into a commitment of people, time and financial resources.

Discussion of Implications

The implementation of an EMS is a significant commitment of resources. Half-hearted commitment to implementing an EMS will likely be a waste of time and money. For the cotton industry, a commitment at the industry level to developing an EMS will need to be similarly supported by implementation of the recommended practices and procedures on individual farms. Strong leadership and guidance at the industry level will help simplify farm implementation requirements.

ISO 14001 states "the successful implementation of an EMS calls for the commitment of all employees of the organisation" (clause A.4.1). The industry will need to ensure that adequate resources have been allocated for the implementation of the EMS. Whilst the BMP Programme provides a good starting point, additional resources, and/or modified structural arrangements may be necessary to ensure effective EMS implementation.

At the farm level, commitment must start with the grower/manager, who must be prepared to allocate the necessary resources and responsibilities. Employees must have clear roles and responsibilities relating to the implementation of the EMS. In relation to cotton farms, it is likely that all employees will have responsibilities for the maintenance of the EMS. Some employees will have direct and specific roles relating to the implementation of particular components of the EMS, and others will have more general responsibilities to work in a manner that is consistent with the environmental policy. For employees with specific or managerial responsibilities, the development of a formal job description may be warranted. However, this clause does not require a new set of job descriptions to be developed, and it would be appropriate on most farms to simply incorporate environmental responsibilities with existing work responsibilities.

The Standard requires the appointment of a "specific management representative" to oversee the implementation and maintenance of the EMS. This could either involve employing a dedicated 'environmental officer', or otherwise assigning the role to a current employee. This position provides an important focus for communication and action, and would most likely perform many of the administrative functions necessary to implement the EMS. Under a 'dual' industry scheme, these positions would have to be established at both the industry and individual farm levels. On many farms it is likely that this role will fall to the manager and it is unlikely to be practical to have a dedicated "Environmental Officer" on smaller farms with few or no full-time employees. The Standard recognises that in small or medium-sized enterprises, the various responsibilities may be undertaken by one person.

Example — Job Description of an Environmental Officer

Environmental Officer – is responsible for overseeing the day to day implementation of the EMS. The officer is responsible for maintaining all relevant EMS documentation, and keeping environmental records. The officer will co-ordinate the internal audits and arrange external audits and environmental reviews with management. The officer has the authority to take action under the procedures for non-conformances and any necessary corrective action. The officer is the first point of contact for internal or external inquiries regarding the EMS.

Specific responsibilities include:

- Maintenance of EMS documentation and related record keeping
- Waste monitoring and documentation
- Tree line establishment

- Cost control – review and monitor farm expenditure in relation to the EMS
- Monitoring water use
- Monitoring soil fertility
- Monitoring levels of soil contamination
- Report on incidents, corrective actions
- Conduct internal audits.

ISO 14001 states: "the successful implementation of an EMS calls for the commitment of all employees of the organisation" (p8). All members need to be aware of their general and specific environmental responsibilities and to undertake their work in a way that meets this responsibility.
ISO 14004 notes: "employees at all levels should be accountable, within the scope of their responsibilities, for environmental performance in support of the overall environmental management system" (p15).

Current Situation

The human and financial resources committed to the BMP Programme by industry organisations are a clear demonstration of the industry's commitment to the programme. A number of positions have been established within industry organisations for the implementation and administration of the programme, and funding has been allocated for the development of further best management practice guidance material. This commitment of resources will obviously need to be continued as the programme expands. To ensure effective implementation and administration of an industry EMS, the roles and responsibilities of industry employees will need to be formalised, and possibly centralised.

The BMP Programme includes recommendations for the development of farm plans that include the assignment of responsibilities for implementing best management practices. However, the programme does not address the issue of organisational structure and responsibilities to the extent required by the Standard.

Requirements

Further investigation of the resource and structural requirements for implementing an industry EMS needs to be undertaken. Particular attention needs to be paid to determining the adequacy of the arrangements under the BMP Programme, for the implementation of an EMS.

Guidance material for growers on assigning appropriate roles and responsibilities and roles for farm implementation of the EMS will need to be provided.

Clause 4.4.2 **Training, Awareness and Competence**

The organisation shall identify training needs. It shall require that all personnel whose work may create a significant impact upon the environment, have received appropriate training.

It shall establish and maintain procedures to make its employees or members at each relevant function and level aware of

a) the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system;

b) the significant environmental impacts, actual or potential, of their work activities and the environmental benefits of improved personal performance;

c) their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements;

d) the potential consequences of departure from specified operating procedures.

Personnel performing the tasks which can cause significant environmental impacts shall be competent on the basis of appropriate education, training and/or experience.

Rationale

The effectiveness of the EMS depends on all employees being aware of and acting on their environmental responsibilities. As well as ensuring employees are trained to effectively carry out particular ‘practical’ tasks, managers must ensure that employees are aware of the procedures that must be carried out to maintain the EMS.

Appropriate training helps ensure that staff have the skills to perform their duties and responsibilities properly, and enables staff to understand the environmental relevance of their actions. Brown notes “Environmental training is fundamental to the demonstration of due diligence or duty of care” (Brown (1) at p1256.3).

Discussion of Implications

Brown notes that “it appears to be reasonable to interpret this clause to mean that all personnel should receive environmental training, eg. environmental awareness training, while those whose work may create a significant impact upon the environment receive more specialised training” (Brown (1) at page 1256), and that “it is ultimately management’s responsibility to train the work force, not the workers’ responsibility to instinctively know how to do things correctly” (Brown (1) at p1256.3).

Training should be based on the organisation's identified environmental aspects and impacts. Training should be specific where necessary, to meet the identified needs of individuals. Training can consist of formal education, work experience, courses or supervised on-the-job training. Documentation of training is essential and a formal training record must be maintained (also Tibor and Feldman at pps57–58).

The first step in determining staff training needs is to identify the elements in the environmental management system that are relevant to each staff member (given their responsibilities), and to then identify the skills required meet these responsibilities. A matrix can then be drawn up listing the current level of training for each employee. A simple example is listed below:

Table 8 Assessment of staff training needs

Name:

Position:

Assessment Date:

Assessed by:

COMPETENCY	NIL	LOW	MEDIUM	HIGH
Chemical Handling		O		X needs to undertake training course
Calibration of spray equipment			O	X needs more experience
Computer Skills			X	O Trained & experienced

X – desired level of competency
O – current level of competency

Emergency Response Training

An important component of environmental training is that relating to the handling of emergencies. Experience at Oakville Pastoral Co. suggests that it may be difficult to train staff in environmental emergencies. It is an implicit requirement of the Standard (Clause 4.4.7) that staff know what to do in a chemical spill or fire, and that procedures are periodically tested.

As Oakville Pastoral Company is located 200 kilometres from the nearest regional centre, it was expensive to arrange the required specialist training. It may be possible to train multiple farms at once to reduce the cost.

Contractors

Many cotton farms have moved towards using contractors for more of the specialised work on the farm (for example, pesticide application, excavating, grading, cotton picking and cotton module hauling). ISO 14001 requires that contractors and suppliers be made aware of an enterprise's relevant environmental practices and procedures. ISO 14004 also makes reference to contractors, noting that "The organisation should also ensure that contractors working at the site provide evidence that they have the requisite knowledge and skills to perform the work in an "environmentally responsible manner".

All contractors will have environmental and occupational health and safety responsibilities when they perform work on the farm and need to be briefed on their responsibilities before they start work.

New Staff

Staff beginning work will need to undergo a formal induction programme, which may involve for example, a checklist system that incorporates the following:

- an explanation of why the environmental management system has been developed, and what the environmental policy is
- a description of the environmental impacts their work can have and why it is important that established procedures are followed
- emergency procedures
- communication procedures and responsibilities.

Certain jobs will also require induction training for the specific activities performed as part of that job, for example:

- chemical handling procedures
- tractor and implement operation
- irrigation and pump procedures
- workplace testing programmes and occupational health and safety in the workplace.

Induction training gives the enterprise an opportunity to introduce at the beginning of an employee's term the culture of the farm. The focus of the training needs to be on making the employee aware of their responsibilities under the EMS.

Whilst this could be partly achieved by having new employees read the relevant documentation and any associated procedures, a formal induction should take place. Occupational health and safety requirements include employee induction programmes that could be built upon or adapted to incorporate environmental issues.

Involvement in the Rural Training Council of Australia's Agriculture Training Package will help compliance with staff training needs.

Current Situation

The BMP Manual addresses employee training in relation to pesticide use. Occupational health and safety legislation has various training requirements, including the need to keep a register of employee training, which will be incorporated into the BMP Manual in the occupational health and safety module, proposed for completion by June 2001.

There is also a cotton-specific version of the Rural Training Council of Australia's Agriculture Training Package ("ATP"). Whilst there is currently no cross-referencing between the ATP and the BMP Manual, the ATP's Cotton Production course materials are due for review in the next 12 months. This will be provide opportunity to ensure that people completing the Training Package are also fulfilling the requirements of the industry EMS.

Requirements

To meet the requirements of this clause, cotton growers will need:

- to identify the training needs of their staff (and themselves)
- to determine appropriate training courses that address any identified training needs
- to have a programme in place that outlines the planned training of staff
- to maintain a register of training undertaken by staff
- to establish an induction programme for new staff and contractors.

Whilst standard training programmes, such as those relating to chemical handling (eg. ChemCert) are available from local TAFE Colleges or private providers, there may be a need for the industry to facilitate the provision of specialist training not available in rural areas.

Assessments can be made at an industry level as to the appropriateness of a training course for meeting the requirements of this clause.

Clause 4.4.3 Communication

With regard to its environmental aspects and environmental management system, the organisation shall establish and maintain procedures for

a) internal communication between the various levels and functions of the organisation;

b) receiving, documenting and responding to relevant communication from external interested parties.

The organisation shall consider processes for external communication on its significant environmental aspects and record its decision.

Rationale

Good internal communication helps ensure that everyone in an enterprise (or industry) understands their own and other people's roles and responsibilities under the EMS. Good communication between members of the enterprise is necessary for the proper implementation of the EMS.

External communication with stakeholders is important for the credibility of the EMS. The industry EMS will be developed in consultation with external stakeholders. Ongoing communication with these stakeholders will therefore be important to ensure the continued development of the programme in a way that is acceptable to the industry and external stakeholders.

Discussion of Implications

An industry EMS would require the development of procedures covering the following types of communications:

- Internal industry communication
- Internal farm communication
- External communication by the industry
- External communication by individual growers.

Internal industry communication

Communications between industry organisations, and between industry organisations and growers will focus on conveying information on industry environmental policy, best management practices, as well as guidance on the implementation and operation of the industry EMS. A number of existing industry communication arrangements and forums could be used for this purpose (for example, the BMP Management Committee, the BMP Audit Office, and local cotton grower associations). To ensure effective and consistent information is provided throughout the industry, EMS communications should where possible be controlled by a central responsible industry organisation. This organisation would be responsible for overseeing the implementation of the industry EMS, and therefore of any communication procedures developed pursuant to the EMS.

Data on the implementation of best management practices, and other performance indicators could be collated by this organisation and reported to industry members and external stakeholders.

Internal farm communication

Procedures for communication between farm management and farm employees need to be put in place to ensure the effective operation of the EMS. Given the small number of permanent employees with which many farms operate, these procedures should be kept simple and focused. Guidance on appropriate communication procedures will be provided by the responsible industry organisation. However, these procedures should be flexible to ensure they are appropriate to the management styles already in place on farms. Farm communication procedures will reflect the organisational structure and EMS responsibilities determined under Clause 4.4.1. Internal farm communication procedures could include or cover the following:

- Induction training and other training programmes
- Written instructions/memos to employees
- Noticeboards
- Formal and informal meetings.

Information to be communicated would include:

- The environmental policy
- Employee roles and responsibilities
- Work instructions
- Details of best management practices
- Job training
- Audit reports and results of the management review
- Progress towards objectives and targets.

External communication by the industry

Ongoing communications with governments, researchers and community groups will be important to ensure the effectiveness and credibility of the industry programme. The industry organisation responsible for the administration of the programme should be the focal point for these communications. This will ensure that communications regarding the EMS are efficient and consistent[20]. Communications could include reporting on the progress of the industry programme, periodic consultation on the development of the programme, complaints and media enquiries.

Procedures for external communications will need to be developed on an industry-wide basis, most likely through a representative committee, such as the Australian Cotton Industry Council, whose members represent each sector of the cotton industry.

External communication by individual growers

Whilst the majority of external communications will be handled at the industry level, growers will need to be provided with guidance on communication procedures for the following:

- Notifying neighbours of pesticide applications
- Handling complaints and enquiries about their operations
- Reporting to local communities on progress (likely to be done through cotton grower associations).

Current Situation

The cotton industry has effective internal communication arrangements already in place. These existing arrangements will be used where possible for communication procedures required under an industry EMS. The BMP Programme contains advice on notifying neighbours of pesticide applications, and the implementation and auditing components of the programme provide mechanisms for effective communications between growers and industry organisations. The BMP Management Committee has proved to be an effective forum for the exchange of information and views that contribute to the development of the programme. This or a similar forum will be a necessary component of the implementation of an industry EMS.

Requirements

Internal industry communication

Existing industry structures and arrangements will be used where possible. Formal procedures will need to be developed by the responsible industry organisation to ensure ‘EMS communications’ are effective and consistent.

Internal farm communication

Guidance material will need to be developed at the industry level on farm communication procedures, and the information to be communicated.

External communication by the industry

Procedures for external communications will need to be developed on an industry-wide basis, through a representative committee such as the Australian Cotton Industry Council.

External communication by individual growers

Guidance on the type of information that growers may need to communicate to external stakeholders, and procedures for doing this will need to be developed at the industry level.

Clause 4.4.4 **Environmental Management System Documentation**

The organisation shall establish and maintain information, in paper or electronic form, to

a) describe the core elements of the management system and their interaction;

b) provide direction to related documentation

Clause 4.4.5 **Document Control**

The organisation shall establish and maintain procedures for controlling all documents required by this International Standard to ensure that

a) they can be located;

b) they are periodically reviewed, revised as necessary and approved for adequacy by authorised personnel;

c) the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed;

d) obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use;

e) any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified.

Documentation shall be legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period. Procedures and responsibilities shall be established and maintained concerning the creation and modification of the various types of document.

Rationale Documentation provides a written framework for EMS implementation and provides evidence that an EMS has been properly implemented. Appropriate documentation and effective document control help ensure that all employees clearly understand and follow their responsibilities under the EMS.

"The objective of maintaining environmental management records is to demonstrate conformance to the requirements of the Standard. Records should be developed and maintained at a level and in a form appropriate to the EMS and to the organisation … Organisations should not make the serious mistake of believing that good documentation is the equivalent of a properly functioning EMS" (Brown (1) at p1648).

Discussion of Implications

It is essential to remember that the primary focus should be on implementing the EMS and improving environmental performance, and not on developing a complex documentation system – a single filing cabinet, with one core manual should be sufficient, as long as a few key principles are addressed.

It is essential to keep EMS documentation simple. Tibor and Feldman note “when creating EMS documentation, simplicity is critical” and “a key guideline in writing EMS documentation is to keep all processes and procedures short and simple” (at p62).

Critical issues are:

- That **appropriate** and relevant documents and records are kept at both the industry and farm levels
- That documents and records are kept in a **systematic manner** so that they can be **easily accessed**
- That documents and records are **maintained up-to-date**, with the **current version easily identifiable**.

In order to help achieve these requirements, each document will need to have certain characteristics, including:

- Be written in plain English
- Appropriate for the audience (i.e. the person using the document)
- Unique (i.e. there should not be two different documents performing exactly the same function)
- Have a specific purpose
- Clear ownership (ie. who uses and/or who is responsible for maintaining it)

Gilbert and Gould identify three levels of documentation:

1. The Environmental Management Manual.
   This is the core of EMS, and will be based on the structure of the Standard (ie. policy, planning, implementation, monitoring and review). This will provide directions to the existence and location of other documents.

2. Procedures.
   These identify both how the various components of the EMS were developed, as well as outlining the practices and processes implemented as a result. They need to exist for the following:
   - Environmental aspects and impacts
   - Legal and regulatory requirements
   - Roles and responsibilities
   - Communication
   - Monitoring and measurement
   - Corrective and preventative action
   - Records
   - Audits
   - Training and awareness
   - Document control
   - Emergency preparedness.

3. Working instructions (standard operating procedures). These will be the detailed instructions on how a particular job is carried out; for example a pesticide application will involve contacting neighbours, monitoring weather conditions before and during the application and cleaning down the application equipment.

ISO 14004 suggests that summary documentation can be used.[21] In an industry scheme it will be important for the responsible industry organisation to provide summary and guidance documents to growers. For example, a checklist of the elements of ISO 14001 indicating where the relevant documentation is located (and a summary of its contents) could be used[22]. It is also important to note that there does not have to be one central 'Manual' that contains all the information required under the EMS. Provided that the location of documents is easily identified, then the exact location, or whether a central location is used, is not important. A document can be filed or stored in the most appropriate location for that particular document (for example, an inventory of pesticides stored may be kept in the chemical store itself).

Summary and template documents should be provided by the industry. Care needs to be taken that the implementation of farm EMSs does not become driven by record keeping and documentation. These components, whilst important, need to be emphasised as providing the evidence of the EMS, rather than the EMS itself.

The use of a comprehensive 'one size fits all' template EMS document is not considered appropriate, as it could prove to be inflexible, overwhelming, and could distract from other core requirements of an EMS such as establishing objectives and targets, and putting work procedures and practices in place to achieve them.

In addition to developing documents that cover the core elements of the EMS, the production, use, storage and disposal of all EMS documents must be properly controlled to ensure certainty in the implementation and maintenance of the EMS. Whilst leadership and guidance on document control procedures can be provided by the responsible industry organisation (as the author of many of the EMS documents), it will be important that growers implement effective procedures in relation to their own operations. Examples of practical methods to help ensure effective document control include:

- Assigning responsibility for the maintenance of each document
- Using colour coding for different types of documents
- Using headers and footers to identify documents
- Regularly reviewing the currency and relevance of all documents.

The detail and complexity of the procedures used to control EMS documents should be kept to a minimum. As with the nature of the documentation itself, simplicity and ease of use are vital.

Current Situation

The BMP Manual provides a good starting point for documentation capable of supporting an ISO 14001 EMS. For example, it contains guidance on assessing environmental aspects associated with pesticide use, developing action plans, and establishing work practices and procedures covering emergencies and operational controls. The auditing component of the BMP Programme emphasises the need to document the implementation of best management practices, reinforcing the need for growers to both properly use the industry-produced documents, and to take responsibility for the development and use of their own documentation. However, the contents of the Manual would need to be expanded and modified to achieve compliance with ISO 14001. For example, guidance on assessing environmental aspects associated with cotton production beyond pesticide use, as well as documentation of some of the specific procedural requirements of the Standard (for example, communication, non-conformance and corrective action, and management review) will need to be developed.

Requirements

Documents that address each element of the Standard will be required. Although the BMP Programme has produced documents that either cover or are consistent with a number of the clauses of ISO 14001, considerable more work is required to ensure conformance to the Standard. Guidance on how documents under the BMP Programme meet the requirements of ISO 14001 will need to be developed (ie. a concordance document that checks ISO requirements against BMP Programme documents).

The development of document control procedures for use at both the industry and farm levels, and guidance for growers on the implementation of these procedures will be required.

Document control procedures will need to:

- Identify each document necessary to support the EMS, including its purpose, currency and ownership/use
- Deal with obsolete documents i.e. facilitate their removal and/ or replacement.

Clause 4.4.6 Operational Control

The organisation shall identify those operations and activities that are associated with the identified significant environmental aspects in line with its policy, objectives and targets. The organisation shall plan these activities, including maintenance, in order to ensure that they are carried out under specified conditions by

a) establishing and maintaining documented procedures to cover situations where their absence could lead to divisions from the environmental policy and the objectives and targets;

b) stipulating operating criteria in the procedures;

c) establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organisation and communicating relevant procedures and requirements to suppliers and contractors.

Rationale

This clause seeks to ensure that there are established work procedures for those areas identified as significant ie. those areas most likely to lead to a deviation from the environmental policy and the objectives and targets.

Establishing written operational controls or work procedures helps ensure tasks are carried out consistently and in a way that minimises the risk of adverse environmental impacts.

Discussion of Implications

"It is preferable to add environment to existing operational procedures, rather than establishing a new range of operating procedures based only on environmental aspects" (Brown (1) at p1295).

Guidance on the matters that may require written operational controls will need to be provided by the responsible industry organisation. Many of the best management practices currently recommended in the industry programme represent 'operational controls'. Whilst growers will be responsible for ensuring that the operational controls implemented on their farms are appropriate and cover all relevant activities, the recommendations provided by the industry organisation will be a good starting point for developing farm-specific practices and procedures.

Operational controls developed under the BMP Programme include work routines for the storage and handling of pesticides, and the calibration and maintenance of pesticide application equipment. Further operational controls will need to be developed to address activities such as the operation of farm machinery and equipment, maintenance of farm machinery and infrastructure, and the handling of fertilisers, fuel and waste.

The Standard requires operational controls to be communicated to contractors and suppliers. Given that many growers surveyed use contractors and the services of agronomists and chemical suppliers, particular attention will need to be paid to this requirement. The industry is currently investigating ways to involve suppliers and service providers in the BMP Programme. This will help develop the programme as a genuine whole-of-industry scheme, and should include educating suppliers and contractors on best management practices, and encouraging growers to use suppliers and contractors whose goods and services are compatible with the objectives of the industry programme[23].

Current Situation

As noted above, many best management practices could be implemented under an industry EMS as ‘operational controls. The BMP Manual currently recommends a range of practices relating to pesticide use that can be used in routine farming operations. Best management practices are currently being developed for water and fuel use, which will include relevant operational controls for the management of these production inputs.

Requirement

Guidance material on operational controls will need to be developed at the industry level. Growers will be responsible for implementing appropriate operational controls on their farms, and of ensuring that suppliers and contractors are aware of the procedures and practices that have been put in place.

Industry strategies to educate and involve suppliers, contractors and service providers in best management practices will also need to continue to be developed.

Clause 4.4.7 Emergency Preparedness and Response

The organisation shall establish and maintain procedures to identify the potential for and respond to accidents and emergency situations, and for preventing and mitigating the environmental impacts that may be associated with them.

The organisation shall review and revise, where necessary, its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situations.

The organisation shall also periodically test such procedures where practicable.

Rationale

Significant environmental impacts can result from many accidental or uncontrollable events, such as chemical spills, fires or severe storms. Emergency preparedness helps reduce the potential impact that these events can have. In particular, the Standard requires reviews of emergency procedures to be carried out after the occurrence of an emergency or accident[24].

"Emergency plans and procedures should be established to ensure that there will be an appropriate response to unexpected or accidental incidents" (ISO 14004, p20).

Discussion of Implications

To ensure all reasonably foreseeable events are accounted for, industry guidance should be provided that lists the types of emergencies that could occur on a cotton farm. This list could include:

- Pesticide drift
- Pesticide spills
- Petrol or other chemical spills
- Fires
- Severe storms/stormwater spill
- Storage dam bursts or overflow.

Template emergency response plans that can be adapted to individual farms need to be developed for each of these possible emergencies. These plans would cover the following:

- Responsibilities for notifying management, and emergency crews
- Emergency contact numbers; farm staff and external (fire, ambulance, SES etc)
- A check-list of actions and safety precautions

- Location of emergency equipment/facilities
- Farm maps, showing hazards and giving directions to the farm for emergency crews.

Emergency plans and procedures should be regularly reviewed. Employees must be familiar with the emergency plans and procedures, which should be part of induction training, and ongoing periodic training. Industry guidance on training and review procedures will need to be provided to growers.

Training for emergencies needs to be explored further by the industry. The (admittedly local) experience of Oakville Pastoral Company was that formal emergency training was difficult to source and the local fire brigade, who were initially approached for training on fuel and chemical spills emergency procedures and safety equipment, were unable to contract out their expertise and to train people for emergencies. Some other possibilities for training staff include:

- Approaching fuel dealers – given the large volumes of fuel purchased it may be in the interest of fuel suppliers to provide another service for growers (assuming they have the expertise)
- Approaching fire extinguisher companies for access to accredited trainers
- TAFE courses
- Volunteer Rescue Association training.

Current Situation

The BMP Manual provides guidance on emergency procedures covering a number of situations, including:

- Storms
- Pesticide spills
- Fire.

Guidance Material

Guidance material on emergency procedures covering the range of emergencies that could occur on a cotton farm need to be developed. This should include guidance on employee training and reviews of emergency procedures.

Clause 4.5 Checking and Corrective Action

Clause 4.5.1 Monitoring and Measuring

The organisation shall establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of its operations and activities that can have a significant impact on the environment. This shall include the recording of information to track performance, relevant operational controls and conformance with the organisation's environmental objectives and targets.

Monitoring equipment shall be calibrated and maintained and records of this process shall be retained according to the organisation's procedures.

The organisation shall establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations.

Rationale

Monitoring and measuring helps ensure that the procedures and practices put in place under the EMS are routinely carried out, and that the enterprise is operating in a way consistent with its performance goals and legal obligations.

Discussion of Implications

There are three types of monitoring contemplated by this clause – monitoring and measuring operational controls, progress towards objectives and targets (ie. performance) and evaluating legal compliance.

Operational Controls

This requires monitoring of specific activities and their impacts, and the controls that have been put in place to minimise these impacts. In relation to cotton farms, monitoring could be carried out with respect to the following activities and operational controls:

- Pesticide applications
- Pesticide storage and handling
- Waste disposal, waste recycling
- Water abstraction (river, bore)
- Water quality monitoring (river, bore)
- Soil testing
- Insect monitoring
- Soil moisture measurement
- Irrigation scheduling

- Machinery operation and maintenance
- Calibration of monitoring equipment[25]

Industry guidance on operational controls that should be subject to monitoring will be required. This will help ensure that monitoring is undertaken in relation to activities that can impact on priority environmental values, and that monitoring is done in a consistent manner across farms.

Objectives and targets

Monitoring and measuring progress towards objectives and targets provides the opportunity for environmental performance to be continually assessed. Under an industry EMS many initial objectives and targets will be to implement best management practices. Growers will be readily able to monitor and measure their progress towards these objectives and targets, and can provide the responsible industry organisation with information on their progress to help establish an industry picture.

What needs to be monitored and measured depends on what is outlined to be improved in the objectives and targets. The Standard only requires monitoring and measuring to be undertaken in relation to significant impacts (which of course must be covered by specific objectives and targets).

Thus critical issues to deal with are:

- Relevance (of the information generated) to the operation (ie. not everything needs to be measured or monitored simply because it can be)
- Cost
- Timeliness of information.

Performance indicators are discussed in detail in Chapter 8 – Key Performance Indicators.

Management System

Monitoring and measuring can be undertaken in relation to the management system, for the following:

- Frequency of training, auditing or other preventative measures
- Number of legal infringements/community/neighbour complaints
- Capital or other expenditure on environmental improvement initiatives
- Percentage of objectives/targets achieved (on time?).

Operations

Monitoring and measuring can be undertaken in relation to farming operations, for the following:

- Amount of water used/water use efficiency
- Amounts of toxic/hazardous substances used
- Amount of energy used (fuel and electricity)
- Amount of waste generated
- Fraction of packaging or containers recycled
- Number of emergencies/corrective actions

Environmental

Monitoring and measuring can be undertaken in relation to environmental conditions for the following:

- Depletion rate of non-renewable natural resources
- Impacts on wetlands or sensitive ecosystems of concern
- Ambient concentrations of hazardous by-products in various media – water quality
- Biological diversity (area reserved/regenerated for/with native species)

There are a number of levels at which environmental performance indicators can be measured; the farm level, the industry level and the region of catchment. Using catchment or regional environmental conditions as direct indicators of the success of an industry based environmental programme is however problematic. As Tibor and Feldman note:

"Evaluating the relationship of such indicators to any single organisation's activities is extremely challenging, unless the operational system and the environmental medium are virtually isolated from other systems" (Tibor and Feldman at p153).

"In most cases it is scientifically impossible to quantify the causal linkages between releases and consequences. Nevertheless, the environmental aspect review may determine that it is important to track certain environmental indicators that are of concern to key stakeholders and are believed to be linked to the organisation's activities" (Tibor and Feldman at p155).

Legal Compliance

The identification of legal requirements will be done at the industry level. That is, the responsible industry organisation will provide growers with summary information on their general legal responsibilities. Guidance will also be provided where necessary on issues where growers may have specific legal obligations (for example, licence requirements for water use or dangerous goods storage). It will be up to growers to relate the industry guidance material to their own operations.

Growers will also need to assess their situation periodically (at least annually). Industry guidance on grower legal obligations will therefore need to be kept up to date. Guidance material will need to be updated whenever significant legislative changes are introduced, and reviewed at least annually.

Current Situation

The BMP Programme requires growers to monitor a number of farm procedures and activities, as well as their progress towards the objectives outlined in the BMP Manual. However, to achieve compliance with ISO 14001, guidance material will need to be developed for monitoring procedures that more explicitly cover significant activities (ie. operational controls), and that measure progress towards objectives and targets. Guidance material on growers' legal obligations, and on how they assess their legal situation will also need to be developed.

Requirements

The development of guidance material covering the following issues is required:

- Farm activities, operational controls and work procedures that should be subject to routine monitoring
- Responsibility for monitoring and measuring
- Timing and frequency of monitoring and measuring
- Record keeping in relation to monitoring and measuring
- Action required where non-conformance is found (see also discussion of clause 4.5.2)
- Protocols for monitoring and measuring progress towards objectives and targets (for example, determination of performance indicators, and methods for the collection and collation of data)
- Assessment of compliance with legal obligations.

Clause 4.5.2 Non-Conformance and Corrective and Preventive Action

The organisation shall establish and maintain procedures for defining responsibility and authority for handling and investigating non-conformance, taking action to mitigate any impacts caused and for initiating and completing corrective and preventive action.

Any corrective or preventive action taken to eliminate the causes of actual and potential non-conformances shall be appropriate to the magnitude of problems and commensurate with the environmental impact encountered.

The organisation shall implement and record any changes in the documented procedures resulting from corrective and preventive action.

Rationale

Problems or weaknesses in the procedures and practices that constitute the EMS could lead to unintended environmental impacts. Procedures should therefore be in place to correct any such 'non-conformances' and ensure that they are prevented from recurring. In simple terms, problems (and potential problems) in the EMS need to be fixed as soon as they are identified, and prevented from happening again.

Discussion of Implications

Non-conformance with the EMS is likely to be detected during monitoring and measuring, audits, management review, or by employees undertaking day to day tasks. Procedures for handling non-conformance should address the following:

- Definition of non-conformances, to ensure their detection
- Responsibilities for reporting and investigating an identified non-conformance
- Responsibilities for determining appropriate corrective and preventive action
- Responsibilities for reporting on (and recording) the cause of a non-conformance, and on the corrective and preventive actions taken.

To ensure that non-conformances are quickly identified and acted on, effective communication procedures and clear workplace responsibilities need to be in place. Industry guidance material on identifying and acting on non-conformances, and on the links between non-conformance and monitoring and measuring, audits, management review, communication and workplace responsibilities, will need to be developed.

Current Situation

The BMP Programme provides for monitoring and review of farm action plans and practices, and for the need for follow-up action where plans are incomplete or where certain practices are not in place. However, procedures for identifying and acting on deficiencies in farm practices or plans have not been made explicit. Compliance with ISO 14001 will require the industry to develop guidance material, and oversee the implementation of appropriate procedures for identifying and acting on non-conformances.

Requirements

Guidance material will need to be developed to assist growers put procedures in place to identify **and** act on non-conformances.

Clause 4.5.3 Records

The organisation shall establish and maintain procedures for the identification, maintenance and disposition of environmental records. These records shall include training records and the results of audits and reviews.

Environmental records shall be legible, identifiable and traceable to the activity, product or service involved. Environmental records shall be stored and maintained in such a way that they are readily retrievable and protected against damage, deterioration or loss. Their retention times shall be established and recorded.

Records shall be maintained, as appropriate to the system and to the organisation, to demonstrate conformance to the requirements of this International Standard.

Rationale

Records provide evidence of the development, implementation and maintenance of the environmental management system, and are therefore a fundamental requirement for verifying the existence of effective environmental management. They can also be used in internal assessments of performance, for example during management reviews.

"The key features of good environmental information management include means of identification, collection, indexing, filing, storage, maintenance, retrieval, retention and disposition of pertinent environmental management system documentation and records" (ISO 14004, p22).

Discussion of Implications

The Standard requires procedures to be put in place for the identification, maintenance and disposal of environmental records. Industry guidance on the types of records that must be kept will be needed. For example, records will need to be kept of the following:

- Policy statement
- Legal obligations (including licences)
- Responsibilities under the EMS
- Operational controls and best management practices
- Monitoring procedures and results
- Employee training
- Communication procedures
- Evaluation of environmental aspects/impacts
- Objectives, targets and programmes
- Emergency procedures

- Cases of non-conformance and the corrective and preventive action taken
- Audit reports
- Results of management review.

A number of these EMS records will be developed at the industry level. For example, the environmental policy, objectives, best management practices and legal obligations at the farm level will be largely determined by the responsible industry organisation. Indeed, the guidance material developed at the industry level will necessarily cover each component of the Standard, and will form the basis of EMS documentation and record keeping at the farm level. Growers will need to maintain farm-specific records where necessary, such as in relation to worker training, environmental programmes, monitoring procedures and results, communication procedures, and audit results. Guidance material developed by the industry will therefore need to address the requirements of the Standard, and provide growers with a flexible framework that can be adapted to their operations.

Guidance on record keeping will need to keep in mind that EMS records should have the following characteristics:

- Comprehensive; ie. they must (along with EMS documentation) demonstrate compliance with the Standard
- Simple; the information collected must be precise and concise, with a clear purpose
- Accessible and protected against damage; records must be easy to locate and use
- Integrated; records should be clearly referenced to the farming activity and component of the EMS to which they relate.

It will be important to keep farm administrative tasks simple. Industry guidance material must be user friendly, and flexible to enable growers to integrate it with their operations. For example, where possible, elements of the Standard should be combined under a single topic (possibly as per the Standard itself, i.e. planning, implementation etc), and record keeping should have a farming context.

Other requirements include developing procedures for creating, identifying, storing and disposing of records. This is discussed under “EMS Documentation”.

Current Situation

The BMP Manual itself generates records, and requires various records to be kept in relation to pesticide use. However, a systematic approach to the maintenance of records needs to be detailed in the Manual if it is to form the basis of an EMS. To simplify the approach, consideration should be given to integrating the record keeping and document control elements of the Standard.

Requirements

Guidance material for growers on the types of records that must be maintained to support an EMS, and on how to maintain and control records, will need to be developed.

Clause 4.5.4 Environmental Management System Audit

The organisation shall establish and maintain (a) programme(s) and procedures for periodic environmental management system audits to be carried out, in order to

a) determine whether or not the environmental management system

1) conforms to planned arrangements for environmental management including the requirements of this International Standard; and

2) has been properly implemented and maintained; and

b) provide information on the results of audits to management.

The organisation's audit programme, including any schedule, shall be based on the environmental importance of the activity concerned and the realities of previous audits. In order to be comprehensive, the audit procedures shall cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results.

Rationale

Auditing provides an opportunity for the organisation to check the operation of its EMS. The assessment that an audit provides can help the organisation identify weaknesses and areas for improvement in its EMS or environmental performance. Certification to the Standard is evidence that an effective EMS is in place. In the words of ISO 14001: "demonstration of successful implementation of this International Standard can be used by an organisation to assure interested parties that an appropriate environmental management system is in place" (page v–vi).

Discussion of Implications

It is important to keep in mind that "the key distinguishing characteristic of EMS audits is that they focus on management planning and control activities related to environmental performance, not on environmental performance specifically"[26]. An EMS audit can be carried out either internally or by a third party. As ISO 14004 notes: "audits of the EMS can be carried out by the organisation personnel, and/or by external parties selected by the organisation. In any case, the person(s) conducting the audit should be in a position to do so objectively and impartially and should be properly trained"[27].

Under the dual scheme being investigated by the industry, EMS audits would be carried out by both internal and external auditors. A dual scheme could involve group certification arrangements similar to those developed under the Enviro-Ag Scheme in New Zealand.

Group certification would require third party audits to be carried out on the industry organisation responsible for administering the programme, as well as (randomly) on individual farms. Additionally, the industry would be responsible for auditing all farms under the programme, to ensure they had fully implemented the components of the EMS.

Current Situation

Under the BMP Programme, growers are audited on their adoption of the 'BMP process' (ie. assess, plan, do, review), as well as their implementation of specific best management practices. This helps growers measure their progress, and verifies the implementation of best management practices. Auditing is carried out by industry-accredited individuals who report to an industry body (currently the Cotton Research and Development Corporation). These auditors are familiar with cotton production systems and farming practices, and have therefore proven to be effective assessors of the implementation of best management practices.

Auditing the implementation of BMPs will continue to be an important component of the industry programme. If a goal of the programme is to foster the adoption of BMPs, then both the extent of adoption of BMPs, and the 'quality' of the practices implemented should be included as indicators of success of the programme.

Requirements

Arrangements for internal and external audits of farm EMSs will need to be put in place.

Clause 4.6 Management Review

The organisation's top management shall, at intervals that it determines, review the environmental management system, to ensure its continuing suitability, adequacy and effectiveness. The management review process shall ensure that the necessary information is collected to allow management to carry out this evaluation. This review shall be documented.

The management review shall address the possible need for changes to policy, objectives and other elements of the environmental management system, in the light of environmental management system audit results, changing circumstances and the commitment to continual improvement.

Rationale

This clause completes the loop of continual improvement that is central to any EMS. ISO 14004 states "the concept of continual improvement is embodied in the EMS. It is achieved by continually evaluating the environmental performance of the EMS against its environmental policies, objectives and targets for the purpose of identifying opportunities for improvement" (clause 4.5.3). The management review provides an opportunity to evaluate each component of the EMS, and to make any necessary changes to the procedures and practices.

Discussion of Implications

Effective evaluation of an industry EMS would require reviews to be undertaken at both the farm and industry levels. Reviews should address each component of the EMS[28], with particular attention to the following:

- The environmental policy
- Objectives, targets and environmental performance
- Environmental programmes
- Audit findings.

The review of the EMS will help ensure its continuing appropriateness. At the industry level, the review will need to consider industry priorities in light of changes in legislation and government policy. Any resulting changes in industry policy, objectives or targets would then be communicated to growers. The review would also provide the opportunity to update the EMS guidance material provided to growers. At the farm level, the review will need to take into account any changes in industry policy or priorities, but will also require a comprehensive assessment of the effectiveness of the farm practices and procedures in place under the EMS.

Industry level reviews could be undertaken every one to two years. Audit findings may provide a useful starting point for growers undertaking a review. Guidance on undertaking a review of the farm EMS will need to be provided to growers by the responsible industry organisation. It will be important to co-ordinate reviews at the industry and farm levels. Farm level reviews will need to take into account any changes resulting from the industry level review, and similarly, the industry review should be informed by issues arising from reviews conducted on individual farms.

Current Situation

The BMP Programme requires growers to monitor and review the implementation of farm action plans. This component of the programme would need to be expanded to cover each aspect of an EMS and achieve compliance with the Standard. Although formal arrangements for the review of the programme have not been put in place, ongoing assessment and review of the programme occurs through the BMP Management Committee.

Requirements

Guidelines for conducting EMS reviews at the industry and farm level will need to be developed. These guidelines will need to address issues such as the timing of reviews, the co-ordination of farm and industry reviews, as well as practical information for growers conducting farm reviews.

Notes

1 It is interesting to note that the ISO occupational health and safety management standard is based on ISO 14001, meaning that (in theory) the two areas can be merged. This is the approach often used in the United States, where the term "HSE" is used by corporations having a combined health, safety and environment management system.

2 The Standard only notes that the scope of its application must be clearly identified (see page 1) and also states that organisations have flexibility in determining the scope of operation of the EMS: "*an organisation has the freedom and flexibility to define its boundaries and may choose to implement this International Standard with respect to the entire organisation, or to specific operating units or activities of the organisation*" (at page 46).

3 It may also be necessary to include a set of 'core' or 'non-negotiable' aspects that are therefore a high priority for all cotton growers, and which would need to be addressed for certification.

4 Further consideration of this issue is required. There is an abundance of jargon in ISO 14001 that differs to that used in other areas, even though the fundamental process being described is the same (especially for example, risk assessment). Identification of activities as the starting point for determining aspects and evaluating impacts is only suggested by ISO 14004; 14001 only requires that aspects be identified and the impacts evaluated. The use of jargon needs to be kept to a minimum.

5 Significant is not defined by the Standard, other than 'a significant environmental aspect is an environmental aspect that has or can have a significant environmental impact'! In order to ensure credibility (as significance is often a subjective decision) both a systematic process for assessing significance and external input would be required to demonstrate that aspects that are significant to interested parties are also considered.

6 The methods of risk assessment outlined here would be used during the determination of significance at the industry level. Training for growers in risk assessment could then be used to help ensure that the final risk assessment also takes into account site specific factors and issues.

7 Only those environmental aspects that the cotton grower can control and over which they can be expected to have an influence need to be considered when determining significant environmental impacts.

8 It is anticipated that impacts would be classified into significant and potentially significant. A significant impact would have to be addressed by the cotton grower unless they could establish that the issue is not relevant for that farm, while potentially significant issues would be designed to act as a checklist for determining for the farm in question whether or not an issue is relevant.

9 Funding has been sought to develop a risk assessment training programme.

10 There is of course significant potential for co-ordination of this issue between industries as well, as there will be large core of legislative requirements common to all sectors of agricultural production.

11 ISO 14004 at page 10 suggests that "*To facilitate keeping track of legal requirements, an organisation can establish and maintain a list of all laws and regulations pertaining to its activities, products or services*".

12 Brown (1999) states that "*Professional advice should always be sought in matters of environmental law, regulation and administration, and should be included in procedures developed to implement the requirements of the Standard*" (at paragraph 3–1500).

13 See for example sections 80 and 81.

14 At page 2

15 ISO 14001, clause 4.3.1.

16 Brown (1) at page 3-3375.

17 At page 3-3395.

18 ISO 14004, paragraph 4.2.5.

19 At page 53.

20 Of course, effective internal industry communication will help ensure that external communications are consistent, and reflect a 'whole-of-industry' view.

21 "*For ease of use, the organisation can consider organising and maintaining a summary of the [required] documentation … Such a summary document can serve as a reference to the implementation and maintenance of the organisation's EMS*" (ISO 14004, page 19).

22 Given that the BMP Program was not conceived with the aim to comply with ISO 14001 in mind, it will be necessary to provide a concordance document that links the structure and content of the BMP Manual, with that of ISO 14001.

23 Brown suggests that operational procedures should be established in relation to the use of contractors, in order to ascertain their environmental credentials (see Brown (1) at page 1297).

24 The experience of Oakville Pastoral Co. generally indicates that this may be a difficult area especially for smaller farms. As well as the difficulties associated with locating a training advisor, a fire in the wheat stubble resulted in problems with alarm and notification procedures. The main office person was unsure where all the staff were at the time of the incident although all emergencies services had been called, (all staff were fighting the fire). The outcome was that a UHF was set up in the office to improve communication rather relying on mobile phones.

25 A key requirement for the Standard is to ensure all equipment used for monitoring and measuring is calibrated and records are kept of the calibration (monitor the monitoring!). Calibration records may be required for ground rigs, neutron probe calibration, anhydrous ammonia and weather monitoring equipment.

26 Tibor and Feldman, p175.

27 At page 22.

28 ISO 14004 recommends that "*the review of the EMS should be broad enough in scope to address the environmental dimensions of all activities, products or services of the organisation*" (Clause 4.5.2).

The results of this review support the feasibility of and potential for beneficial environmental impacts to result from the introduction of an EMS in the Cotton Industry. For such an approach to be most beneficial, government-endorsed catchment management plans and targets are required within which EMS objectives and practices can be situated. This would also enhance the credibility of an industry EMS.
The MDBC could usefully support a cotton industry EMS, as well as the research and development of best management practices that will result in the sustainable use of natural resources on farms.

NATURAL RESOURCE MANAGEMENT ISSUES

Appendix 5

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Executive Summary

The results of this review support the feasibility of and potential for beneficial environmental impacts to result from the introduction of an EMS in the Cotton Industry. For such an approach to be most beneficial, government-endorsed catchment management plans and targets are required within which EMS objectives and practices can be situated. This would also enhance the credibility of an industry EMS. The MDBC could usefully support a cotton industry EMS, as well as the research and development of best management practices that will result in the sustainable use of natural resources on farms.

The adoption of better farm management practices is an essential step in improving the environmental conditions, productivity and water use efficiency in the Murray-Darling Basin. The MDBC has supported several initiatives that have evaluated alternative mechanisms for assisting adoption of these practices.

The MDBC is funding a large initiative that is investigating the feasibility of introducing an EMS to assist adoption of Best Management Practices for several of the most important irrigation industries in the Murray Darling Basin. One of these key industries is the cotton industry. This study forms a small component of the MDBC and industry funded project being conducted by the Cotton Research and Development Corporation (CRDC), and the Australian Cotton Growers Research Association (ACGRA) that is investigating such an approach for the cotton industry.

A comprehensive review was made of the MDBC policies and strategies of relevance to the cotton industry (Section 3). As well, the full range of natural resource issues of interest to the MDBC, the State Catchment Committee, and the cotton industry were evaluated (Sections 4 and 5). This analysis indicates that the environmental issues of highest priority for the cotton industry are:

- Pesticide management, particularly from the viewpoint of community, OH&S and water quality impacts (this issue has received considerable attention over the years and the industry is confident that it has good management protocols in place)
- Reductions in water allocations as a result of government water reforms
- Groundwater allocations that ensure Estimated Sustainable Yields (ESY) are not exceeded[1].

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1 These two last points highlight issues that are outside a farmer's control, but which can have a significant impact on farm management practices.

Issues that are of high priority but which are local in nature include:

- Groundwater quality deterioration due to over extraction
- Protection of wetlands from farm operations
- Floodplain buffer zones so that farming operations are kept away from rivers
- Water harvesting on floodplains and consequent impact on flows and the riparian zone
- Soil salinity.

Issues of high priority for the cotton industry in its position as recipient of water from the upper catchment include:

- Increasing water salinity
- Water turbidity.

Issues that were identified by the industry as being of low priority include:

- Vegetation clearance (most vegetation clearance in cotton growing areas occurred many years ago, and current development is generally occurring on treeless plains)
- Soil compaction (due to the use of well established management practices (eg. SOILpak))
- Soil acidification
- Soil contamination other than at a very local level
- Soil structure decline
- Soil sealing
- Irrigation efficiency
- Irrigation salinity
- Wind or water erosion.

The Terms of Reference for this study and the primary findings for each are as follows:

Determine the extent to which the introduction of an EMS based on ISO 14001, or other identified standard, will meet the MDBC's natural resources management objectives

An EMS certified to ISO 14001, introduced industry-wide could provide an effective mechanism for achieving MDBC natural resources management objectives, particularly the implementation of regional natural resource management plans and Land and Water Management Plans.

A cotton industry-based EMS should address (or respond to) the priority issues of the MDBC in an explicit and targeted manner. These issues are:

- Allocation (abstractions) and management of surface and ground water
- Changed flow regimes (ie. by meeting diversion licence conditions)
- Surface water quality (particularly with respect to pesticides and nutrients)
- Floodplain management (wetlands and riparian strips)
- Biodiversity management.

Further information is required before it is possible to be confident that rising groundwater (and hence waterlogging and salinity) will not be a longer-term concern. This should be addressed through specific studies.

At this stage, it is considered that the areas of greatest risk of mismatch between the priorities of the industry and the MDBC are:

Protection and management (for nature conservation purposes) of riparian vegetation and the riparian zone

River water quality; although the industry is highly conscious of pesticide impacts, the potential impact of nutrients (fertilisers) should also be addressed.

The following issues are of generally low priority and require special consideration before inclusion in an industry programme:

- Acid sulphate soils
- Water repellence
- Wind erosion
- Land subsidence, although this should be catered for by groundwater licensing within ESY
- River turbidity and sedimentation (which are catchment issues); farm management of erosion is a current focus to help control pesticide movement off-farm
- River water pH and pathogens
- Impact on natural heritage sites
- Pest plants and animals
- Degradation of tourist sites.

The following issues need to be addressed if the objectives of the MDBC are to be effectively met:

- Government-endorsed regional plans and targets for natural resource outcomes; these are essential for the effective management of key natural resources issues (biodiversity/ vegetation management, water quality, water allocations (surface and groundwater)); these plans would identify regional priorities, and facilitate the implementation of practices that are compatible with Basin objectives; in the absence of these plans, there is a risk that targets, practices and indicators developed under an industry programme will be over-ridden by or inconsistent with subsequently developed regional plans; an alternative scenario is that development of industry best management practices could assist the development of the regional plans; either way, a close industry-government-scientific community working relationship is required
- The MDBC should continue to be involved in the development of the cotton industry's Best Management Practices Programme
- The MDBC should consider formally endorsing any best management practices that are developed by the industry to ensure they have wide community support.

Identify Key Performance Indicators (KPI) by which the success of the introduction of an industry EMS can be measured, including natural resource conditions

- A number of KPIs identified in the MDBC's Basin Sustainability Programme are not amenable to an industry programme; nonetheless, a comprehensive industry EMS should make a positive contribution to achieving MDBC objectives (ie. natural resource outcomes)
- An analysis of the key outcomes to be targeted, management approaches and performance indicators is provided (Section 6)
- Performance indicators relating to the following should be considered essential inclusions in an industry EMS (preferably in a regional context as identified above):
  - The quality of water leaving farms (with respect to salinity, pesticides, turbidity, nutrients (N,P), and the volume of water leaving the farm in specific events)
  - Surface and ground water abstractions and compliance with licence conditions (eg. timing and rate of abstractions)

  - Revegetation and vegetation management (eg. fencing off of riparian strip of defined size, protection of wetlands, management for nature conservation purposes)
  - Water use efficiency (yields and water use on a field by field basis if possible)
  - Groundwater levels and salinity.

Identify any research and development requirements for the introduction and on-going operation of an industry EMS to facilitate improved natural resource outcomes in the irrigated cotton industry within the Murray-Darling Basin

The development of Best Management Practice Manuals is required covering the following issues:

- Pesticide management (which already exists)
- Water management
- Soil and nutrient management
- Vegetation management.

Technical reviews, studies and workshops would be required to develop these guidance materials. This work would also help identify long-term research needs.

- Specific issues requiring further research include:
  - Regional groundwater monitoring, modelling and water balance studies to understand the long-term risk of irrigation-induced salinity
  - Irrigation best management technologies and practices
  - Long term hazards of nutrient and pesticide concentrations in storage
  - Potential for groundwater pollution by pesticides and nutrients
  - Long-term impacts of defoliants on native vegetation
  - Performance of tree corridors in arresting pesticide drift
  - Role of biodiversity in cotton production
  - Market segmentation to determine appropriate transfer and adoption tools
  - Development of industry-based documentation to facilitate the introduction of an EMS
  - Quantification of the relationship between the adoption of best management practices and natural resource benefits.

1 Background

1.1 This Report

This report is a component of several projects funded by the MDBC to investigate the *"Feasibility of introducing an appropriate Audit and Certification model to foster better management practice in natural resources management in the irrigation regions across the Murray-Darling Basin"*. The larger project has components dealing with rice, cotton, dairy and viticulture irrigation industries as well as Land and Water Management Planning Groups, Rural Water Authorities, Municipalities and Catchment Authorities throughout the Murray Darling Basin.

The cotton industry component of this larger project involves a detailed investigation of the feasibility of introducing an EMS across the cotton industry. This detailed investigation is being carried out in relation to the cotton industry for two reasons. First, the cotton industry is further developed in implementing environmental management practices than most other agricultural industries. Second, the cotton industry through the Australian Cotton Growers Research Association (ACGRA) is investigating the feasibility of introducing an industry EMS on its own initiative. This report supports the industry initiative, and provides valuable input on the relevance of an industry EMS to achieving the MDBC's natural resource management objectives. The objectives of this study are to:

- Determine the extent to which the introduction of an industry EMS, based on the ISO 14001 standard (or other identified standard), will meet the MDBC's natural resource management objectives.
- Identify Key Performance Indicators (KPI) by which the success of the introduction of an industry EMS can be measured, including natural resource conditions.
- Identify any research and development requirements for the introduction and on-going operation of an industry EMS to facilitate improved natural resource outcomes in the irrigated cotton industry within the Murray-Darling Basin.

The report is based on a review of available information and discussions with key MDBC, industry, and State agency staff. The ability to confirm the veracity of the views obtained was limited by the time available for the study and the limited availability of information on the natural resource base. Consequently, in many instances the report represents the opinion of the author based on these limited discussions and information resources.

For the purpose of this report, it is assumed that a cotton industry EMS will be one based on the ISO 14001 standard. It is further assumed that an industry EMS would include auditing and certification components. For simplicity, the terms ‘EMS’ and ‘certified EMS’ are used throughout the report in relation to this proposed industry EMS, certified to ISO 14001.

The report consists of the following:

- An outline of the existing bio-physical setting of the cotton industry and the environmental issues faced by the industry
- An outline of the MDBC's objectives, policies and strategies address natural resource issues in the Basin; this forms the primary basis for determining the extent that an industry EMS would contribute to achieving MDBC objectives
- Priority issues identified by catchment management groups are identified for the cotton growing areas in order to ensure that relevant issues are included in an industry EMS
- The full range of natural resource (land, water and nature conservation) issues and their relevance to the MDBC and cotton growing areas are reviewed to establish a checklist of issues that should be included in an industry EMS; an initial prioritisation of these issues is made
- The relative significance of issues and management practices (for the MDBC and the cotton industry) is established
- The preferred and most feasible KPIs are identified along with further research needs
- Comment and recommendations are provided on the effectiveness of introducing an EMS in the cotton industry from the MDBC perspective.

1.2 Drivers for introducing an industry environment management system

Protection and rehabilitation of the natural environment has emerged rapidly over the last 10 years as an important issue attracting high levels of public awareness and support. The management of natural resources in rural Australia has for some years, relied on voluntary approaches such as Landcare and catchment planning, and has often received only limited financial support. State and Commonwealth laws addressing natural resource issues are still evolving to reflect public concern. Nonetheless, it is possible that legal action for serious mismanagement of natural resources will become more common in future as society's expectations in relation to natural resource management become more demanding. A comprehensive and effective environmental management system should help agriculture industries and individual farmers meet society's expectations regarding natural resource management, and help demonstrate these parties' 'due diligence' in their natural resource management practices.

The reasons for introducing an EMS vary depending on stakeholder needs. From the farmer's point of view, adoption of an EMS based on Best Management Practices should result in increased economic returns from more efficient use of resources, improved product quality, and maintenance of the resource base for future use. Also, as noted above, implementing an EMS could help establish a defence of 'due diligence' against claims of environmental harm.

From the MDBC perspective an industry EMS could effectively help achieve its natural resource objectives. From the industry perspective, an EMS would promote the industry as a good corporate citizen and should lead to effective stewardship of the natural resource base. Such an approach could also improve industry economic benefits (through better use of the available resource base), as well as potentially attracting a premium for 'green' product or accessing markets that require a 'green' label.

2 Bio-Physical and Environmental Setting of the Cotton Industry

2.1 Agriculture

A broad outline of cotton growing in the MDB is shown in the following two tables.

Table 2.1 Cotton Growing Regions in the Murray-Darling Basin

Cotton Region	Irrig. Area (ha) *	Yield (Bales/ ha)*	Potential Water Demand (GL)**	Principal River System	G'water Resources (GL)****	Valley Irrigation Diversion (97/98) (GL)***
Queensland						
Darling Downs	32,000	7.0	160	Condamine	290 (Condamine/ Balonne)	536 (Condamine/ Balonne)
St George	24,500	8.35	123	Balonne	17 (Moonie)	536 (Condamine/ Balonne)
Macintyre	See NSW				108.9 (Border Rivers)	174 (Border Rivers)
Total QLD	56,500	7.6	283			
New South Wales						
Macintyre	352,000	8.3	260	Macintyre	108.9 (Border Rivers)	204 (Border Rivers) (& 174 Q)
Gwydir	82,000	8.4	410	Gwydir	59	535
Upper Namoi	19,560	7.0	98	Upper Namoi	296 (Namoi)	253 (Namoi/ Peel)
Lower Namoi	54,500	7.6	273	Lower Namoi	296 (Namoi)	253 (Namoi/ Peel)
Macquarie	45,000	8.2	225	Macquarie	215	425 (Macquarie/ Castlereagh/ Bogan)
Bourke	11,500	8.35	58	Darling	0	186 (Barwon Darling)
Tandou	9,000	6.7	45	Lower Darling	0	39
Total NSW	**273,560**	**8.03**	**1369**			
TOTAL MDB	**330,060**	**7.95**	**1,662**			

* Source: Cotton Yearbook 1998
** assuming an average water application of 5 ML/ha
*** Source: MDBC Water Audit Monitoring Report 1997/98
**** Murray-Darling Basin Resources (MDBC,1997)

Cotton is the major user of water in the northern NSW river basins, and the area of land used for cotton production in these regions is generally increasing.

Table 2.2 Area of Cotton Grown in Relation to Other Irrigated Crops

River System	Area of Irrigated Crops (ha)	Area of Irrigated Cotton (ha)
Macquarie	55,000	45,000 (increasing)
Namoi	79,000	75,000 (increasing, 25%–75% irrigated partly or wholly with groundwater
Gwydir	83,000	77,000
Border R	36,000	33,000 (increasing)

2.2 Soils

The majority of soils in which cotton is grown are low permeability, grey, cracking clays (vertisols) of low slope. There are however cotton growing areas on more permeable prior stream soils and red hard-setting soils (eg. in the Macquarie river basin) and on soils on steeper slopes (eg. Emerald irrigation area).

2.3 Surface Water Quantity

The allocation of diversion licences is a major and contentious issue currently being dealt with by water reforms in the Murray-Darling Basin, New South Wales and Queensland. It is an issue that can only be resolved by governments determining allocations for competing uses and then allocating appropriate licences (which will presumably deal with issues of how much and at what rate).

The interim cap was instituted following concern:

- That licences overallocated the available resource
- The increasing uptake of licences was adversely affecting existing water users and the environment
- Over the poor condition of waterways in the MDB.

An interim cap was applied until a more sustainable allocation of water resources is determined. This is underway for most rivers in northern NSW and Queensland (exceptions being Macquarie/Castlereagh/Bogan and the Namoi/Peel). It is consequently difficult at this stage to ascertain the impact on irrigated agriculture other than that water will become an increasingly valuable and scarce resource (for example the 1997/98 Audit report indicated that the Barwon/Darling system consistently exceeds the cap).

One of the difficulties in developing the cap and assessing future development impacts is the limited information available on crops, surface and groundwater use and environmental needs.

2.4 Surface Water Quality

The New South Wales Department of Land and Water Conservation (DLWC) reports annually on the condition of water resources throughout New South Wales. According to the 1996/1997 report (Window on Water) surface water quality in the regions where cotton is grown (Far West, Central West, and Barwon) is generally poor for turbidity, phosphorous, macro invertebrates and fair for salinity. Water quality declines with increasing distance down the catchment. Conditions in Queensland are expected to be similar.

A number of factors contribute to these catchment conditions (for example, urban and rural development, and the presence of carp increasing water turbidity). Also, the incipient condition of soils in the catchment can result in relatively high turbidity and levels of phosphorous even under natural conditions.

Pesticide pollution of water bodies is a clear concern of the cotton industry and the community. Whilst current guidelines are based on best information, it seems that the full effects of pesticides on the range of native aquatic and terrestrial fauna (in particular invertebrates) are not fully understood.

The cotton industry initiated a jointly funded water quality monitoring programme with DLWC in 1989/90 to monitor 30 sites across 4 catchments in NSW. The findings showed that drinking water standards were rarely exceeded but exceeding environmental standards was common (eg. endosulfan exceeded guidelines on 65% of occasions). Similarly, herbicide levels for irrigation supply water were regularly exceeded.
The programme reveals some interesting trends. The highest levels of pesticide were recorded in 1991–92, and results in subsequent years did not approach the 1991–92 figures. The drought years of 1993–95 resulted in much smaller areas being cropped and consequently significantly lower levels of pesticides were recorded.

Following the drought, the levels recorded rose. However in 1998–99 levels fell (some to the drought levels) even though the area planted was high (although there was low summer rainfall and little runoff). The monitoring data is open to interpretation, however the results may reflect the increased awareness and implementation of best management practices in the cotton industry.

It has been speculated that dryland cotton represents a significant risk to surface water quality as these farms do not have the water control systems for managing runoff that have been put in place on irrigation farms (Muschal, pers. com.).

The recent MDBC Salinity Audit (1999) reported on groundwater depth and quality, and surface water quality trends throughout the Murray-Darling Basin. The report recognised the limited nature of some of the data and forecasts significant increases in water salinity in the rivers of northern NSW and southern Queensland, as shown in Table 2.3.

Table 2.3 Current and Projected River Salinities in Cotton Growing Areas

River Valley	Average River Salinity at end of system unless location indicated (EC)			
	1998	2020	2050	2100
Lachlan	530	780	1150	1460
Menindee	360	430	490	530
Bogan	730	1500	1950	2320
Macquarie	620	1290	1730	2110
Marromine	440	900	1200	1450
Castlereagh	640	760	1100	1230
Namoi	680	1050	1280	1550
Gunnedah	580	930	1150	1400
Gwydir	560	600	700	740
Macintyre	450	450	450	450
Warrego	210	1270	1270	1270
Condamine-Bolonne	210	1040	1040	1040
Border Rivers	310	1010	1010	1010

Whilst increases in river salinity of this order are of concern, they are not expected to cause yield losses in cotton which is classified as a salt tolerant crop (FAO, 1977).

2.5 Groundwater

The most contentious current issue in relation to groundwater is the over-abstraction of the resource in a number of areas, resulting in reduced levels and reduced water quality. Government working groups and task forces are currently addressing this issue. Shallow and/or rising watertables are reported to be an issue in a limited number of localities. It has been suggested (Gordon) that groundwater could be rising in some districts but that groundwater monitoring networks are inadequate for making an accurate assessment.

The DLWC undertakes a limited pesticide monitoring programme for groundwater. In 1996/1997 27 sites were sampled in the Macquarie Valley and 26 sites in the Jemalong-Wylde Plains area. Atrazine (a herbicide used in agriculture but not used in cotton production) was detected at 9 of the Macquarie Valley sites and 6 of the Jemalong-Wylde Plains sites at concentrations well above the level that would have a significant effect on stream flora and fauna (20 ug/L). Similarly, groundwater studies by the UNSW found Atrazine in groundwater (40% of sites) in the Liverpool Plains area. Although none were above levels considered a risk to human health, some were above the levels for action. This demonstrates that certain types of chemicals can be leached into groundwater systems. In some instances pesticides used in the cotton industry that are strongly adsorbed by soil were also found in groundwater. The study also found a number of bores where quality (salinity) was deteriorating due to over pumping.

Nitrate pollution of groundwater could emerge as significant issue in cotton growing areas, particularly if groundwater is used as a source of drinking water. Significant nitrogen is applied (apparently most commonly in gaseous form) to cotton. Nitrate has been found in a number of groundwater samples in the Liverpool Plains area, at levels above the standard for drinking water for infants.

Allocations of groundwater that ensure use is within sustainable yields can only be resolved by government action and licensing. Issues of management of shallow watertables and groundwater pollution can only be satisfactorily addressed by a regional approach to managing the resource.

2.6 Vegetation

Vegetation management is important on cotton farms for biodiversity, aesthetics, the control of spray drift, and productivity (windbreak) purposes.

The majority of native vegetation in cotton growing areas has been cleared and new developments are generally taking place on land that is already being used for agriculture or on treeless plains in the arid areas of western NSW and Queensland. There are usually narrow strips of trees along waterways in cotton growing areas (and in some cases no effective strip) and the industry is aware of the importance of trees in controlling pesticide drift.

There are several issues that do not appear to have been adequately considered or resolved at this stage. First, whilst new development of cotton lands may not be resulting in clearance of trees, degradation of habitats comprising native grasses and shrubs may be occurring where only extensive grazing has occurred in the past. Second, the limited extent of remnant vegetation increases its local significance as a refuge and habitat for birds and animals. Arguably these stands should be protected from spray drift as the impact of pesticides on terrestrial flora and fauna does not appear to be well understood at this stage.

These issues are likely to be dealt with when regional vegetation management plans are developed under the new vegetation management arrangements in NSW. Arrangements are less certain in Queensland.

3 Murray-Darling Basin Commission Goals and Objectives

3.1 The Natural Resources Management Strategy

The Murray-Darling Basin Agreement defines the roles and responsibilities of the Murray-Darling Basin Ministerial Council, the Murray-Darling Basin Commission and the member governments (the Commonwealth, NSW, Victoria, South Australia, Queensland and the ACT). The initiative includes operational responsibilities for the sharing of River Murray water resources, as well as policy and programme-setting arrangements covering the entire MDB. The focus of policies is generally the management of inter-jurisdictional natural resource issues.

The MDBC Natural Resources Management Strategy (NRMS) is the overarching strategy for natural resources management under the Murray-Darling Basin Initiative (involving Commonwealth, NSW, Victoria, SA, and Queensland governments). The Strategy provides a framework for joint community-government action. It seeks to stimulate action by providing mechanisms for on-going planning and policy development, and by fostering a community-based programme of works, measures and community education supported by a strong information and knowledge base.

The aims of the NRMS are to:

- Prevent further degradation
- Restore degraded resources
- Promote sustainable user practices
- Ensure appropriate resource use planning and management
- Ensure a long-term viable economic future for Basin dependents
- Minimise adverse effects of resource use
- Ensure self-maintaining populations of native species
- Preserve cultural heritage
- Conserve recreational values
- Ensure community and government cooperation.

The Basin Sustainability Programme (BSP) provides the planning, evaluation and reporting framework for the full range of NRMS-sponsored activities. The BSP includes strategies focussing on the following three areas:

- Policy development
- Generation and transfer of knowledge
- Implementation of on-ground works and measures.

The major priority areas of the Natural Resources Management Strategy have been grouped into the following three sub-programmes of the Basin Sustainability Programme:

- Riverine Environment Sub-programme
- Irrigated Regions Sub-programme
- Dryland Regions Sub-programme.

The objectives and Strategies/Plans associated with these sub-programmes are shown below. The sub-programs are targeted to produce beneficial outcomes in the following four Key Result Areas:

- Sustainable Agricultural Productivity
- Water Quality
- Nature Conservation
- Cultural Heritage.

3.2 Riverine Environment Sub-Programme

The Riverine Regions Sub-Programme is described in detail in the Riverine Environment Sub-programme Strategic Plan 2000–2002 (draft for evaluation). The aim of the Riverine Environment Management Sub-programme is to achieve ecologically sustainable management of the Murray-Darling Basin's rivers and riverine environments, by:

Improving the quality of the water in streams, rivers and groundwater for environmental, consumptive and recreational uses including by implementing appropriate flow regimes

- Improving planning to support sustainable use of floodplains, wetlands and rivers
- Maintaining and enhancing the sustainable use of floodplain, wetland and riverine flora and fauna
- Establishing flow regimes that provide an appropriate balance between consumptive and in-stream, wetland and floodplain water requirements
- Maintaining/re-establishing viable populations of native species and integrity of ecological communities throughout their range within floodplain, wetland, riparian, in-stream and estuarine ecosystems

Protecting and conserving cultural heritage values of significant sites/places/landscapes by (a) identifying places and their cultural heritage values; (b) establishing river flow regimes that provide agreed balance between consumptive and in-stream, wetland and floodplain water requirements and heritage values; and (c) promoting better protection of cultural heritage places.

There are a number of issue-based and more specific strategies/plans to give effect to these objectives. These Basin-wide strategies are:

3.2.1 Integrated Catchment Management

The Draft Integrated Catchment Management in the Murray-Darling Basin 2001–2010 policy highlights the need a cooperative approach to natural resource management in the Basin. The policy establishes a framework for governments, catchment managers, industry groups, community groups and landholders to commit to improving the natural resource conditions in the Basin. The policy outlines the need for the following:

- Commitment from all stakeholders in natural resource management in the Basin
- An integrated approach to natural resource management in each catchment in the Basin
- Natural resource targets for each catchment
- An innovative approach to the mechanisms required to achieve catchment targets
- Monitoring, evaluating and reporting on progress towards targets and natural resource outcomes
- Clear responsibilities between the various stakeholders in natural resource management in the Basin
- Government investment in arrangements for integrated catchment management.

The policy outlines the goals, values and principles that must be common to all stakeholders to ensure progress is made in improving natural resource conditions in the Basin.

3.2.2 Salinity Management Strategy

Rising salinity levels in the River Murray and increasing land salinisation in Murray Valley irrigation areas were the first major issues addressed by the Initiative in the mid 1980s. The Draft Basin Salinity Management Strategy 2001–2015 replaces the Salinity and Drainage Strategy (1988). The draft Strategy establishes the framework for State salinity strategies, catchment management strategies and land and water management plans to work together to achieve common objectives. It sets out a process to identify key community values and assets at risk, develop targets to protect them, and establish a 15 year programme of works and landscape change, to achieve those targets.

The objectives of the Strategy are, for the next 15 years:

- To maintain the water quality of the shared water resources of the Murray and Darling Rivers for all beneficial uses – agricultural, environmental, urban, industrial and recreational
- To control the rise in salt loads in all tributary rivers and, through that control, protect their water resources and aquatic ecosystems at agreed levels
- To control land degradation and protect important terrestrial ecosystems, productive farm land, cultural heritage, and built infrastructure at agreed levels
- To maximise net benefits from salinity control across the Basin.

The Strategy establishes the Commission's vision of maintaining River Murray salinity at less than 800EC for 95% of the time, at Morgan, as the target for the next 15 years. The Strategy aims to complete the programme started with the Salinity and Drainage Strategy (1988) to fully achieve an 80EC reduction at Morgan. Under the Strategy, States have committed to adopting end-of-valley targets. These targets will be finalised by State governments in consultation with their catchment communities.

3.2.3 Algal Management Strategy

The Algal Management Strategy aims to minimise the risk of blue-green algal blooms by reducing nutrient inputs to the river system, improving stream flow regimes and increasing our understanding of the nature of blue-green algae. A focus of this effort is the treatment of point sources of nutrients (especially P), particularly those associated with Sewerage Treatment Plants.

3.2.4 The Cap (Water Sharing Quota)

An audit of water use in the Basin completed in1995 indicated that increasing diversions were reducing the security of supply to all users and exacerbating river health problems. Following further studies and an independent review, the Ministerial Council established a Cap on water diversions, limiting diversions to the volume of water that would have been diverted under 1993–94 levels of development. Procedures have been put in place for monitoring and reporting on compliance with the Cap. Controlling diversions is vital for achieving the objectives of strategies such as the Salinity Management Strategy, and the Algal Management Strategy, and for enhancing in-stream biodiversity conditions.

There are two primary objectives behind the decision to implement the Cap:

- The need to maintain and, where appropriate, improve existing flow regimes in the waterways of the Murray-Darling Basin to protect and enhance the riverine environment
- To achieve sustainable consumptive use by developing and managing Basin water resources to meet ecological, commercial and social needs.

A priority for the development of the cap in the northern part of the MDB is to define the resource base and its current and future uses, on a valley by valley basis.

3.2.5 Fish Management Plan

The aim of the Fish Management Plan is to sustain native fish populations in perpetuity. Priority outcomes for the Plan are:

- Sustained fish populations
- Rehabilitation and protection of native fish habitats
- Improved management of native fish and their habitats
- Optimised fish passage throughout the river system
- Increased controls on exotic fish and diseases
- Protected populations and habitats of threatened or endangered fish species.

Management plans for each of the functional zones delineated within the river system, are required. These plans will address:

- Habitat restoration and maintenance
- Improved water flow management to benefit fish populations
- Establishment of fishcare groups
- Development of artificial wetlands to protect fish habitats
- Off-stream water reuse schemes to protect fish habitats
- Building of fish-ways and culverts.

3.2.6 Floodplain Wetlands Management Strategy

The goal of the Floodplain Wetlands Management Strategy is to maintain and, where possible, enhance floodplain wetland ecosystems in the MDB for the benefit of present and future generations.

Priority outcomes for the Strategy are:

- Integrated management of floodplain wetlands
- Improved water quality in rivers and wetlands
- Optimised use of wetlands for flood mitigation and water storage
- Enhanced wetland ecosystems to conserve biological diversity
- Increased community involvement in wetland management.

Actions to achieve this involve the development and implementation of integrated wetland management plans that aim to:

- improve the management of effluents and runoff that can enter river systems via wetlands
- improve cropping and stock grazing regimes in and around wetlands
- improve land use practices adjacent to floodplains and wetlands
- promote the re-vegetation of wetlands
- improve water management within wetlands
- control introduced species in wetlands
- restore and maintain wetland habitats
- manage the recreational use of wetlands.

3.3 Irrigated Regions Sub-Programme

The Irrigated Regions Sub-programme is described in detail in the Irrigated Regions Sub-programme Strategic Plan 2000–2002 (draft for evaluation). The aim of the Irrigated Regions Sub-programme is to achieve ecologically sustainable use of the irrigated regions of the Murray-Darling Basin by:

Key Result Area: Water Quality

- Substantially reducing salt, nutrient, sediment and other contaminating exports from rural, urban and industrial sources to streams and rivers
- Protecting groundwater quality.

Key Result Area: Sustainable Agricultural Productivity

- Continuously improving the efficiency and effectiveness of irrigation water use
- Matching new and current land use and land management practices to land suitability and capability
- Maintaining and enhancing the sustainable productive capacity of the land resource base by:
- reducing environmental degradation
- reducing production losses resulting from salinisation and waterlogging
- engaging the irrigation industry at the regional level in establishing river flow regimes that provide an appropriate balance between consumptive and in-stream water uses
- ensuring the sustainable use of groundwater resources.

Key Result Area: Nature Conservation

Maintaining key ecological processes; maintain or re-establish viable populations of native species and the integrity of ecological communities (especially vegetation); controlling threats to biodiversity by: providing an appropriate balance between irrigation production systems and nature conservation values, and minimising adverse impacts of irrigation production systems on nature conservation values.

Key Result Area: Cultural Heritage

Protecting and conserving cultural heritage values of significant sites/places/landscapes by identifying places and their cultural heritage values; establishing river flow regimes that provide agreed balance between consumptive and in-stream, wetland and floodplain water requirements and heritage values; and promoting better protection of cultural heritage places.

There are four Basin-wide Strategies/Plans to give effect to aspects of these Key Result Areas.

Integrated Catchment Management

The Draft Integrated Catchment Management in the Murray-Darling Basin 2001–2010 policy highlights the need a cooperative approach to natural resource management in the Basin. The policy establishes a framework for governments, catchment managers, industry groups, community groups and landholders to commit to improving the natural resource conditions in the Basin.

The policy outlines the need for the following:

- Commitment from all stakeholders in natural resource management in the Basin
- An integrated approach to natural resource management in each catchment in the Basin
- Natural resource targets for each catchment
- An innovative approach to the mechanisms required to achieve catchment targets
- Monitoring, evaluating and reporting on progress towards targets and natural resource outcomes
- Clear responsibilities between the various stakeholders in natural resource management in the Basin
- Government investment in arrangements for integrated catchment management.

The policy outlines the goals, values and principles that must be common to all stakeholders to ensure progress is made in improving natural resource conditions in the Basin.

3.3.2 Salinity Management Strategy

Rising salinity levels in the River Murray and increasing land salinisation in Murray Valley irrigation areas were the first major issues addressed by the Initiative in the mid 1980s. The Draft Basin Salinity Management Strategy 2001–2015 replaces the Salinity and Drainage Strategy (1988). The draft Strategy establishes the framework for State salinity strategies, catchment management strategies and land and water management plans to work together to achieve common objectives. It sets out a process to identify key community values and assets at risk, develop targets to protect them, and establish a 15 year programme of works and landscape change, to achieve those targets.

The objectives of the Strategy are, for the next 15 years:

- To maintain the water quality of the shared water resources of the Murray and Darling Rivers for all beneficial uses – agricultural, environmental, urban, industrial and recreational
- To control the rise in salt loads in all tributary rivers and, through that control, protect their water resources and aquatic ecosystems at agreed levels
- To control land degradation and protect important terrestrial ecosystems, productive farm land, cultural heritage, and built infrastructure at agreed levels
- To maximise net benefits from salinity control across the Basin.

The Strategy establishes the Commission's vision of maintaining River Murray salinity at less than 800EC for 95% of the time, at Morgan, as the target for the next 15 years. The Strategy aims to complete the programme started with the Salinity and Drainage Strategy (1988) to fully achieve an 80EC reduction at Morgan. Under the Strategy, States have committed to adopting end-of-valley targets. These targets will be finalised by State governments in consultation with their catchment communities.

3.3.3 Irrigation Management Strategy

The aim of the Irrigation Management Strategy is to achieve an economically and environmentally sustainable and self-sufficient irrigation industry in the southern Murray-Darling Basin by the year 2010.

This is being achieved through:

- Market reform (COAG, 1994)
- Development and implementation of integrated regional development plans which provide for:
  - sustainable natural resources
  - water supply and drainage infrastructure
  - profitable agriculture.

3.3.4 Regional Economic Development Policy

The goal of the policy is to encourage strong, growing and diversified regional economies, based on competitive rural industries, self-reliant communities and ecologically sustainable management of natural resources.

3.3.5 Dryland Regions Sub-Programme

The Dryland Regions Sub-programme is described in detail in the Dryland Regions Sub-programme Strategic Plan 2000–2002 (draft for evaluation). The aim of the Dryland Regions Sub-programme is to achieve ecologically sustainable development of the dryland regions of the Murray-Darling Basin by:

Key Result Area: Sustainable Agricultural Productivity

- Matching new and current land use and land management practices to land suitability and capability

Maintaining and enhancing the sustainable productive capacity of the land resource base by:

- reducing environmental degradation
- slowing or reversing rising groundwater tables
- managing dryland salinity
- Maintaining and expanding perennial vegetation cover
- Ensuring the sustainable use of groundwater resources.

Key Result Area: Water Quality

Substantially reducing salt, nutrients, sediments and other contaminating exports from rural, urban and industrial sources to streams and rivers

- Protecting groundwater quality.

Key Result Area: Nature Conservation

Maintaining key ecological processes; maintain or re-establish viable populations of native species and the integrity of ecological communities (especially vegetation); control threats to biodiversity by: providing an appropriate balance between dryland production systems and nature conservation values, and minimising adverse impacts of dryland production systems on nature conservation values.

Key Result Area: Cultural Heritage

Protecting and conserving cultural heritage values of significant sites/places/landscapes by (a) identifying places and their cultural heritage values; (b) establishing river flow regimes that provide agreed balance between consumptive and in-stream, wetland and floodplain water requirements and heritage values; and (c) promoting better protection of cultural heritage places.

Regional Economic Development Policy

The goal of the policy is to encourage strong, growing and diversified regional economies, based on competitive rural industries, self-reliant communities and ecologically sustainable management of natural resources.

The Dryland Regions Sub-programme is not considered further in this report.

Evaluation of BSP Objectives and Indicators

The Basin Sustainability Programme includes a number of Key Performance Indicators that, it is understood, are currently under review. These are considered in later sections when the effectiveness of an industry EMS in delivering MDBC objectives is assessed.

4 Catchment Issues and Identified Actions

4.1 The following section presents the priority issues identified in regional catchment strategies in the relevant regions of the MDB. This information has been adapted from the "MDBC Basin Sustainability Programme: Consolidated Three Year Rolling Investment Plan. 1999–2000 to 2001–2002". Recommended actions to address each issue are also listed.

In the case of New South Wales, Regional Catchment Management Committees developed the issues and proposed actions. In Queensland these were prepared by the Department of Natural Resources.

Natural Heritage Trust community programmes support the implementation of these regional priorities.

Table 4.1 Issues and Practices Identified in Regional Catchment Strategies Central West Region (NSW)

	Sustainable Productivity	Water Quality	Nature Conservation
Irrigated Regions Sub-programme	Water access, water use efficiency, salinisation, waterlogging, rising watertable levels, increasing river water salinity	Stormwater and tail-water management, changed flow regimes, increasing river salinities	Preservation of remnant vegetation, proximity of developments to sensitive ecological systems, declining tree health
Dryland Regions Sub-programme	Rising watertables, soil structure/fertility, soil erosion, soil acidification	Impact of drainage lines, condition of riparian zone, loss of production due to poor water quality, access of stock	Clearance controls, protection of endangered species, conservation of biodiversity
Riverine Environment Sub-programme	N/A	Algal blooms, turbidity, sedimentation, poor condition of riparian vegetation	Conservation and enhancement of riparian zone, fish protection, protecting/improving in-stream habitat
Actions proposed	Irrigation reuse systems, improved irrigation technology, water transfer, conservation tillage and grazing management, property planning	Flow management plans, management of riparian zone, river and floodplain management planning, fencing riparian zone, repair of erosion. construction of storm and tail-water structures	Flow management, plans of management for the riparian zone river management planning, conservation incentives, floodplain management,

Table 4.2 Lachlan Region (NSW)

	Sustainable Productivity	Water Quality	Nature Conservation
Irrigated Regions Sub-programme	Rising saline groundwater, declining soil structure and fertility, declining water quality, damage to crops and infrastructure	Algal blooms, chemical/pathogen contamination	Managing threatening processes, loss of species, decline of native plant and animal species, control of introduced plant and animal species, inappropriate clearing, overgrazing
Dryland Regions Sub-programme	Rising saline groundwater, declining soil structure and fertility, acid soils, erosion, pest plants	Algal blooms, chemical/pathogen contamination, groundwater allocation, erosion	Managing threatening processes, loss of species, decline of native plant and animal species, control of introduced plant and animal species, inappropriate clearing, overgrazing
Riverine Environment Sub-programme	N/A	Pathogenic and chemical contamination, salinity sedimentation, bank stability and erosion, land use of near riparian land	Carp proliferation, native fish and biodiversity decline, decline in wetland health riparian vegetation, biodiversity/habitat, and water quality, floodplains used beyond capacity
Actions proposed	Improve irrigation efficiency, groundwater pumping, deep rooted perennials, retaining a minimum of 10% remnant vegetation, land used within capability, revegetation	Control river flows, control point source pollution, revegetation, introduce reuse systems, better farming practices to reduce sediments, toxic chemicals and fertiliser runoff, improve groundwater knowledge	Control inappropriate clearing of native vegetation, fencing and revegetation of riparian strips, control carp, fencing of remnant stands of native vegetation, revegetate with native plant species, clear exotics, establish vegetation corridors, protect threatened species

Table 4.3 Lower Darling (NSW)

	Sustainable Productivity	Water Quality	Nature Conservation
Irrigated Regions Sub-programme	Inefficient water use, waste management, infrastructure management, drainage disposal, rising water tables, lack of restructuring	Deteriorating water quality (drainage, nutrients, (drainage, nutrients, river flow	Biodiversity conservation, native vegetation decline, pest plants and animals, river regulation, total grazing pressure, high watertables, waterlogged and salinised soils, uncontrolled recreational pressure
Dryland Regions Sub-programme	Drought management, total grazing pressure, vertebrate pests, crop management, lake bed cropping, restructuring, land condition, lack of restructuring	N/A	Pest control, grazing pressure, soil erosion, biodiversity conservation
Riverine Environment Sub-programme	N/A	Water supply, environmental flows, grazing management, stream bank erosion and slumping, riparian zone management, blue green algae, wetland management, stormwater management	Wetland and river corridor degradation, river regulation and operation of lakes
Actions proposed	Incentives for irrigation scheduling, no drainage disposal to floodplains, soil surveys, supply rehabilitation, on-farm BMPs, structural adjustment, control of pest plants and animals, land use within carrying capacity Drought management, total grazing pressure, vertebrate pests, crop management, lake bed cropping, restructuring, land condition, lack of restructuring	Elimination/management of drainage disposal to rivers better management of drainage including chemical users courses, identification of flow and quality objectives, nutrient control plans, protection of areas from logging	Reservation of vegetation communities, regional vegetation plans, educate on importance of biodiversity, implement pest control plans, wetland incentives and rehabilitation works, management of weir pools, piping of open channels

Table 4.4 North Western Region (NSW)

	Sustainable Productivity	Water Quality	Nature Conservation
Irrigated Regions Sub-programme	Over extraction and over allocation, sleeper and dozer licences, vegetation clearing and floodplain management, salinisation and waterlogging	Point source and diffuse pollution, chemicals and pesticides, eutrophication, carp, tailwater management, over extraction	Tree decline and clearing, soil erosion, weeds, pasture establishment/ management herbicide resistance
Dryland Regions Sub-programme	Rising watertables and salinity, soil erosion, tree decline, pest plants and animals, pasture management, soil fertility and structure decline, floodplain management, acidification, chemical resistance	Soil erosion/runoff, grazing management, streambank erosion, nutrient management (diffuse and point source), agricultural chemicals, saline runoff, loss of riparian vegetation/ buffer capacity, declining groundwater levels due to over-, allocation sustainable groundwater management	Loss of biodiversity, rising watertables, soil erosion, pasture establishment/ management, clearing, soil fertility and structure decline, vegetation fragmentation
Riverine Environment Sub-programme	N/A	Riparian vegetation loss, overgrazing and inappropriate land use, river regulation affecting channel structure, streambank erosion, carp, point/diffuse source pollution, impact of mining extractive industries, recreational pressures, poor flood mitigation works	Riparian vegetation loss, stream bank erosion, pest plants and animals, wetland management, carp increase, river regulation, aquatic health
Actions proposed	Improving water use and irrigation efficiency, floodplain mitigation works, vegetation management (cropping and grazing systems) to improve infiltration, reduce runoff and reduce recharge, opportunity cropping, erosion control	Retention of tail water on-farm, biological control of major pests (IPM strategies), farm BMPs, guidelines for chemical use, vegetation management (cropping and grazing systems) to improve infiltration, reduce runoff and reduce recharge of saline watertables, riparian vegetation management, buffers strip plantings riparian zone fencing, river planning and structural works	Riparian vegetation management, buffer strip plantings, river planning, plantings, river planning, fencing of significant remnants, corridor plantings, revegetation, incorporation of biodiversity management into farm planning, refuge plantings in cotton growing areas

Table 4.5 Western Region (NSW)

	Sustainable Productivity	Water Quality	Nature Conservation
Irrigated Regions Sub-programme	Water sharing, salinity, off river storage, water quality impacts, chemical contamination, compaction, tributary flows	Blue green algae, P, salinity, pathogens and pesticides, impacts of water extractions, flow pattern changes	Conservation of threatened species, clearing controls, biodiversity loss, pest plants and soil animals, total grazing pressure
Dryland Regions Sub-programme	Restoration/maintenance of perennial pastures, declining soil structure and fertility, soil erosion, clearing of native vegetation, pest plants (woody weeds) and animals, total grazing pressure, quantity and sharing of groundwater	Quality of groundwater	Conservation of threatened species, clearing controls, biodiversity loss, pest plants and animals, total grazing pressure
Riverine Environment Sub-programme	N/A	Sharing of water resources, environmental flows, flow volumes and variability, effects of weirs, management of floodplains, wetlands and stream banks carp	Management of floodplains, flooding regimes, lake bed cropping, grazing pressure, floodplain structures, protection of riparian areas and corridors, sharing surface water resources, environmental flows and variability, impacts of weirs, management of floodplains, wetlands and stream banks, fish management
Actions proposed	Whole farm water use efficiency studies, irrigation training and scheduling, BMP adoption	Implementation of water reforms, river management plans, floodplain and wetland management, bore rehabilitation, setting flow and quality objectives, improving streambank and bed stability, effective management of pollution hazards and waste	Implementation of water reforms, development of river management plans, floodplain and wetlands rehabilitation and management

Table 4.6 Queensland Murray Darling Basin Region

	Sustainable Productivity	Water Quality	Nature Conservation
Irrigated Regions Sub-programme	Efficiency of water use, structural adjustment, declining terms of trade, aging rural populations, pesticide movement	Use of waste water; conservation, rehabilitation and management of in-stream and riparian habitats, wetlands and floodplains	Biodiversity loss, loss and decline of habitat
Dryland Regions Sub-programme	Declining terms of trade, aging rural populations, pest plants and animals, dryland salinity, soil erosion	Disposal of hazardous chemicals, sediment, nutrient and pesticide loads, location of intensive industries, groundwater use, floodplain management and development pressures	Landscape degradation due to pest plants and animals, overgrazing, clearing and changed fire regimes, lack of representation of 'at risk' ecosystems in reserves, transport of pest weeds, animals and insects between regions in equipment and with stock
Riverine Environment Sub-programme	N/A	Water allocation and flow management, environmental flows, water quality, river stability	Floodplain management, sharing of overland flows, management of in-stream, riparian, wetland and floodplain habitats and rehabilitation of degraded areas, water allocations and flow management, environmental flows, water allocation, water quality, river stability, natural wetlands, riparian vegetation retention and rehabilitation, conservation, rehabilitation and management of in-stream and riparian habitats, wetlands and floodplains

	Sustainable Productivity	Water Quality	Nature Conservation
Actions proposed	Pesticide management, conservation cropping, dryland salinity management, native and improved pastures	Strategies to minimise impacts, groundwater management plans, water allocation and flow management plans	Nature conservation plans, flow and water quality management plans, floodplain management plans, environmental water allocations, vegetation management plans, biodiversity plans

4.2 Comment

At this stage, most regional strategies provide at best, a broad picture of the priority issues within catchments. It is difficult to see such strategies becoming comprehensive and detailed plans of management at current levels of resourcing. A more likely evolution will be the development of State or Basin-wide plans dealing with the most urgent issues requiring coordinated and targeted action such as water resource sharing, water quality, floodplain management, vegetation management and flood management. These Basin-wide plans will be implemented at the regional level by local action plans dealing with the specific local conditions. Regional action plans will also deal with specific local priority issues, such as irrigation or dryland salinity.

However, a constraint to this approach is the level of government funding and the availability of volunteer time. Industry-based approaches offer an opportunity for the MDBC to provide further impetus and strong support for these regional approaches. However, the appropriateness of industry-based programmes will be dependent upon the strength of the regional approach and information availability.

5 Environmental Issues and the Cotton Industry

5.1 Background

The cotton industry has for a number of years taken a forward-looking approach to managing environmental issues associated with cotton production. The industry has funded a number of studies and investigations with a view to improving the environmental performance of the industry, as well as participating in state and national initiatives (such as LWRRDC, MDBC).

Key reports dealing with environmental management in the cotton industry include:

- Gibb Environmental Sciences & Arbour International (1991), An Environmental Audit of the Australian Cotton Industry
- ERM Mitchell McCotter Pty Ltd (1995), Environmental Compliance and Procedures Manual for Cotton Growers
- ERM Mitchell McCotter Pty Ltd (1995), Environmental Guidebook for Cotton Growers
- Australian Cotton Industry (1997), Best Management Practices Manual.

This section consolidates and analyses the issues identified in the preceding sections and in a range of reports (eg. the MDBC Natural Resources Management Strategy (1990), VDNRE (1997), Walker and Reuter (1996)) and discussions with industry representatives and technical specialists. Attachment 1 analyses these issues from the perspective of their relevance and significance to the natural environment and the objectives of the MDBC as well as those of the cotton industry.

MDBC policies and strategies target the condition of the land, water, and nature conservation resources of the MDB, and their use in a sustainable (economically and environmentally) way. For these reasons and because of the work already undertaken by the cotton industry, this report focuses on the land, water and nature conservation issues in the Basin, and does not directly consider issues such as OH&S, noise, odour, dust, or community health further. Similarly, the issue of pesticide drift affecting neighbouring properties is not treated further. This report does however touch on the interaction between pesticides, water quality and biodiversity.

For the purpose of this report, the cotton industry is taken to include family and corporate farm operators, processing companies and cooperative, and contractors. The inclusion of processors is of potential relevance to MDBC objectives because of the issues associated with the disposal of wastes that may be contaminated with pesticides and the implications for water (surface and groundwater quality in particular) (refer to Gibb Environmental Sciences & Arbour International, 1991).

5.2 Key Issues – Cotton Industry Perspective

Discussions with industry leaders indicated that the environmental issues of highest priority for the cotton industry are:

- Pesticide management, particularly from the viewpoint of community, OH&S and water quality impacts (this issue has received considerable attention over the years and the industry is confident that it has good management protocols in place)
- Reductions in water allocations as a result of government water reforms
- Groundwater allocations that ensure Estimated Sustainable Yields are not exceeded[2].

Issues that are of high priority but which are local in nature include:

- Groundwater quality deterioration due to over extraction
- Protection of wetlands from farm operations
- Floodplain buffer zones so that operations are kept away from rivers
- Water harvesting on floodplains and consequent impact on flows and the riparian zone
- Soil salinity.

Issues of high priority for the cotton industry in its position as recipient of water from the upper catchment include:

- Increasing water salinity
- Water turbidity.

Issues that were identified by the industry as being of low priority include:

- Vegetation clearance (most vegetation clearance in cotton growing areas occurred many years ago, and current development is generally occurring on treeless plains)
- Soil compaction (due to the use of well established management practices (eg. SOILpak))
- Soil acidification
- Soil contamination other than at a very local level
- Soil structure decline
- Soil sealing
- Irrigation efficiency
- Irrigation salinity
- Wind or water erosion.

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2 These two last points highlight issues that are outside a farmer's control, but which can have a significant impact on farm management practices.

These reports and discussions with industry leaders identified the following environmental issues associated with cotton production:

Table 5.1 Key Cotton Industry Operations and Potential Environmental Impacts

ORIENTATION	ENVIRONMENTAL IMPACT
Site Preparation	
Land clearing	Habitat and species loss; landscape and visual impacts; fragmentation of remnants; impacts on cultural resources; wind erosion, water erosion, water turbidity
Land levelling	Landscape and visual impacts; hydrological and soil impacts Installation of infrastructure Noise, hydrological impacts
Fertiliser application	Eutrophication, contamination of groundwater and surface water resources, soil acidification
Planting	Soil compaction
Insect Control	
Pesticide drift	Community health; impacts to non-target species (terrestrial and aquatic); odour; contamination of water and land resources
General	Occupational health; development of resistant strains; noise; waste management including spills, disposal of containers and unused pesticides etc
Irrigation	Depletion of surface and groundwater resources; water quality impacts on downstream users and groundwater, impacts on downstream habitats and associated species, excessive use causing shallow watertables and salinity, sodicity, soil erosion

Weed Control	
Pesticide drift	Community health; impacts on non target species and habitats, odour; contamination of land and water resources
General	Occupational health; development of resistant strains; noise; waste management including spills, disposal of containers and unused pesticides etc
Defoliant Application	
Pesticide drift	Community health; impacts to non target species and habitats, odour; contamination of land and water resources
General	Occupational health; development of resistant strains; noise; waste management including spills disposal of containers and unused pesticides etc
Harvesting	Waste generation, occupational health, noise, storage and disposal issues
Processing	Occupational health and safety; noise; waste generation and disposal issues, dust generation

5.3 Natural Resource Management Issues

Attachment 1 lists and analyses the range of possible natural resource management issues identified from the literature, catchment plans, MDBC reports, cotton industry reports and discussions with industry leaders. These issues have been assessed to give an indication of their significance to both the cotton industry and the MDBC.

Ranking the significance of MDBC objectives is difficult as they tend to be all-encompassing without providing an explicit indication of their relative significance. Nonetheless, an attempt has been made to rank these objectives. It was considered that a general understanding of the relative significance of an issue will help determine the level of effort that should be directed to addressing that issue.

For example, a highly significant issue may justify extra (and costly) effort in ensuring that it is rigorously implemented and monitored whereas a relatively insignificant issue may only demand moderate effort (and hence cost).

5.3.1 The MDBC Perspective

In the absence of priorities in this regard, ranking significance from the MDBC's perspective is based on:

1 = Highly significant
management of the issue is clearly an objective of an agreed thematic MDBC Strategy/Plan as these have been specifically considered in detail by the MDBC and MDBMC

2 = Significant
the issue is identified in the Basin Sustainability Plan objectives;
the issue comprises off-site effects (i.e. is principally of public good)

3 = Moderate significance
the issue is identified in the Basin Sustainability Plan objectives;
the issue comprises on-site effects (i.e. is principally of private good)

4 = Possibly significant
identified as an issue in the NRMS

5 = Of low significance
not specifically identified in any of the above sources.

Differentiation is made between public and private benefits. The objective of public (government) policy is the wider public good. For example, government is responsible for the allocation of water property rights between users. Once the property right has been established, management of the water becomes a private responsibility. Managing externalities such as impacts on water quality then emerge as a government responsibility. This could take the form of a licence condition for the use of that water. This differentiation may provide some additional information as to issues that are of relatively greater importance/ responsibility to the MDBC.

5.3.2 The Cotton Industry Perspective

Ranking significance from the cotton industry's perspective is based on the levels of action already taken or demonstrated by concern in reports and/or discussions with industry representatives. The rankings used are as follows:

1 = Highly significant
specific action taken or underway at an industry level to address this issue

2 = Significant
successfully addressing the issue will have immediate and obvious benefits to the industry/operators

3 = Moderate significance
not generally seen as important by the industry but seen as an emerging issue by technical experts

4 =Low significance
not identified in reports or in discussions as significant

5 = Not relevant
issue does not affect the industry.

The significance of issues to the MDBC is unlikely to correspond exactly to those of the cotton industry. It may be instructive to consider commonalties and disparities in order for each other's priorities and objectives to be better understood.

5.3.3 Scale of Action Required

The scale of action required to effectively manage an issue is an important consideration when evaluating the likely beneficial natural resource and environmental outcomes to the MDBC of an industry-based EMS. The scale of action required helps determine the effectiveness of the cotton industry taking action in isolation from other industry or catchment management initiatives.

A farm operator taking unilateral action on his property can satisfactorily manage some issues, such as soil compaction. These issues therefore would be relatively straightforward and well addressed by their incorporation in an industry programme. Such issues are marked with an asterisk (*) in Attachment 1.

Other issues, such as irrigation salinity or pesticide use, are best addressed at a regional scale if significant regional outcomes are to be achieved. A farm operator however can take unilateral action that will have a significant benefit on his property even if other operators do not undertake similar action. If the issue is one that is specific to the cotton industry (eg. cotton industry pesticide use) and the cotton industry has the major regional impact then a 'mere' industry approach is likely to make a significant positive contribution. A double asterisk (**) marks these issues.

However, a number of identified issues require strong government action and a catchment level approach to develop regional management plans or defined property rights that landholders can adapt to their properties. Issues of this sort include sustainable surface water and groundwater allocations, some water quality issues and some vegetation and biodiversity issues. The management of pesticides that are used across a range of agricultural industries would also fall into this category. For these issues unilateral action by one landholder or the cotton industry in isolation will have little or limited effect and it would be difficult for a 'mere' industry approach to make a verifiable and substantial positive impact. A triple asterisk (***) marks these issues.

5.4 Discussion

The above analysis assists identification of the key natural resource issues and the relative significance attributed to these issues by the different stakeholders. This helps determine the boundaries of an industry programme that can satisfy the needs of the cotton industry as well as those of the MDBC. It suggests that priority issues for the cotton industry are those marked 1, 2 and 3 in Attachment 1. Using this as a guide, it is possible to recommend that a cotton industry-based EMS should address (or respond to) the priority issues of the MDBC (Category 1) in an explicit and targeted manner. These issues are:

- Allocation (abstractions) and management of surface and ground water
- Changed flow regimes (ie. by meeting diversion licence conditions)
- Surface water quality (particularly with respect to pesticides and nutrients)
- Floodplain management (wetlands and riparian strips)
- Biodiversity management.

Further information is required before it is possible to be confident that rising groundwater (and hence waterlogging and salinity) will not be a longer-term concern.

At this stage, it is considered that the areas of greatest risk of mismatch between the priorities of the cotton industry and the MDBC are:

- Protection and management (for nature conservation purposes) of the riparian zone
- Protection and management of riparian vegetation (for nature conservation purposes)
- River water quality; although the industry is highly conscious of pesticide impacts, the potential impact of nutrients (fertilisers) should also be addressed.

The following issues are of generally low priority and require special consideration before inclusion in an industry programme:

- Acid sulphate soils
- Water repellence
- Wind erosion
- Land subsidence, although this should be catered for by groundwater licensing within ESY
- River turbidity and sedimentation that is a catchment issue; farm management of erosion is a current focus to control pesticide movement off-farm
- River water pH and pathogens
- Destruction of natural heritage sites
- Pest plants and animals
- Degradation of tourist sites.

6 Farm Management Practices, Environmental Impacts and Indicators

The level of support from the MDBC for introducing a cotton industry EMS is largely dependent on the contribution such an approach could make to achieving the MDBC's natural resource objectives.

This section focuses on the current best practices used in the cotton industry and analyses the contribution that these practices can make towards the MDBC's targeted natural resource outcomes. Examples of Key Performance Indicators that could be used at both the farm and industry levels (for the purposes of an EMS) are also provided, including those aimed at assessing progress towards natural resource outcomes.

The following sections are grouped according to categories of farm management operations Implementing an industry EMS will most likely be done according to groups of farm operations where best management practices can be used to target farming and environmental objectives simultaneously.

6.1 Water Management

6.1.1 Current Practices

Improving water management on farms is an important factor that will help achieve a number of MDBC objectives. Priority objectives include improving farm water use efficiency, reducing production losses due to salinisation and waterlogging, reducing off-site impacts such as water pollution, improving the water quality of streams, and maintaining key ecological processes.

Major government initiatives are underway to sustainably allocate water resources (surface and groundwater) between users, and to improve the environmental condition of waterways.

(a) Water Abstractions

Governments are currently determining water allocations, property rights and licence conditions as part of the MDBC Cap arrangement. Improved water management on farms will assist farms adjust to this new regime.

(b) Farm Irrigation System Performance

Historically it has been thought that irrigation of the grey cracking clay soils, common in the cotton growing areas was highly efficient with little scope for improvement (other than through reducing evaporation losses from on-farm storage dams).

However, recent research (on 4 farms) questions this view. The research so far shows overall farm water use efficiency of around 60%, with 40% of the water entering storage and 5%–6% of water passing through channels being lost to evaporation and deep seepage. Field efficiencies show 70%–80% being used through the plant depending upon whether tail-water was collected. Of the about 30% losses in the field about 25% is thought to be deep drainage (Raines, pers. com.).

Options for improving performance include reducing the number and increasing the depth of storage, emptying storage sequentially, using shorter runs in fields and cutting the inflow to fields earlier to reduce deep drainage, waterlogging and tailwater volumes.

There is a need for improved guidelines for design (and perhaps a simple Decision Support System (DSS) approach) catering for varying farm and soil conditions. It is believed there is enough information available to prepare a first version of Best Management Practices for water use efficiency (although it is recognised that there is still a need for much more research in this area). The approach should be similar to that used for the development of the LWRRDC/MDBC/CRDC BMP (pesticides) Programme.

(c) Farm Storage

A condition of water users licences in NSW is that all tailwater be collected and retained on-farm. This helps minimise the risk of nutrients and pesticides entering streams in runoff. This is also a sound practice from an economic perspective as it conserves water for productive uses. It is understood that in Queensland there is not a similar requirement or licencing, however the EPA Act imposes an ‘environmental duty’ on all Queenslanders, and establishes penalties for ‘unlawful environmental harm’.

There is a recognised risk to the environment from storm events due to the movement of pesticides and sediments. For this reason it is recommended that farmers design and operate on-farm storage so that the first 15mm of runoff from crops is collected and retained on-farm.

Structural failure or spills from large water storage and distribution channels used in the cotton industry represent a significant risk to the environment in the form of pesticide-contaminated water, local erosion, sediment deposition in streams, as well as flooding and infrastructure damage. Storage and other farm structures need to be built according to irrigation engineering codes.

Deep drainage from farm storage may have some local impact but this has not been identified as a significant issue on an industry scale.

(d) Distribution Systems

Recommended best management practices cover the design of the distribution and drainage system to minimise water velocities and erosion. Deep drainage from distribution systems may have some local impact but this has not been identified as a priority issue for the industry.

(e) Irrigation Method

Long (0.5 to 1km) irrigation furrows formed by laser levelling equipment have been used in the cotton industry for many years because of the low relief land and heavy clay soils. It has been considered that this has struck a good balance between cost and efficient water use with the clay soils effectively controlling the amount of water that can pass the rootzone, resulting in even irrigation and limited waterlogging. However as indicated above, recent research suggests the potential for significant losses due to deep drainage.

Management options to reduce irrigation water use include the following (those marked with an asterisk (*) are also expected to minimise erosion):

- Early irrigation cut-off to reduce recycling losses*
- Laser levelled fields to reduce deep drainage and increase uniformity of irrigation*
- Shorter furrow lengths according to rainfall intensity, slope, and soil type runs to reduce waterlogging, recycling losses, and deep drainage*
- Rapid irrigation to reduce ponding times (although this can result in an increased risk of recycling losses and erosion)
- Use of ‘V’ rather than ‘U’ shaped furrows
- Minimum tillage and long fallows to conserve moisture (although the latter can increase the risk of groundwater recharge and surface run-off)
- Surge flow irrigation to reduce deep drainage and increase uniformity of irrigation*.

The following practices are recommended by the cotton industry to reduce field erosion due to irrigation:

- Tail drains less than 0.25 metres below bottom of furrow
- Culverts designed to control upstream and downstream erosion
- Tail-water drains designed so that water travels at non-erosive velocities.

Recent research (Gordon, pers. com) shows that on many soils where cotton is grown, the potential for percolation losses is much higher than previously thought.

There has been limited experimentation with trickle (or 'drip') irrigation on cotton. Commercial size areas are irrigated in this way on the Lower Darling. Water savings of 10%–15% are reported but the main benefit is a 30% increase in yield due to better management (more frequent irrigation and a reduction in waterlogging in an area where heat limits production (Smith)) where the previous irrigation system had extremely long (up to 3km) runs. It is expected that trickle irrigation will also be worthwhile on red setting soils (Austin, pers. com.).

The benefits of trickle irrigation on cracking clay soils of northern NSW are not clear, and trials some years ago showed little benefit. However, it has been speculated that if the irrigation system was used as a management tool (controlling crop vegetative and reproductive growth) it could return worthwhile increases in yield (Austin).

Experimental and field studies of trickle irrigation of cotton (Gordon) have found that without good management (controlling frequency and volumes applied), water losses and waterlogging can be worse than with conventional irrigation. This has also been shown with surveys of field practice for other crops (eg. fruit trees), where the potential savings from the technology were not made in practice because of poor management (Jerie, pers. com.).

Small percentage water savings are possible (5–10%) through improvements in irrigation management, which over a farm or region represents a significant volume of water.

(f) Irrigation Scheduling

Irrigation scheduling using neutron moisture meters (NMM) was widely used in the late 1980s – early 1990s. In that time, farm operators built up experience and understanding in relation to irrigation scheduling. It is now widely held (eg. Austin, Hearne, Raines), that systematic scheduling is far less common with operators relying on the experiences ('self-calibration') gained when NMMs were used. Also, once the irrigation season/cycle has begun there is limited scope to change the frequency of irrigation, as fields are irrigated in a sequential roster. If irrigation of one field is delayed because of particular soil conditions this will delay all fields despite their soil moisture conditions. With surface irrigation, the soil rather than the operator is controlling depth of application. Some experts believe that increased use of irrigation scheduling methods would benefit farm water use efficiency, particularly if the relationship between crop vegetative and reproductive growth was better understood (Austin).

(g) System Management to Reduce Storm Impacts

Managing runoff from storm water events is a significant component of the industry's Best Management Practice Programme. The principal objective is to minimise pesticide transport from farms to water bodies because of the:

- Erosive effects and loss of topsoil containing (adsorbed) pesticide residues
- Washing of pesticides from crop foliage
- Their capacity to overwhelm the water control system and cause damage.

Industry best management practices involve the development of a farm storm water management plan that includes:

- Retaining at least 15 mm of runoff from fields treated with pesticide
- Designing overflow points to minimise the impact of runoff onto sensitive areas
- Field retention of storm water as a temporary buffer
- Maintaining space in farm storage dams
- Timing pesticide applications according to advance weather forecasts
- A protocol for storm preparedness and management.

The build-up of nutrients and pesticides held in water storage is an issue that requires further research, to determine the likely effects on water birds and the wider environment in the event that the water has to be released.

The use of levee systems to protect farms from flood damage is a significant issue due to the potential for these levees to redirect floodwaters to adversely affect landholders 'downstream'. This issue should be addressed in an industry programme.

6.1.2 Outcomes Sought

Table 6.1 Water Management Approaches Relevant to Achieving Priority Environmental Outcomes

Outcome	Approach
Improved quality of aquatic environments	River flows adequate for in-stream needs water abstractions according to licence conditions; Reduce pollution (nutrients sediments and pesticides) entering streams and wetlands Use of billabongs and wetlands for water storage or drainage water prohibited Riparian strip fenced with adequate setback of agriculture from water body
Water (surface and groundwater)	Managed sustainably and shared between users water abstractions according to licence conditions Groundwater abstractions according to licence conditions Water pricing to recover costs of managing, maintaining and replacing the water regulation and delivery system
Water quality meeting national standards managed sustainably and shared between users	River flows meet in-stream needs Water abstractions according to licence conditions Use of buffers and vegetation to reduce pollutants (nutrients, sediments and pesticides) entering streams Keeping field run-off on farms Management of fertiliser (N) and pesticides to protect surface and groundwater
Limit land salinisation	Reduce groundwater recharge and provide subsurface drainage
Increased productivity and value of production per unit of water	Reduce waterlogging losses Schedule water applications Shorter run lengths Improved/shorter irrigation cutoff Reduce recycling losses Reduce numbers of storage and empty sequentially Short season varieties Long fallow (although impact on raising water-tables needs consideration) Minimum tillage practices; stubble retention

Measures that could be used to monitor progress towards these outcomes include:

Table 6.2 Options for Monitoring Priority Water Outcomes

Outcome	Indicator and Comment
Improved quality of aquatic environments	Options here include monitoring and recording waterbird diversity, the condition of aquatic environments throughout the river system from upstream to downstream of the cotton growing areas, and implementing a register of fish kills. A number of systems for monitoring waterway condition exist, including AusRivas which principally considers the ratio between observed and expected levels of macro invertebrates. A wider assessment methodology based on approaches used in some states is being applied by the National Land and Water Audit (parameters include hydrology, physical form of the stream, streamside zone, water quality and aquatic life (macro invertebrates)). These assessments are beyond the means of individual farmers and are more likely to be conducted by government or volunteer community groups. It would be feasible for an agricultural industry to sponsor such an approach, although measurement of outcomes seems beyond the scope of an industry programme. An important consideration is the separation of the effects of wider catchment land and water use, from those within the control of the cotton industry.
Water managed sustainably and shared between users	The main indicators here relate to having an objective basis for sharing water between all uses and ensuring (monitoring) adherence to the agreed arrangements. Enforcing this is the responsibility of state governments. Water prices set to full cost recovery levels.
Water quality in streams and groundwater meeting national standards	Water quality monitoring of key parameters and comparison to national standards (trends and number of results exceeding established limits). The parameters of most interest are pesticides and nutrients. States have monitoring programmes in place, however meaningful results require extensive monitoring, which has considerable practical and cost implications.

Limit land salinisation	Area of land salinised and the area and quality of shallow watertables. Land salinisation is not easily measured.
Increased productivity and value of production per unit of water	Direct measurement of yields and water use (and farm water balances) is required. This is feasible at a farm level and possibly at a field level. Good record systems are required to maintain this information. Recording the best management practices used as part of an industry EMS should also be undertaken.

The monitoring and reporting of most outcome level indicators (eg. water quality, groundwater levels) are the responsibility of governments; although current (government) monitoring is inadequate to identify resource base conditions and trends. In areas dominated by one type of agricultural production system (eg. cotton), the industry should arguably take the lead in (or at least support) monitoring its environmental impacts. This would be consistent with the approach used in relation to industries located in urban areas; ie. that of the 'polluter' paying for the monitoring of its impacts.

6.1.3 Management Practices, Indicators of Performance, Monitoring and Reporting

The practices used by the industry and farmers to contribute to these outcomes are identified in the following table. An industry EMS would require having Best Management Practice guidelines and recording and reporting implementation of these practices.

Table 6.3 Key Farm Water Management Practices and Key Monitoring and Reporting Indicators

Practice	Monitoring and Reporting Indicator
Water abstractions (surface and groundwater) according to licence conditions	Record abstractions (dates, time, volume, locations)
Farm Plan to endorsed standard for: – stormwater management – erosion minimisation – nutrient management – irrigation efficiency and productivity protecting the natural environment (waterways, wetlands and remnant vegetation)	Development and endorsement of Plan Implementation of Plan according to targets Measure/estimate volumes and quality (EC, N, P, pesticides, sediment) of water leaving the farm Measure/estimate volumes and quality (EC, N, P, pesticides) of water held in store Measure/estimate field efficiency of water use and losses to groundwater

6.1.4 Evaluation of Adoption Benefits

Implementation of the above measures can help improve river and stream health, which is an important MDBC objective. These measures of conditions/outputs should be feasible and enable useful assessments of farm and industry performance to be made.

Best management practices are required in relation to on-farm water management. Improving performance to achieve overall efficiencies of 60% to 80% should be feasible. However, substantially improving performance on farms already operating at high levels of efficiency would be difficult.

6.1.5 Cost Implications

Implementation of the above approach would have the following cost implications:

1. ('Positive') The development and implementation of farm plans is expected to result in financial benefits by facilitating improved water management on farms. However, additional costs would be incurred if the level of performance (water use efficiency) was set such that it became difficult for farmers to achieve without significant capital investment (e.g. reducing numbers of storage, or providing reticulation systems to enable water transfers between storage)
2. ('Negative') The resources required by farmers to record and report compliance, and for the industry to collate and report on this information.

6.1.5 Further Information Needs

Further information is required on water balance studies, irrigation best management practices, and simple decision support systems.

6.2 Vegetation Management

6.2.1 The Current Situation

Significant natural resource benefits resulting from vegetation management (biodiversity outcomes) will most likely be achieved if there is a regional plan which identifies high value vegetation (trees, shrubs and grasslands), threatened species, and where vegetation corridors will be of most benefit. Development of these plans are best undertaken at a regional scale either by government or catchment managers and the cotton industry would have strong interest in being involved in the development and implementation of these regional plans. In areas where cotton is the predominant agricultural land use, there would be some kudos in the cotton industry leading the development of such a plan.

The cotton industry's Best Management Practices Manual contains guidelines for suitable buffer strips that can reduce the movement of spray droplets onto sensitive areas. Recommendations for vegetative buffer strips to maximise drift-catching ability include that they:

- Be at least 30m wide
- Comprise a variety of trees and shrubs planted randomly
- Have a density of approximately 50%
- Consist of shrubs and trees with slender rough foliage
- Attain a maximum height of 1.5 x the height of spray release.

Recent computer modelling by DLWC and CSIRO has looked at a range of options for intercepting spray drift, including tree breaks in and around farms, and wide (1km) vegetated strips and breaks next to sensitive areas. This work shows that interception at the source (using windbreaks in or around fields) is most effective in intercepting spray drift. Protective plantings around high value sites (houses, rivers, and native vegetation) can also help protect these sites. Riparian vegetation say 500m either side of a river, would provide good protection to the riparian zone. However, this work still requires field-testing and validation. A trade-off will be required between the width of this strip (and hence the environmental benefits), and the economic costs from land lost from agricultural production. Information is also required on the resistance of trees and shrubs to the different farm chemicals used (for example, insecticides, herbicides and defoliants). A decision support system could also be developed to assist farmers determine the effectiveness of existing plantings, and how the effectiveness of these plantings could be improved.

An important and difficult (politically and technically) issue for the industry and governments to resolve is the distance from waterways that agriculture should be conducted. Several specialists (eg. Keys, Vincent pers. com.) suggest the need for wide (300m to 500m) buffer zones to offer effective protection of the riparian zone. For major streams and rivers, fenced vegetated areas of say at least 500m on either side of the stream would likely give good protection to the stream and riparian zone. Expert advice is required to assist this determination.

6.2.2 Outcomes Sought

Environmental outcomes that could be sought by introducing best management practices for vegetation management, within an industry EMS include:

- Reduced input of sediments and nutrients into waterways through management of vegetation and riparian strips
- Reduced pesticide drift to water bodies and high value habitat areas by tree plantings and vegetation buffers
- Improved habitat and biodiversity by protecting and enhancing existing terrestrial and riparian remnant vegetation
- Improved biodiversity (including in waterways) through planting trees to improve habitat.

These outcomes are consistent with the objectives of the MDBC Basin Sustainability Plan.

6.2.3 Management Practices, Indicators of Performance, Monitoring and Reporting

Current Best Management Practices and possible indicators of performance include:

Table 6.4 Key Farm Vegetation Management Practices and Key Monitoring and Reporting Indicators

Practice	Monitoring and Reporting Indicator
Farm vegetation plan conforming to regional plan guidelines (if one exists): – Retaining natural vegetation along waterways, ridges, and erosion prone areas – Plan of revegetation for biodiversity purposes and control of drift to waterways, water bodies, high value habitat areas, home sites and non-target areas – Adequate setbacks of agriculture from waterways and water bodies – Siting and geometry of wind breaks and protective plantings – Targets for implementation	Target for development and endorsement of farm vegetation plan and progress against target

Fencing off native vegetation (terrestrial and riparian) areas and management (e.g. grazing) according to established practices	Compliance with targets and management recommendations
Controlling noxious weeds and feral animals in remnant areas	Compliance with control practices (eg. handling of chemicals, obtaining permits)
Clearance of native vegetation according to permit requirements	Recording areas cleared and obtaining required government permits and following required procedures and practices

Table 6.5 Key Regional Vegetation Management Practices and Key Monitoring and Reporting Indicators

Practice	Monitoring and Reporting Indicator
Regional plan identifying high value areas, corridors, plans and targets.	Development of Plan
Regional Plans should also incorporate minimum requirements (eg. targets) for re-vegetation,	Progress against targets (eg. length of riparian zone of adequate width and protected from stock and drift, area remnant vegetation, area of re-vegetated areas meeting required targets) for various areas and practices. Extent of vegetation of various categories could be readily measured by satellite (but is probably not justified in an industry programme)

6.2.4 Evaluation of Adoption Benefits

The above analysis suggests that significant outcomes can be achieved through effective management of natural vegetation. These outcomes will include the extent (coverage) and condition of natural habitats, and will require the targeting of high value areas. Of course, the exact nature of these outcomes depend on the particular practices that are put in place, and the level of performance expected for vegetation protection and rehabilitation. If progress towards environmental outcomes is to be monitored, parameters such as water quality, species, diversity and populations would have to be measured. However, this is considered to be beyond the means and skills of most farmers. Irrespective of whether farmers are involved in monitoring and measuring environmental conditions, a major challenge will be obtaining scientific agreement on the methods to be used and sources of funding required to undertake the work.

6.2.5 Cost Implications of Implementation

The above farm-based practices would be part of the development of an industry EMS, and the main cost would be, in effect, developing and implementing the farm vegetation plan. Ongoing costs of monitoring and reporting should not be significant.

Development of Regional Vegetation Strategies would be an additional significant cost but presumably borne by the relevant State government.

There are significant costs in fencing off vegetation zones and moderate costs associated with tree planting. For this reason regional priorities are important.

Regional coordination and compilation of results and reporting (eg. by the cotton industry) would amount to about 0.5 person per year although this would also include other aspects of programme coordination and implementation.

6.2.6 Further Information Needs

Scientifically agreed standards for plantings for the above purposes should be developed (e.g. width, varieties, sensitivity of species to farm chemicals, protection of sensitive areas such as riparian strips and remnant vegetation stands, identification of high value areas). There are general guides available but these need to be more explicit and justified with technical studies. Validation of recently conducted computer models is also essential.

Information is required on the impact of pesticides of terrestrial flora and fauna to enable guidelines for protecting high value habitats to be developed. Depending upon the level of expert knowledge available, this could be low cost or it could require some research.

To ensure effective and consistent development and implementation of farm vegetation plans, vegetation strategies under an industry programme should be developed in line with State and catchment vegetation management plans.

Further information is required on the long-term impacts of defoliants on perennial woody vegetation.

6.3 Soil and Crop Management

6.3.1 The Current Situation

Soil degradation can adversely affect yields. Management of soil compaction has been a major issue for the cotton industry over the last 20 years, and in this time considerable research has been undertaken to develop sustainable systems of soil management.

The industry has developed a soil management system called 'SOILpak for Cotton Growers that appears to be widely adopted so that compaction no longer seems to be a major concern amongst farmers.

Fertilisers (particularly, nitrogen (N) as urea or anhydrous ammonia) are extensively used in the cotton industry to boost crop yields. Approximately 50%–60% of the applied N is reported to be recovered by cotton plants with the bulk of the remainder being lost to denitrification, with small losses occurring through volatilisation and leaching (McKenzie, pers. com.). Environmental risks associated with fertiliser use include nitrogen compounds in runoff entering streams, and nitrate pollution of groundwater (monitoring has found N in groundwater, Timms, 1997). The cracking clay soils used for cotton production are naturally high in phosphorous and it is therefore usually not necessary to apply phosphatic fertilisers on cotton farms. However, after many years of cropping, levels of soil phosphorous, potassium, and some trace elements in heavily cut areas are beginning to decline.

Other issues that are beginning to emerge include soil acidification (in lighter soils), and increasing alkalinity. Detailed yield mapping is also showing high yield variability in fields, possibly due to sodicity and dispersion.

The third edition of SOILpak has recently been released. This manual provides a comprehensive and flexible soil management model, which caters for different soils in different regions. A 'NUTRIpak' manual is being finalised to deal with nutritional aspects of crop management. The information contained in these documents could be readily incorporated into an industry EMS.

Due to the generally low relief of soils used in cotton production, there are limited water erosion problems, however for the reasons mentioned above, steps must be taken to prevent soil loss to streams.

Pesticide application also results in some pesticides becoming bound to soil particles. For this reason it is important to limit the movement of soil into watercourses. Some pesticides can be readily leached, creating a risk of groundwater pollution. However, this risk is low on heavy clay soils that tightly bind most pesticides.

The contamination of soils, and surface and ground water is therefore a real risk in cotton production. The industry has comprehensively addressed this issue in the BMP Programme. For example, industry best management practices for pesticide use cover:

- The application of pesticides including, rigorous planning of applications, communication with neighbours, control and monitoring of applications, minimising the amount of pesticide applied, and minimising the risk of pesticides affecting non-target areas, including the use of downwind buffer zones during applications (100m for ground applications, 300m for aerial applications)
- Integrated pest management practices aimed at reducing reliance on conventional insecticides, such as managing crops for early maturity, preserving beneficial insects, monitoring fields for insect damage, using cultural and biological insect control methods, and preventing insect resistance to insecticides
- Pesticide storage and handling, including preventing and controlling spills, security and safety, emergency planning, handling rinsates, and safe disposal of pesticide waste
- Farm design and management practices to control irrigation and stormwater runoff, and minimise soil movement.

Developing best management practices for pesticide use has been an important focus of the cotton industry. The LWRRDC/MDBC joint programme involved a $6 million investment of funds and is widely seen as a highly effective approach.

6.3.1 Outcomes Sought

- Maintenance and where possible improvement in the physical, chemical and biological condition of soils in order to increase productivity and to maximise future options for land use
- Increasing farm productivity and net value of production per hectare
- Crop management to reduce soil and water degradation/ contamination.

6.3.2 Management Practices, Indicators of Performance, Monitoring and Reporting

Table 6.6 Key Farm Soil and Crop Management Practices and Key Monitoring and Reporting Indicators

Practice	Monitoring and Reporting Indicator
Implement practices contained SOILpak	Area of land managed using SOILpak
– establish permanent beds	Recording soil management practice
– avoid working soil when wet – minimise number and weight of machine passes	Monitoring of outcomes would require regular (eg. 5 year) surveys of soil condition
– allow soil cracking between crops	
– use crop rotations	
– use minimum tillage	
– use dry soil, deep ripping for remediation	
– yield mapping	
– use gypsum where necessary	
Fertiliser and pesticide application	
– follow industry's Best Management Practice Manual	Record chemical, dates and rates of applications with a preference for less mobile forms of chemicals
– use of soil and tissue sampling to plan fertiliser application rates	Maintain high soil organic matter to encourage breakdown of chemicals
– construct infrastructure and manage pesticide waste	Monitor soil nutrient levels
	Manage runoff using tail-water schemes (see water management section)
	Monitor groundwater quality
Farm management	Farm cash income/ha Farm business profit/ha Cotton quality

6.3.3 Evaluation of Adoption Benefits

Many of the practices outlined above can contribute to the achievement of MDBC outcomes and could be readily included in an industry programme. However, it is unlikely that the 'farm management' indicators noted above would be reported through such an approach for reasons of relevance to the industry programme and privacy (eg. income/profit, although ABARE surveys report similar information).

A recent major review of catchment indicators (see Walker and Reuter) proposed a list of indicators including those relevant to (dryland) farm reporting. Relevant indicators include:

Table 6.7 Indicators for Monitoring Farm Soils and Farm Performance

Bio-physical condition	Biophysical trends	Productivity/ financial performance
Soil consistence	Effective root depth	% potential yields
Soil texture	Soil pH	Water use efficiency (eg. yield/ML)
Soil colour	Soil EC	Farm cash income/ha
Water intake rate		Farm Business profit/ha
Soil strength		Product (cotton) quality
Slaking and dispersion		
Cotton strip test (biological activity)		
Soil analysis for chemical fertility (total N, total P, exchangeable K)		

Indicators relating to soil condition are generally simple and inexpensive to monitor and measure, and directly related to productivity and existing farming practices. The table above suggests that a number of soil quality parameters can be monitored and measured. It will be important to limit the soil monitoring and measuring requirements under an industry programme to a level that is manageable for growers. Industry and MDBC agreement on the most important parameters may be necessary. There is a case here for the industry with the state governments and MDBC to undertake say five-yearly monitoring of the most important indicators.

6.3.4 Cost Implications

The suggested farm management practices should be relatively simple to monitor and record. The cost of recording and reporting would be the only (small) additional cost.

A decision to monitor environmental outcomes (as described in section 7.3.1) would be a high cost exercise and would require careful consideration.

6.3.5 Further Information Needs

A thorough review (say several times with a 3–5 year frequency) is required of the best management practices to ensure they reflect current knowledge.

The potential of groundwater pollution from pesticide and fertiliser use requires detailed study to confirm the adequacy of recommended pesticide and nutrient handling, application and disposal practices.

7 Effectiveness of an Industry EMS for Achieving MDBC Objectives

7.1 Background

The MDBC BSP identifies an extensive range of (at this stage non-operational) indicators that could be used to monitor implementation of the industry programme. As well, some of the specific MDBC strategies have monitoring requirements.

It is necessary to make a number of assumptions about the particular components of an industry EMS in order to determine the possible effectiveness of such an approach in addressing MDBC objectives. It is therefore assumed that a cotton industry EMS would incorporate:

Best Management Practices Manuals

A suite of Best Practice Manuals would be developed by the industry and preferably endorsed by government/MDBC. These would contain best management practices for each industry sector (eg. farming, ginning). Best management practices for growers would be a priority, given their use of extensive land and water resources, and the current focus of the industry BMP Programme on this group. Implementation of best management practices could be recorded and audited for compliance with the programme.

Best Management Practice Manuals covering the following issues are required:

- Pesticide management (which already exists)
- Soil and nutrient management
- Water management
- Vegetation management.

Guidance material for growers on each of the components of the EMS would also need to be developed. Similarly, training materials on management tools or processes may need to be developed; for example, risk assessment, auditing and management review.

Recording and Reporting of On-Farm Practices (Activity Monitoring)

Farmers would monitor their farm practices (including BMPs and where possible, resource inputs such as water, pesticides and fertilisers), and retain records. In the event of an industry report this information would be compiled by an industry organisation. The best management practice manuals would identify ‘priority’ practices that must be implemented and monitored for assessment of performance (for example, through auditing).

Resource Condition Measurements on Farm (Output Monitoring)

Farmers would also be responsible for recording agreed resource condition measures such as:

- Quantity and quality of water leaving the farm
- Groundwater (depth and quality)
- Vegetation (extent and condition)
- Soil conditions and yield (eg. using yield mapping technology).

The industry could compile records of farm level conditions at agreed intervals to give an industry picture.

Regional Monitoring (Outcomes Monitoring)

Government (possibly assisted by regional communities) would undertake some regional monitoring to assess environmental conditions and evaluate the performance of the industry in relation to key measures such as:

- Stream water quality and flows
- Waterway conditions
- Groundwater (depth and quality)
- Vegetation (extent and condition)
- Biodiversity.

7.2 Application of BSP Indicators to a Cotton Industry EMS

Attachment 2 assesses each indicator identified for the BSP, for its relevance to an industry EMS. This assessment considers the performance indicators from the following two perspectives:

- Would the indicator be readily and usefully included in an industry EMS? This is taken literally in that the indicator needs to be in a form that could be readily included in the short term, on an industry/farm scale
- Would an industry EMS help achieve the intended objective or outcome of the MDBC?

7.2.1 Indicators in an industry EMS

The following indicators were considered to have possible application in an industry-based EMS, in order to reflect MDBC objectives. Whilst all of the following indicators (other than groundwater conditions) could be included in an industry EMS, in all cases further work is required by the industry and governments to define specific targets and practices (eg. water quality leaving the farm, vegetation condition, acceptable irrigation practices etc).

Measurement of groundwater conditions could be included in an industry EMS, however as it deals with resource condition rather than farm level activity its inclusion is subject to considerations of practicality and cost.

(a) Irrigated Regions Sub-programme

- % adoption of more efficient irrigation techniques
- % adoption of minimum tillage practices
- Area of land protected by drainage (surface and sub-surface)
- Net area of land revegetated
- Area of land salinised or waterlogged
- Height and salinity of groundwater
- Rate of groundwater rise
- Salt, nutrient and pesticide loads leaving the farm in surface water
- Incorporation of nature conservation objectives property management plans and regional/catchment plans
- Area of remnant vegetation protected and managed
- Area of revegetation established serving biodiversity purposes
- Implementation of control strategies for threatening processes
- Increase in cover of local provenance vegetation.

(b) Riverine Environmental Sub-programme

- Implementation of catchment management plans promoting adoption of BMPs for nutrients, pesticides salinity and erosion in catchments
- Implementation of management plans for the riverine environment
- Agreement on permanent cap on diversions with no decline in river flow regimes across the Basin
- New operating rules adopted that better suit the river environment
- Permanent Cap on diversions implemented and annual audits undertaken
- Implementation of weed and feral pest management/control programmes for the riverine environment
- Extent of habitat rehabilitation measures implemented (eg. extent of riverine corridor and wetland habitats fenced and managed to maintain nature conservation programmes)
- Improved viability of native riverine species listed as endangered or vulnerable.

7.2.2 Indicators to assist achieving MDBC objectives

Although many of the specific indicators outlined in the BSP could not be directly included in an industry EMS, the table in Attachment 2 suggests that a comprehensive approach to natural resource issues (covering water diversions, irrigation practices and systems, water quality leaving the farm, vegetation and biodiversity management) would be likely to significantly assist in achieving the intended outcomes of the BSP.

7.3 Costs and cost sharing

7.3.1 Monitoring of Activities, Outputs and Outcomes

Effective implementation of an industry EMS will require monitoring and measuring of farm activities, outputs and environmental outcomes.

ACTIVITY	→	OUTPUT	→	OUTCOME
In accordance with defined BMPs eg. pesticide management, operation of farm water storage and water abstractions		**eg. water quality leaving farm**		**stream WQ**

The degree of difficulty and cost of monitoring is generally higher as data collection moves from monitoring activities to outputs to outcomes.

The development of comprehensive natural resource plans by individual farmers is likely to be extremely expensive and to result in piecemeal and inconsistent approaches to natural resource management being taken across farms. The resulting fragmentation of natural resource management would greatly increase the likelihood that government and MDBC objectives will not be adequately addressed.

An industry-based approach on the other hand, where the development of recommended farm practices is centralised and informed by external stakeholders, should significantly decrease the cost of farmer participation, and significantly increase the likelihood of government and MDBC objectives being properly addressed.

Table 7.3.2 Private or Public Benefit

The implementation of best management practices should improve on-farm efficiencies and farm profitability. It will be difficult for the industry to encourage farmers to adopt practices that could have significant adverse implications in either of these respects. Therefore, best management practices need to be to a large extent, farm-focussed. However, many of the natural resource benefits that are also expected to result from the implementation of best management practices are of interest to governments and the MDBC. The degree of congruence of interest between industry and the MDBC can vary from issue to issue.

The following table indicates how the 'level of benefit' might vary for a range of actions that should be considered for inclusion in an industry EMS that addresses MDBC priorities (a bold arrow indicates a greater level of benefit).

Table 7.1 Magnitude of Benefits for Key Management Practices

Public Benefit	ACTION	Private Benefit
↑	Water abstractions within licence	↑
↑	Recycling runoff	↑
↑	Reducing erosion	↑
↑	Buffer strips to arrest pesticide drift	↑
↑	Handling pesticides safely	↑
↑	Natural vegetation riparian strip	–
↑	Fencing riparian strips	–
↑	Bio diversity corridors	–
↑	Tillage to control heliothis	↑
–	Managing soil compaction	↑
↑	Managing soil nutrient levels	↑
↑	Improved irrigation efficiency	↑

This analysis also provides an indication as to where there is greater justification of government involvement in issues included in an industry programme. For issues that are principally of public benefit (eg. biodiversity management), strong government support (eg. to develop regional biodiversity strategies and incentives for implementation) will be required for an industry programme to be successful. On the other hand, issues that relate to primarily private benefits are generally adequately addressed without close government assistance.

7.4 Programme Credibility

An important issue for the industry programme is the credibility and acceptability of the practices and performance levels included within it, particularly where there are issues of public interest at stake such as regional environmental conditions. The mere use of an EMS is not a guarantee that acceptable objectives or targets will be established or that acceptable environmental outcomes will be achieved.

For this reason, the credibility of the industry programme will be enhanced if the issues addressed, and the practices developed and implemented, are done so openly with government. The need for external stakeholder involvement in the development of acceptable farm practices adds further weight to the argument that it is a role best done at the industry rather than the individual farm level.

An example of this industry/government cooperation is seen in the development of the industry's BMP Programme for pesticide management. As a result of the consultative approach taken during the development of the programme, there appears to be widespread acceptance that the recommended practices do in fact represent 'best practice' and that public benefits such as stream water quality, are well considered.

8 Research and Development Requirements

To effectively implement an industry EMS, a number of information and education needs will have to be met. These requirements relate to ongoing research and development of best management practices that address industry and MDBC priorities, and the education of industry members in the managerial tools and procedures associated with an EMS. Additional research and development requirements relate to better quantifying the environmental impacts of cotton production, and determining any resultant benefits for natural resource conditions, of changes in farm management practices.

To address the priority issues of the MDBC, the industry needs to develop Best Management Practice booklets for the following:

- Pesticide management (already in place)
- Water management
- Soil and nutrient management
- Vegetation management.

Short-term technical reviews, studies and workshops would be required to develop these. This would also help identify longer-term research needs. Also, guidance material on the components and operation of an industry EMS will also need to be developed. This guidance material would be based on the specifications of ISO 14001, and would include detailed information on management tools necessary for effective EMS implementation. For example, risk assessment, monitoring and measuring techniques and protocols, and auditing.

Some specific issues requiring further research include:

- Regional groundwater monitoring, modelling and water balance studies to understand the long-term risk from irrigation-induced salinity
- Irrigation best management technologies and practices
- Long term hazards of nutrient and pesticide concentrations in farm storage dams
- Potential for groundwater pollution by pesticides and nutrients
- Long-term impacts of defoliants on native vegetation
- Performance of tree corridors in arresting pesticide drift
- Role of biodiversity in cotton production

- Market segmentation to determine appropriate transfer and adoption tools
- Quantification of the relationship between the adoption of best management practices and natural resource benefits.

Where relevant, research priorities should be determined in a consultative manner between the MDBC and the industry, to ensure that each party's respective priorities are met, and that duplication of research efforts is avoided.

9 Conclusion

The results of this review support the feasibility of and potential for beneficial environmental impacts to result from the introduction of an EMS in the Cotton Industry. For such an approach to be most beneficial, government-endorsed catchment management plans and targets are required within which EMS objectives and practices can be situated. This would also enhance the credibility of an industry EMS. The MDBC could usefully support a cotton industry EMS, as well as the research and development of best management practices that will result in the sustainable use of natural resources on farms.

(1) Introduction of an industry EMS could have a major positive impact on achieving the objectives of the Basin Sustainability Programme and other MDBC objectives.

(2) Introduction of an industry EMS could provide a potentially effective mechanism for delivering the regional plans and strategies referred to in the BSP.

(3) An industry EMS would assist the development of regional plans as it could provide information on the feasibly of practices, their likely levels of adoption, and any resulting natural resource benefits.

(4) There are relatively few indicators that are specified in the Basin Sustainability Programme that could be directly included in an industry EMS. Indicators that should be considered as essential inclusions are those relating to:

- Water quality (salinity, pesticides, turbidity, nutrients (N,P) and the volume of water leaving the farm in specific events) leaving the farm
- Surface and ground water abstractions and compliance with licence conditions (eg. timing and rate of abstractions)
- Revegetation and vegetation management (eg. fencing off a riparian strip of defined size, protection of wetlands, management for nature conservation outcomes)
- Water use efficiency (yields and water use on a field by field basis if possible)
- Groundwater levels and salinity.

(5) An industry-based EMS should address (or respond to) the priority issues of the MDBC (Category 1) in an explicit and targeted manner. These issues are:

- Allocation (abstractions) and management of surface and ground water
- Changed flow regimes (ie. meeting diversion licence conditions)
- Surface water quality (especially pesticides, nutrients)
- Floodplain management (wetlands and riparian strips)
- Biodiversity management.

Further information is required before it is possible to be confident that rising groundwater (and hence waterlogging and salinity) will not be a longer-term concern.

(6) At this stage, it is considered that the areas of greatest risk of mismatch between the priorities of the industry and the MDBC are:

- Protection and management (for nature conservation purposes) of the riparian zone
- Protection and management of riparian vegetation (for nature conservation purposes)
- River water quality; although the industry is highly conscious of pesticide impacts, the potential impacts of nutrients (fertilisers) should also be addressed.

(7) The following issues are of generally low priority and require special consideration before inclusion in an industry programme:

- Acid sulphate soils
- Water repellence
- Wind erosion
- Land subsidence, although this should be catered for by groundwater licensing within ESY
- River turbidity and sedimentation (which are catchment issues); however, farm management of erosion is a current focus to control pesticide movement off-farm
- River water pH and pathogens
- Destruction of natural heritage sites
- Pest plants and animals
- Degradation of tourist sites.

(8) For reasons of EMS credibility and in order to increase the likelihood of achieving desired natural resource outcomes in the Basin, a joint approach involving the industry and the MDBC, followed by formal endorsement of the EMS by the MDBC, is justified.

10 List of Interviewees

Nick Austin, New South Wales Department of Agriculture, irrigation

Ian Gordon, Queensland DNR, Indooroopilly

Brian Hearn, Narrabri, irrigation, agronomy and soils

Jack Holland, Environment Australia, pesticides

Michael Jamieson DLWC Tamworth, Groundwater

Peter Jerie, Institute for Sustainable Irrigated Agriculture, DNRE, Victoria

John Keys, DLWC Gunnedah, buffer strips

Jerry Killen, Narrabri, Namoi Valley Water Users Association

Dave MacKenzie, Orange, soils

Monica Muschal, DLWC Wollongong, water quality

Jim Purcell, Narrabri, irrigation engineer

Steve Raines, University of Southern Queensland, irrigation

Nick Schofield, LWRRDC, pesticides and in-stream impacts

Bob Smith, Gol Gol, cotton farmer, irrigation

Rachel Thomas, Environmental Officer, Southern Star Cotton Narrabri, EMSs

Wendy Timms, UNSW, groundwater

Murray Vincent, EPA Queensland, water quality

Jack Warnock, Narrabri cotton farmer, groundwater

Allan Williams, Executive Officer, ACGRA, Narrabri

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Attachment 1: Review of Natural Resource Management Issues and their relevance to the Cotton Industry

Legend

In the table below, “significance” from the MDBC’s perspective is based on the following:

1 = Highly significant
management of the issue is clearly an objective of an agreed thematic MDBC Strategy/Plan as these have been specifically considered in detail by the MDBC and MDBMC

2 = Significant
the issue is identified in the Basin Sustainability Plan objectives; the issue comprises off-site effects (ie. is principally of public good)

3 = Moderate significance
the issue is identified in the Basin Sustainability Plan objectives; the issue comprises on-site effects (ie. is principally of private good)

4 = Possibly significant
identified as an issue in the NRMS

5 = Of low significance
not specifically identified in any of the above sources.

"Significance" from the cotton industry’s perspective is based on the following:

1 = Highly significant
specific action taken or underway at an industry level to address this issue

2 = Significant
successfully addressing the issue will have immediate and obvious benefits to the industry/operators

3 = Moderate significance
not generally seen as important by the industry but seen as an emerging issue by technical experts

4 = Low significance
not identified in reports or in discussions as significant

5 = Not relevant
the issue does not affect the industry

Scale of issue

This provides a guide to the minimum level of action required to effectively address an issue

* = action by an individual farmer on their property is sufficient to address the issue

** = action at a regional or industry scale is required to effectively address the issue

*** = action at a catchment scale, with strong government involvement/support is required to effectively address the issue

ISSUE	MDBC SIGNIFICANCE 1=highest 5=lowest	INDUSTRY SIGNIFICANCE 1=highest 5=lowest	SCALE OF ISSUE * = farm ** = industry ***= catchment	COMMENT
LAND				
Irrigation soil salinity	1 (S&D Strategy)	3	**	A localised issue, not considered significant
Irrigation waterlogging	1 (S&D Strategy)	3	*	A result of low permeability of clay soils, exacerbated by poor irrigation practice and field design and layout
Dryland salinity	3	NA	***	Not significant in cotton growing areas although the deterioration of water quality in the incoming irrigation water (caused by dryland salinity) was identified as a cause for concern and has been identified as a potentially significant (future) issue by the MDBC salinity audit
Soil structure decline (including sodicity)	4	3	*	Not widely considered a problem although evidence emerging that it is a major contributor to in-field yield variability
Soil nutrient decline	4	3	*	Managed by fertiliser (N) applications, soil and plant tissue testing. P, K and some trace elements are emerging as a need
Soil acidification	4	3	*	Although not considered significant, the incipient conditions for the development of acid soils (nitrate leaching) exist in some areas with light soils
Wind erosion	4	4	**	Cotton is generally grown on clay soils not highly susceptible to wind erosion
Water erosion	4	2	**	Although cotton is generally grown on land with low relief (Emerald area an exception), farm design recommendations should aim to ensure that water erosion and sedimentation do not become significant. Erosion can result from irrigation, storm events or failure of water storage and distribution structures
Soil compaction	5	1	*	Serious problem which has been addressed by soil management systems (SOILpak)

ISSUE	MDBC SIGNIFICANCE 1=highest 5=lowest	INDUSTRY SIGNIFICANCE 1=highest 5=lowest	SCALE OF ISSUE * = farm ** = industry ***= catchment	COMMENT
LAND				
Soil contamination	5	3	*	Local issue. Created from disposal of waste (pesticides, petroleum) from farms and processors (containers, spills, washdown etc)
Soil sealing	5	4	*	Insignificant for areas with cracking clay soils; significant for some small areas of hard setting duplex soils
Acid sulphate Soils	5	5	*	Not relevant to cotton growing areas
Water repellence	5	5	*	Not relevant for soils in cotton growing areas
Failure of major on-farm earthworks	5	3	*	Potentially a significant issue with potential for major off-site environmental impacts (sedimentation, turbidity and return of tailwater to streams and wetlands)
WATER				
Irrigation system efficiency	1	2	*	Important to the cotton industry as it will enable the industry to adjust to reduced water allocations from the MDBC cap and raise farm productivity. Inefficient irrigation systems may result in excess water leaving the property (groundwater recharge or tailwater)
Groundwater				
Groundwater degradation (salinity and contamination)	2	3	***	‘Moderate significance’. Evidence of Atrazine N and some cotton insectcides in groundwater suggests action is warranted
Groundwater depletion and over allocation of groundwater	4	1	***	High significance in some areas; this is being addressed by government projects determining Estimated Sustainable Yields, and through licence conditions

ISSUE	MDBC SIGNIFICANCE 1=highest 5=lowest	INDUSTRY SIGNIFICANCE 1=highest 5=lowest	SCALE OF ISSUE * = farm ** = industry ***= catchment	COMMENT
WATER				
Groundwater dependant	5	4	***	Not considered significant, although not a well studied area. Development in mound spring areas would be of concern and require special management
Soil surface subsidence	5	4	***	Not thought to be significant; will be effectively managed once ESYs established
Surface water				
Over-allocation of water resources	1 (Cap)	1	***	A significant issue being addressed by government projects (Water reform in NSW and WAMP process in Qld) and through licence conditions
Changed flow regimes	1 (Cap)	1	***	A significant issue being addressed by government projects (Water reform in NSW and WAMP process in Qld) and through licence conditions
Deteriorating surface water quality				Water quality in the regions (Far West, Central West, Barwon) where cotton is grown in New South Wales (conditions in Queensland are expected to be similar) is generally poor for turbidity, phosphorous, macroinvertebrates and fair for salinity. Water quality declines with increasing distance down the catchment
Pesticides	1 (Fish Management)	1	**	Historically the most significant issue for the cotton industry. The industry with other agencies (LWRRDC, MDBC) has addressed the issue extensively and now has a Best Management Practices Program in place
Salinity	1 (S&D Strategy)	3	***	For the industry, the most significant aspect of water salinity relates to the deterioration in (irrigation) water quality coming from up catchment. There is little irrigation salinity associated with shallow watertables in cotton growing regions and limited concern with it developing

ISSUE	MDBC SIGNIFICANCE 1=highest 5=lowest	INDUSTRY SIGNIFICANCE 1=highest 5=lowest	SCALE OF ISSUE * = farm ** = industry ***= catchment	COMMENT
WATER				
Turbidity	1 (Algal Strategy)	4	***	River water turbidity is generally poor in the relevant catchments of NSW. Its cause appears to be wider management of the catchment of which cotton growing is part) rather than cotton production specifically
Nutrients	1 (Algal Strategy)	3	***	The most common fertiliser used in cotton is nitrogen. Phosphorous is of primary concern as it stimulates algal growth. Total Phosphorous levels are generally low in the relevant rivers (Macquarie is fair – poor) of inland NSW. Towns and STPs are the main cause of concern for algal management in the cotton growing regions. If P fertilisers are increasingly applied to crops precautions will be required to keep it out of rivers
pH	2	4	***	Does not appear to be significant
Microbes/pathogens	2		***	Does not appear to be significant
Sedimentation	1 (Fish Management)	4	***	This issue appears to be a wider issue of catchment management but underlines the need for cotton farms to control erosion on farms
Floodplain management	1 (Wetlands Strategy)	2	**	Floodplain management is a significant issue for the cotton industry. Key issues that should be addressed include: avoiding using wetlands for storage of water, buffers and isolation of wetlands from pesticide drift and surface water input (unseasonal input, tailwater, of potentially polluted stormwater)
Flooding (infrastructure)	5	2	***	A significant catchment management issue. Extensive construction of levees and ring tanks can have a major impact on floodways

ISSUE	MDBC SIGNIFICANCE 1=highest 5=lowest	INDUSTRY SIGNIFICANCE 1=highest 5=lowest	SCALE OF ISSUE * = farm ** = industry ***= catchment	COMMENT
BIODIVERSITY				
Degradation of wetlands	1 (Wetlands Strategy')	2	**	Cotton production near wetlands can threaten these ecosystems through for example, direct water abstractions, contaminated runoff or tailwater, or pesticide drift. The industry BMP Program seeks to address these issues
Vegetation clearance	2	1	***	Vegetation clearance is a significant issue throughout NSW and Queensland being addressed by vegetation management reforms at the government level. It is not considered to be a significant (future) issue for the cotton industry as most clearing occurred a number of years ago. New development is generally taking place on treeless plains or in areas where agricultural production systems already exist. However, conversion of areas used for extensive grazing may have an impact on native grasslands/ shrubs.
Decline of native vegetation	2	3	**	A significant issue as there is limited native vegetation remaining (generally limited to narrow riparian strips) and what remains is often either old or not in good condition, and is therefore vulnerable to pressure from agriculture. It is understood that in general this vegetation is not fenced off and that therefore there is limited understorey development or young trees. Further decline may be accelerated by the drift of defoliants
Habitat loss	2	3	**	A significant issue for the above reasons. The limited extent of native vegetation increases the importance of remnant stands. Practices that threaten the condition or extent of remnant native vegetation need to be addressed. The use of native vegetation as a buffer to pesticide drift to watercourses may reduce the suitability of the habitat for native fauna
Habitat modification	2	3	**	See above

ISSUE	MDBC SIGNIFICANCE 1=highest 5=lowest	INDUSTRY SIGNIFICANCE 1=highest 5=lowest	SCALE OF ISSUE * = farm ** = industry ***= catchment	COMMENT
BIODIVERSITY				
Species decline and extinctions	2	3	***	See above
Degradation of tourist/ recreation sites	4	4	–	Not considered significant in cotton areas
Destruction of natural heritage sites	4	5	–	Not considered significant in cotton areas
CULTURAL HERITAGE				
Degradation of aboriginal heritage sites	4	3	–	Potentially a significant local issue
Degradation of historic heritage sites	4	5	–	Not considered significant; managed by State cultural heritage legislation
PEST PLANTS AND ANIMALS				
Pest plants	4	4	**	Not considered significant in cotton areas
Pest animals	4	4	**	Not considered significant in cotton areas

Attachment 2: Evaluation of MDBC Basin Sustainability Indicators

Legend

The following table summarises the relevance of each of the indicators identified in the Basin Sustainability Program, to a cotton industry EMS.

This assessment was made from the following two perspectives:

– Would the indicator be readily and usefully included in an industry EMS? This is taken literally in that the indicator needs to be in a form that could be readily included in the short term, on an industry/farm scale (second column in table)

– Would an industry EMS help achieve the intended objective or outcome of the MDBC? (third column in table)

Irrigated Regions Sub-Program

KEY RESULT AREA: SUSTAINABLE AGRICULTURAL PRODUCTIVITY

Objective: To continually improve the efficiency of irrigation water use

Indicator	Useful in EMS?	EMS add value?	Comment
Development of more efficient irrigation techniques and crops with higher economic return for water used	N	Y	This is interpreted to mean the development of more efficient techniques. It is reasonable to expect that in implementing an industry EMS better techniques will emerge, particularly if effort is put into coordinating overall implementation and industry performance
% adoption of more efficient irrigation techniques	N	Y	Unlikely to be used as an indicator in an industry EMS due to a lack of a definition of efficient irrigation techniques. The industry could collate/dis seminate information on efficient practices that have been implemented on farms. The introduction of an industry EMS could assist in achieving the objective
Increasing 5 year average $ return per ML of water diverted	N	Y	Not likely to be used as in indicator in an industry EMS, although recording water use and value of production would enable reporting. The indicator is imprecise due to likely fluctuations in international cotton prices. Introduction of an industry EMS (and BMPs) should result in general trends that reflect increased returns per ML
Decreasing difference between regional crop water requirements and crop water application	N N	Y Y	Not likely to be used as an indicator in an industry EMS. Introduction of an industry EMS could assist in achieving the objective

KEY RESULT AREA: SUSTAINABLE AGRICULTURAL PRODUCTIVITY

Indicator	Useful in EMS?	EMS add value?	Comment
Removal of impediments to competition (COAG)	N	N	Government responsibility
Agreed water property rights, pricing policy and water market established?	N	N	Government responsibility
% adoption of higher value crops for water used Introduction of an industry EMS not likely to assist in achieving the objective	N	N	Indicator would not be used as in indicator in the cotton industry EMS.
Number of participants and volume of water traded enabling trading will address this issue	N	N	Outside the scope of an industry program. Government water reform

Objective: To remove the impediments to developing nationally and internationally competitive irrigated agriculture

Number of farms implementing best practice in property management plans	Y	Y	Could be used as in indicator in an industry EMS. Introduction of an industry EMS would assist in achieving the objective
Development of 'Best Management Practice' code irrigation industry	N	Y	An industry EMS would include best management practices for water for use; effectively, a 'code of practice'
Number of participants in property management planning courses	N	Y	Not likely to be used as an indicator in an industry EMS. Introduction of an industry EMS could assist in achieving the objective
Increasing real value of exports	N	N	Outside the scope of an industry EMS

KEY RESULT AREA: SUSTAINABLE AGRICULTURAL PRODUCTIVITY

Objective: To reduce environmental degradation and production losses resulting from salinisation and waterlogging

Indicator	Useful in EMS?	EMS add value?	Comment
Height and salinity of groundwater	Y	Y	Of low significance in cotton areas. Watertable monitoring can be readily incorporated into an industry EMS
Net area of land revegetated	Y	Y	
Area of land salinised or waterlogged	Y	Y	Salinity not a significant issue in cotton areas, although waterlogging has some localised significance; Practices to avoid and address waterlogging can readily be included in an industry EMS
Rate of groundwater rise	Y	Y	This would result from the previous indicator. Managing groundwater should be an outcome of the government led reforms currently underway. Groundwater monitoring needs to be conducted on a regional scale to be most useful
Area of land protected by drainage	Y	N	Not a significant issue in cotton growing areas
Land and Water Management Plans developed that meet Salinity and Drainage Strategy requirements	N	Y	An industry EMS will promote the implementation of practices that are consistent with S&D Strategy actions
Development of alternative farming techniques or uses for waterlogged and salinised land	N	Y	An industry EMS could promote practices that address the management of waterlogged or salinised land
Coverage by regional/catchment plans incorporating sustainable land and water management practices	N	Y	An industry EMS would provide a ready means of incorporating any regionally developed strategies/practices into on-farm action.
Sustained regional productivity	N	Y	Not likely to be used as in indicator in an industry EMS. An industry EMS could help achieve the objective

KEY RESULT AREA: WATER QUALITY

Objective: To substantially reduce salt, nutrient, sediment and pesticide exports from rural, urban and industrial sources

Indicator	Useful in EMS?	EMS add value?	Comment
Salt, nutrient and pesticide loads less than or equal to mandated levels, consistent with water quality objectives of Riverine Environment Sub-program	Y	Y	Measuring farm outflows could be included in an industry EMS
Development of Catchment Management Plans, incorporating best practice and appropriate standards for nutrients, salinity and pesticides	N	Y	An industry EMS provides an effective mechanism to incorporate Catchment Plan actions
Number of catchments with comprehensive Catchment Management Plans implemented, including disposal, reuse, treatment of urban sewerage and stormwater	N	Y	An industry EMS provides an effective mechanism for plan implementation

KEY RESULT AREA: NATURE CONSERVATION

Objective: To ensure that ecologically sustainable development adequately addresses nature conservation objectives by:

- **– maintaining key ecological processes**
- **– maintaining viable populations of native species and integrity of ecological communities, especially vegetation; and**
- **– controlling threats to biodiversitys**

Indicator	Useful in EMS?	EMS add value?	Comment
Incorporation of nature conservation objectives property management plans and regional/ catchment plans	Y	Y	Useful once defined by governments – readily incorporated in an industry EMS
Area of remnant vegetation protected and managed	Y	Y	Measure could be readily incorporated in an industry EMS
Area of revegetation established serving biodiversity purposes	Y	Y	Measure could be readily incorporated in an industry EMS
Implementation of control strategies for threatening processes	Y Y	Y Y	Relevant measures could be readily incorporated in an industry EMS when defined
Increase in cover of local provenance vegetation	Y	Y	Measure could be readily incorporated in an industry EMS
Management plans developed conservation	N	Y	An industry EMS would incorporate regional requirements for nature
Policies in place to protect remnant vegetation and promote revegetation	N	Y	An industry EMS would incorporate regional requirements for nature conservation
% of endangered and vulnerable species for which recovery plans are being implemented	N	Y	An industry EMS would incorporate regional requirements for nature conservation
Strategies developed to control threatening processes	N	Y	An industry EMS would incorporate regional requirements for nature conservation
No further Basin native species or ecological communities being listed as extinct, endangered or vulnerable; and improved viability of species and communities currently listed as endangered or vulnerable	N	Y	Government responsibility. An industry EMS could contribute to the objective

KEY RESULT AREA: NATURE CONSERVATION

Indicator	Useful in EMS?	EMS add value?	Comment
No significant reduction in population size of native species within the Basin objective	N	Y	Government responsibility. An industry EMS could contribute to the
Degree of impact of threatening processes on nature conservation values	N N	Y Y	Government responsibility. An industry EMS could contribute to the objective
Conservation status known for species, ecological communities and ecological processes	N	N	Government responsibility
Incentives/cost sharing mechanisms established	N	N	Government responsibility
Degree to which a comprehensive, adequate and representative reserve system has been established, complemented by off-reserve measures implemented through property and regional/catchment plans	N	N	Government responsibility

RIVERINE ENVIRONMENT SUB-PROGRAM

KEY RESULT AREA: WATER QUALITY

Objective: To improve the quality of the water resources for environmental, consumptive and recreational uses

Indicator	Useful in EMS?	EMS add value?	Comment
Identification of water quality objectives for each catchment	N N	Y Y	Government/community/industry joint responsibility; Once determined, water quality objectives would inform practices in an industry EMS
Development/implementation of catchment management plans promoting adoption of BMPs for nutrients, pesticides, salinity and erosion in catchments	N	Y	Practices under an industry EMS would be informed by/consistent with catchment management plans; BMPs will be vital components of an industry EMS
Development/implementation of management plans for the riverine environment	N	Y	Practices under an industry EMS would be informed by/ consistent with catchment management plans
Appropriate monitoring programs established in each catchment	N	Y	Monitoring done at the farm/industry scale would be consistent with that undertaken at the catchment scale
Improvements in water quality as specified in the: Australian Water Quality Guidelines for fresh and Marine waters for turbidity, salt, blue-green algae and phosphorous	N	Y	An industry EMS would help achieve this objective
Status of invertebrates according to selected criteria from the National River Health Program	N	Y	An industry EMS would help achieve this objective
Improvements in water quality according to identified catchment water quality objectives	N	Y	An industry EMS would help achieve this objective
Number of sewerage treatment pants with tertiary treatment and nutrient removal	N	N	
Reduction in phosphorous loads discharged from sewerage treatment plants and other point sources	N	N	
Tonnes of salt intercepted and diverted from river	N	N	This indicator is targeted within the S&D Strategy salt interception schemes and is probably not relevant to an industry scheme

KEY RESULT AREA: WATER QUALITY

Objective: To establish river flow regimes that provide a balanced and fair distribution of water between human and environmental uses

Indicator	**Useful in EMS?**	**EMS add value?**	**Comment**
Permanent Cap on diversions implemented and annual audits undertaken	Y Y	Y Y	An industry EMS would include practices designed to facilitate licence compliance
New operating rules adopted that better suit the river environment	Y	Y	An industry EMS would reflect these new 'operating rules'
Agreement on permanent cap on diversions with no decline in river flow regimes across the Basin	N	Y	Government responsibility; An industry EMS would recommend practices that help growers adapt to the cap
Long term assessment of environmental flow requirements through development of generic tools and indices for facilitating the water trade-off process including the development of: – a set of decision support tools – an ecology flows handbook – a physically-based River Classification System – a River Health Index	N	Y	Government, industry to be involved in discussions of tradeoffs. Practices under an industry EMS would reflect tradeoff decisions/ arrangements
Agreed Basin-wide policy on environmental property rights	N	N	Government responsibility
Short term assessment of environmental flow requirements developed by expert panels with community consultation or equivalent process	N N	N N	Government responsibility Government responsibility
Agreed flow regimes for each region/catchment and balance of allocations	N	N	Government responsibility
Establishment of management responsibility for environmental allocations and implementation of flow regimes	N	N	Government responsibility

KEY RESULT AREA: WATER QUALITY

Indicator	Useful in EMS?	EMS add value?	Comment
Implementation of agreed flow regime with monitoring and evaluation of river health	N	N	Government responsibility
Health of riverine environments measured according to agreed indices	N	N	Government responsibility

KEY RESULT AREA: NATURE CONSERVATION

Objective: To enhance biodiversity and maintain ecological communities throughout their range within floodplain, wetland, riparian and in-stream ecosystems

Indicator	Useful in EMS?	EMS add value?	Comment
Improved water operations for maximum environmental benefit	Y Y	Y Y	An industry EMS could be linked with the implementation of licence conditions
Extent of habitat rehabilitation measures implemented (.eg. extent of riverine corridor and wetland habitats fenced and managed to maintain nature conservation programs)	Y	Y	An industry EMS should include measures to improve the riparian strip
Implementation of weed and feral pest management/ control programs for the riverine environment requirements	Y	Y Y	An industry EMS could adopt weed/feral pest management consistent with regional/catchment plans
Establishment of effective monitoring processes	N	Y	An industry EMS could be linked with government/catchment monitoring arrangements
Degree of impact of threatening processes on nature conservation values in the riverine environment	N	Y	Government responsibility; An industry EMS could help achieve reduce threats to nature conservation values

KEY RESULT AREA: WATER QUALITY

Indicator	Useful in EMS?	EMS add value?	Comment
No further native riverine species or ecological communities being listed as extinct, endangered or vulnerable	N	Y	An industry EMS could help achieve this objective
Improved viability of native riverine species listed as endangered or vulnerable	N	Y	An industry EMS could help achieve this objective
No significant reduction in population size of native riverine species	N	Y	An industry EMS could help achieve this objective
Removal or modification of structures impeding fish migration	N	N	
Number of management plans being implemented which incorporate riverine environment requirements	N	N	
Health of riverine environment assessed against River Health index	N	N	
Proportion of endangered and vulnerable species for which a recovery/management plan has been developed	N	N	Government responsibility
Identification of the major threats impacting on nature conservation values within the riverine environment and best management practices to address those threats, including development of management plans	N	N	Government responsibility An industry EMS could include (where relevant) practices consistent with those developed to address nature conservation threats

This section discusses the types of standard that could be used for the cotton industry's environmental programme.

The three broad types of standard discussed are:

- **process standards**
- **performance standards**
- **specification standards**

A list of actual programmes has also been extracted from a Quality Assurance Services report commissioned by the Cotton Research and Development Corporation.

TYPES OF STANDARD

Appendix 6

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Types of Standard – specification, performance and process

Summary of main points

Determining an appropriate standard to use as a model for an environmental audit and certification programme is of particular importance. The type of standard chosen largely determines what it is that participants in the programme are being asked to comply with: for example, are participants audited on their compliance with a certain set of procedures, a certain level of environmental performance, or adoption of a set of specific practices?

For the purpose of this discussion, the following three types of standard have been identified.

- A **specification standard** sets out the precise measures or practices to achieve a particular end: examples of specification standards include design and technical standards for articles such as storage tanks/signs.
- A **performance standard** sets out goals or objectives that need to be met to achieve a particular end: examples of performance standards include general duties contained in environment protection legislation
- A **process standard** sets out procedures to achieve a particular end (such as environmental protection or product quality): examples of process standards include ISO 9001 for quality assurance systems, ISO 14001 for environmental management systems

A process standard such as ISO 14001 is the most appropriate model on which to base the cotton industry's environmental programme. Process standards can be used to incorporate a range of performance goals and practices, and provide flexibility to review, update and change these goals and practices as necessary. Process standards can provide effective frameworks in which to achieve continual improvement in environmental management. An industry environmental programme based on a performance or specification standard would on the other hand, be inherently inflexible, and limited by the particular performance goals or practices on which it was based.

It needs to be kept in mind however, that an industry programme seeking to improve on-farm environmental management, should include elements of "process", "performance" and "specification". That is, the three types of standard are complementary rather than mutually exclusive, and (within the same subject area) distinctions between programmes based on "process", "performance" or "specification" often reflect which of these elements is being focused upon to achieve desired outcomes, rather than substantive differences in the outcomes themselves.

Types of Standard – specification, performance and process

"It is important to understand that the ISO 14000s are "process", not "performance" standards. ISO 14000 does not prescribe what environmental performance organisations must achieve"[1].

To determine the benefits or otherwise of developing an environmental programme based on a 'process' standard, such as ISO 14001, it is important to understand what a process standard is and what other generic types of standard, or models could be used.

A process standard sets out procedures to achieve a particular outcome (such as environmental protection or worker safety), whereas a performance standard sets out goals or objectives that need to be met to achieve that same end. Further up the scale of practical detail, a specification standard is one where the precise measures or practices to achieve the end are stipulated[2]. To achieve meaningful outcomes in natural resource management or environmental protection, it is necessary that elements of "process", "performance" and "specification" be included. That is, the three types of standard are complementary rather than mutually exclusive, and (within the same subject area) distinctions between programmes based on "process", "performance" or "specification" often reflect which of these elements is being focused upon to achieve desired outcomes, rather than substantive differences in the outcomes themselves. Although it is recommended that a process standard provides the greatest flexibility and potential for encouraging continual improvement, it is suggested that an effective environmental programme cannot be based purely on "process", "performance" or "specification", but will contain elements of each.

Specification standards

Specification standards are by their nature very detailed and somewhat inflexible. Setting exhaustive, precise measures to achieve an outcome leaves little in the way of interpretation for the user. Nonetheless, such an approach can be useful to control very specific situations. For example, a number of standards have been developed around occupational health and safety that prescribe design requirements for industrial plant and equipment. Australian Standard 1692 details requirements relating to the design of storage tanks for flammable liquids, including shell thickness, height and diameter, joint construction and vent size. A similar level of detail is contained in Australian Standard 1657 concerning the design and installation of fixed platforms, walkways, stairways and ladders.

Despite the limitations of specification standards[3], there are nonetheless many cases where it is useful to provide detailed guidance on specific measures or practices that can help achieve an outcome[4]. The specific and technical nature of the matters covered by the above-mentioned Australian Standards justifies the use of detailed and specific requirements in these cases. More complex situations, such as addressing environmental impacts across an entire enterprise, require greater flexibility, and a management framework within which specifications can be used.

A further example of the use of detailed specifications is the cotton industry's BMP Programme. To successfully introduce changes to farm management practices under the programme, practical and detailed guidance material was required to a certain extent[5]. Of course, these specific practices have been given context by being situated under performance goals, within a simple process framework. Nonetheless, the practical aspects of the programme have been an important focus, and it is unlikely that the use of strictly performance or process-based approaches would have been as successful.

Performance standards

Performance standards specify a goal or outcome but leave the detail of how to achieve the outcome up to the user. At a regulatory level, performance standards are often expressed as general duties. For example, the duty under Queensland environmental legislation to "not carry out an activity that causes, or is likely to cause, environmental harm"[6], and the general duty on employers under occupational health and safety legislation to provide a safe workplace both reflect performance-based approaches. Similarly, the Queensland Farmers' Federation Environmental Code of Practice for Agriculture is structured around six "expected environmental outcomes" which must be met to establish compliance with the Code.[7] Performance standards can therefore be based on meeting a general legal duty, a general environmental outcome, or specific impact-related targets (such as reducing pollutants to a particular concentration, or reducing the amount of waste produced by an activity to a particular mass or volume).

Non-mandatory guidance on specific, practical measures that can be put in place to meet performance goals is often developed by government or industry. Alternatively, enterprises can develop their own methods to achieve compliance. Performance standards are much more flexible than standards based on specifications, as users can choose for themselves how to best achieve the goal, and can readily adopt new information and 'best practices' as they are developed.

Leaving the concrete measures to achieve an outcome up to the user encourages the development of site-specific, least cost solutions. However, performance-based approaches can limit organisations by encouraging a compliance mentality. That is, the performance goal (often legal compliance) becomes the ultimate end, and the limit of managerial effort. Thus, little incentive is created to go beyond 'mere compliance'; once compliance has been achieved, maintaining the status quo becomes the goal, rather than achieving a higher level of operation and performance.

Nonetheless, performance goals are important components of for example, environmental management. Performance goals provide a clear focus for day to day operations, as well an indication of an enterprise's progress. Equally as important as the performance goals however, is a commitment to continually achieving and resetting them[8]. A process or systems approach to environmental management establishes a framework where this philosophy of continual improvement can be translated into action.

Process standards

A process or *systems*-based standard sets out procedures that an enterprise should adopt to achieve particular outcomes. Such an approach focuses on the structure and overall management of an enterprise; the responsibilities, procedures, practices and resources for implementing and maintaining for example, effective environmental management. For example, ISO 14001 is a process standard for environmental management, and ISO 9001 is a process standard for quality assurance.

A process or systems approach is the most flexible of the three types of standard described here, which in its pure form exists independently of performance goals or detail on the means to attain those goals. This is noted by Alexandra in relation to the ISO 14000 series of standards, "ISO 14000 is a generic model, a management system, which has no externally specified way of determining how to arrive at the appropriate policy, goals or targets, performance criteria or indicators. It may be necessary to provide these targets, criteria and indicators at a regional or industry scale."[9]

Systems-based standards can accommodate a wide range of performance goals, and a wide range of specific practices directed at achieving those goals. As Gunningham and Johnstone note, a systems approach "provides considerable flexibility and enables enterprises to devise their own least cost solutions, but which gives them direct incentives to go 'beyond compliance' with minimum legal standards"[10] as opposed to specification or performance-based standards which are limited by the fact that they "only require enterprises to achieve minimum standards and provide no incentives or encouragement to go beyond those minima"[11].

A significant attraction to adopting a systems approach, is that it creates a managerial framework that involves all levels and components of the enterprise in environmental management. It is not limited to any one or group of activities, or to a particular environmental hazard or impact. Rather, it looks at the entire enterprise and how it operates, to ensure environmental issues are considered and acted upon at all stages of its operations. This embeds environmental issues as relevant concerns to everyone in the enterprise, as Gunningham and Johnstone note, "a systems based approach addresses occupational health and safety [or environmental issues] across an entire enterprise, and facilitates best practice and continuous improvement."[12] Thus, a systems approach can change the norms of the enterprise to reflect environmental values. It can help influence attitudes throughout the enterprise and therefore change the culture of the enterprise, leading to a cycle of continual improvement in managerial and environmental performance[13].

The BMP Programme in its current form is arguably focused more on specifications and performance, than on process or systems. Namely, practices and objectives to minimise the environmental and human health risks of pesticide use[14]. The BMP Manual contains advice on processes that can be used in relation to these goals and practices (eg, risk assessment) within the context of a simple cycle of management based on 'assess, plan, do, review'. However, given the small size of many cotton growing enterprises and the need to educate growers in a relatively short time in the practical means to attain an important industry goal, a performance/specification-based approach was considered most appropriate. The development of a systems approach would require the BMP Manual to be expanded to include more detailed guidance on management processes, such as those outlined in ISO 14001. For example, information on communication procedures, document control and undertaking a management review would need to be provided. Supporting information on appropriate practices and performance goals relating to issues beyond pesticide use (such as water management, soil management and vegetation management) will also need to be developed to give content to these management processes.

Attachment – Extract from QAS Report

Findings

Generic Standards/schemes

A broad analysis of the standards, schemes and programmes identified in this study is provided together with an overall statement of the key features including common themes and practices, motivators and barriers, types of enterprises using the standard, implementation pathways, auditibility etc. The study also includes a broad comparison of the linkages/commonalities of the standards with ISO 14001.
The analyses are summarised in section 5.0 of this report.

AgCare Environmental Farm Plans

The concept for Environmental Farm Plans (EFP) originated in the Ontario farm community having been derived from the United States Farm*A*Syst model of self assessment. The EFP is a generic programme which can be applied to any farm enterprise. The programme was started as a pilot project in 1993 in seven selected counties across Ontario and to date has been adopted by approximately 45% of Ontario’s 35, 000 farmers (Francis 1999). Similar programmes have been established in other provinces. Types of agricultural enterprises using the EFP include dairy producers, grains, and fruit and vegetables. Farmers are involved in every stage of development and their input to the document has been augmented by technical expertise provided by government agencies and education institutions.

Implementation of the AgCare programme commences with a training workshop for the self assessment and implementation processes. Farmers then conduct the self assessment to highlight environmental strengths on their farm, identify areas of environmental concern, and set realistic goals and action plans to improve environmental conditions according to their own timetable. Farmers submit their EFP to their local farmer committee for peer review. The government also provides a financial incentive to farmers to implement and maintain their plans once the plan has been approved by the farmer peer group.

The EFP self-assessment covers up to 23 different environmental areas of concern;

1. Soil and site evaluation
2. Water wells
3. Pesticide storage and handling
4. Fertiliser storage and handling
5. Storage of petroleum products
6. Disposal of farm wastes
7. Treatment of household wastewater
8. Storage of agricultural waste
9. Livestock yards
10. Silage storage
11. Milking centre washwater
12 Noise and odour
13. Water efficiency
14. Energy efficiency
15. Soil management
16. Nutrient management in growing crops
17. Manure use and management
18. Horticultural production
19. Field crop management
20. Pest control
21. Stream, ditch, & flood plain management
22. Wetlands and wildlife ponds
23. Woodlands and wildlife

The AgCare Environmental Farm Plan does not include a formal management system component, nor does it have an audit programme. This is acknowledged by AgCare and a pilot programme is currently being developed for an on-farm EMS based on the ISO 14001 model and will include some form of third party audits (Cassidy 1999 pers. comm., 22 December).

LEAF (Linking Environment and Farming)

The LEAF programme has been designed as a management tool to assist farmers to assess farm practices and performance. The programme is voluntary and run by farmers and has commanded enormous support from business, consumers, government agencies and conservation groups. Approximately 10% of UK farmland is covered by LEAF including dairy producers, cereals and horticulture. LEAF promotes practices that take the best of traditional methods, such as crop rotations and soil management and the best of modern technology, such as precision agriculture and detailed soil nutrient analysis. Stakeholder involvement with LEAF is high with the organisation made up of a farmer based executive committee, a small staff, an advisory board comprising a broad range of organisations including environmentalists, consumers, retailers, and voluntary self-auditing by members.

LEAF incorporates standards for Integrated Crop Management (ICM) and a self assessment process which provides the opportunity for the farmer to identify those areas where they are meeting the standards of ICM. The LEAF audit is a series of self assessment forms and provides a convenient and structured way which, when carried out on an annual basis, will monitor farm systems and help determine priorities on the farm in order to adopt a fully integrated approach. The audit is principally a statement of current farm practice and records and evaluates the criteria on which to base the participant's farm system and ongoing policies and work practices.

Implementation is via training workshops conducted for farmers and demonstration farms are set up by LEAF throughout the UK to show farmers and those involved directly in agriculture about the principles of Integrated Crop Management.

Farm*A*Syst

Farm*A*Syst is arguably the 'matriarch' of environmental farm programmes having served as a model for the development of other environmental farm programmes such as AgCare's Environmental Farm Plan, the cotton industry's BMP Programme and North Otago's (New Zealand) EnviroAg programme. The Grain Research Development Corporation in Australia (GRDC) has also incorporated components of Farm*A*Syst in one of its development projects funded by the GRDC for the grains' industry in the Riverina district of Victoria. Progress to date indicates good acceptance from growers (Ridley 1999 pers. comm.,10 November).

Farm*A*Syst had its genesis in groundwater pollution in the early 1980s and the programme has evolved considerably since those early days.

It now embraces a whole farm approach and includes soil and land management, pesticides and fertilisers, storage of fuels, field crop management, managing hazardous farm wastes and animal care.

The programme has spread nationally with permutations appearing in many States. In Georgia, for example, the cotton industry, through the Nation Cotton Foundation, has developed a Farm*A*Syst programme with its major focus on pest management (Jackson 1999 pers. comm., 22 December).

Dairy producers in California have recently signed an agreement with their State Extension Service for development of an ISO 14001 version of Farm*A*Syst which will be expanded into a certification programme. Consumer demands and market differentiation are the driving forces behind this initiative (Jackson 1999 pers. comm. 22 December).

Farm*A*Syst consists of a series of environmental self-assessments or checklists. These self-assessments record activities and conditions on the farm that may affect water quality, soil nutrients etc. Participation in Farm*A*Syst is voluntary with two options available for implementation. The first consists of farmers attending a training workshop and then conducting the self assessments with the aid of a facilitator. Action plans are developed detailing strategies for dealing with the areas of concern. The second option for implementation is essentially a self declaration and only involves the self assessment and action plan. According to Jackson (1999 pers. comm., 22 December), state government agencies do not place much confidence in this option.

A sister programme, Home*A*Syst, complements Farm*A*Syst by including home-related activities and conditions that may affect drinking water quality, household wastes etc.

Enviro–Ag Environmental Farm Plan

Enviro-Ag, formerly known as Ag-Vantage, is a voluntary programme which was developed by the North Otago Sustainable Land Management Group (NOSLaM) under the auspices of the Otago Regional Council in New Zealand. Enviro-Ag incorporates elements of ISO 14001 and the hazard analysis and critical control point (HACCP) process.

Similar to AgCare's environmental farm plan, implementation consists of training workshops for farmers and a self assessment programme conducted with aid of a facilitator. The similarities end here with EnviroAg offering a computer software programme for conducting risk assessments.

Also, on going monitoring and auditing is mandatory with EnviroAg, whereas the AgCare programme does not stipulate such a programme following the initial assessment.

According to NOSLaM the Enviro-Ag concept draws together in one package the opportunity for landholders to identify and address environmental, animal welfare and product safety issues using a common process (Brown 1999 pers. comm., 18 November).

Enviro-Ag is auditible and certifiable by accredited third party organisations, and is currently providing certification for groups of farms. In this way individual farms within the group, in this instance NOSLaM, have overcome the potential issues of complexity and onerous resources required for individual certification. The group certification involves an external audit of the group's management system components and random audits of the individual farms. Certification requires that internal audits be carried out by the group of farms. Should non conformances of a systemic nature be detected on a farm during one of the internal audits, or a major non conformance is not actioned within a given time frame, certification for that particular farm will be removed by the group.

To date, there are almost 100 farms ranging in size from 200 to 100,000 hectares in the North Otago region (mostly horticulture and livestock) enterprises participating in the Enviro-Ag environmental farm plan. Two farms have received certification and four are pending certification. Community recognition of the scheme is presently limited to the North Otago region. However, the dairy industry in the North Island is considering implementing Enviro-Ag across the whole of the dairy industry.

EMAS

The Eco-Management and Audit Scheme (EMAS), is a European initiative that encourages industry to manage its environmental effects and to publicly report progress on its environmental achievements. Environmental effects requiring attention might include emissions to air and water, the management of waste for disposal on land, and the use of natural resources. The EMAS Regulation provides the legal framework for implementation of the Scheme in EU Member States and sets out the requirements for companies wishing to participate.

EMAS is strongly supported by the UK Government as a positive step to promoting good environmental management and performance, and to improve the competitiveness of British industry internationally. Companies large and small are participating in the scheme, including BP Amoco, Shell, Blue Circle, Sainsbury's, Vauxhall Motors, Exhall Plating, the Beacon Press and many more. In the UK, EMAS has been extended to include local authorities (LA-EMAS), to help them with their work on Local Agenda 21, and to sites in the distribution sector.

Presently, EMAS is not being applied to the agricultural sector, although this will need to be reviewed when the European Commission publish the amendments to the EMAS Regulation
(refer following paragraph).

The European Commission recently published proposals to amend the EMAS Regulation to make the scheme available to all types of organisation in all economic sectors. Subject to the text of the Commission's proposal being finalised and agreed, it is expected that changes to the scheme will come in to affect by January 2000.

Key features of the proposed amendments include:

- Enhancing the scope of EMAS, so that it is applicable to all types of organisation from all economic sectors, rather than being restricted to sites in the manufacturing, power and chemical sectors
- Adopting ISO 14001 as the management system specification for EMAS, making the steps for progressing from ISO 14001 to EMAS more straightforward
- Greater flexibility in the use of the EMAS logo, helping to raise the profile of companies participating in the scheme
- Providing organisations with an opportunity to produce environmental statements for different stakeholder groups from a body of validated information
- Maintaining the requirement for compliance with environmental laws and regulations and for a commitment to continuous environmental improvement, thereby ensuring that the key strengths and distinguishing features of the existing scheme are maintained.

EMAS involves setting up an environmental management system (EMS) to ensure that all the activities of the business that might have a significant effect on the environment are properly managed and controlled. An environmental statement is then produced to ensure that the public, and other interested parties, understand the environmental impacts of the site and how they are being managed. The EMS and the environmental statement are then checked by an independent verifier to ensure that the site is complying with all of the requirements of the scheme. It is only after this has been done that the site can apply to the EMAS Competent Body to be registered.

HACCP

HACCP is an acronym for Hazard Analysis Critical Control Points. The concept of HACCP was first introduced in the United States in 1971 for the food industry. It was not until the mid 1980's that Australian companies embraced HACCP (Alexander 1990).

HACCP is simply a system for identifying what and where problems can occur, and the solutions for each problem. It is a method of keeping control of a process and involves:

- an investigation of each step of production to determine what could go wrong
- determining the severity, should something go wrong
- monitoring and keeping records
- taking corrective action where necessary, and
- verifying the system is working correctly.

Elements of HACCP have featured in the development of QA programmes for the agricultural industry eg. SQF 2000 and Cattle Care, covering on farm activities as well as the downstream operations ie. food processing, packing plants etc. Components of HACCP were also adapted and included in NOSLaM's EnviroAg programme.

SQF 2000

SQF 2000 is a Quality Code developed by the AgWest Trade and Development section of Agriculture Western Australia specifically for the food industry. It has gained wide acceptance in a range of industries and markets across Australia, primarily in Victoria, South Australia and of course Western Australia where it originated. SQF 2000 has also been accepted in a number of foreign countries and markets.

The Code provides the tools for a food-based enterprise to implement a system which demonstrates compliance with food safety standards and customer quality requirements. It incorporates the Hazard Analysis Critical Control (HACCP) principles, a proven method used by the food industry to reduce the incidence of unsafe food reaching the market place. The Code is third party audited and is appropriate for all the food industry sectors, from farming and primary production through to food processors and manufacturers, food service providers and retail outlets. It is very much suited to small growers than other quality assurance systems, as it is simple and cost effective.

There are two pathways for implementation- self implementation by growers who have undergone an accredited HACCP training course, or by employing a facilitator who is HACCP trained to work with the grower in implementing the Code. Once certification is achieved, regular maintenance audits are carried out twice a year.

ISO 9000 The ISO 9000 series of standards for quality management systems have gained international recognition and acceptance across a wide range of industry sectors including agriculture. However, this study did not identify any particular agricultural organisation or enterprise in Australia which is ISO 9001/9002 certified, although the study did identify a number of on farm improvement programmes which are QA based using the ISO 9000 series as a model. For example, Cattle Care, Flock Care and SQF 2000.

The ISO 9000 series of standards, some of which specify requirements for quality systems (ISO 9001, ISO 9002 and ISO 9003), and others which provide guidance to aid in the interpretation and implementation of the quality system, eg. ISO 9000–2, ISO 9004–1. However, ISO 9000 in its “pure” form does not cover significant on and off-farm environmental risks. Similarly, the QA based programmes like Cattle Care and SQF 2000 also do not address environmental concerns other than, to a limited extent, the handing and application of chemical substances such as pesticides.

In comparing the ISO 9000 QA and ISO 14001 EMS standards, a number of commonalities between the two standards are identified. For example, document control, dealing with non conformances, monitoring, corrective and preventative action, management review etc. At the risk of oversimplification, the ISO 9000 standard does, however, form a sound foundation for building an environmental programme for the agricultural enterprises providing it is expanded to include other elements such as, for example, identifying and managing environmental risks. The interim ISO 9000 2000 is more closely aligned to ISO 14001, but again it still does not include a component for dealing with environmental risks.

LMS The Land Management Society (LMS) in Western Australia is a group intent on developing sustainable farming systems. They are most interested in broadacre issues at the moment, but their products have generic application. The Society has developed a farm monitoring kit which has had limited uptake by farmers- they need to be convinced of its usefulness as it costs more than $1000 – not a large amount for many of Western Australia’s farmers, but still enough to make them cautious. The idea of a monitoring and recording kit tailored to an EMS does have some merit (Wilson 1999 pers, comm., 9 December).

From the information provided by LMS it is believed that the kit could be modified to fit an EMS – the basic ideas could be very applicable once a system was structured.

Enterprise specific standards/schemes

Cotton BMP

The Australian cotton industry through the Cotton Research Development Corporation (CRDC) has developed a Best Management Practices (BMP) manual. The initial focus is on pesticide management, with the rationale being that this would more likely gain acceptance by cotton growers if a staged approach to environmental management for the industry was adopted. It is anticipated that best practice booklets will be developed at a later stage covering all areas of cotton farming. In relation to compatibility with ISO 14001, it is understood that BMP will in the future be aligned with ISO 14001 principles and the development of a three-tier accreditation framework for that includes grower compliance audits with BMP.

A pilot study for auditing the BMP was conducted by CRDC and QAS in early 1999 and involved thirty four growers. The study's findings indicated that the BMP formed a good basis for ensuring growers consider the environmental aspect and impacts of their activities and implement actions that will result in improvement in on-farm environmental management- all key requirements for ISO 14001. The pilot audits highlighted a number of opportunities for improvement in the BMP and the auditing process that may be incorporated for the next round of participant growers (McAdam 1999).

BMP has two primary components- guidelines for best management practices, and a basic framework that growers can use to identify, document and manage the environmental aspects and impacts associated with their farming operations. Two pathways are offered for implementation- Self Assessment using prepared worksheets based on best practice guidelines (developed from the Farm*A*Syst and AgCare EFP schemes),or an optional Hazard Analysis process the detail of which is determined by grower self assessment. Participating growers have attended a training workshop that covered the implementation process.

According to Williams (1999) the success of the BMP is in the development of action plans to address those areas highlighted during the self assessment process as posing significant risk to the environment. Feedback from growers indicates that the cotton BMP has generally been well accepted (Pyke 1999 pers. comm., 20 December).

Given the initial success of BMP, its potential for further development to cover whole of farm aspects and the proposed alignment with ISO 14001, and of course it is industry specific, further development of BMP is highly recommended.

Cotton Cares

Cotton Cares is an environmental excellence programme currently being pilot by the National Cotton Foundation in the USA. Attempts to obtain detailed information from the Cotton Foundation, both via direct contact and the Foundation's Internet site have not been successful.

The general overview of the programme, as listed on the Foundation's Internet site, states that seventy producers are currently enrolled in the voluntary programme. Some form of credit and public awareness is given for measures adopted by producers to enhance air, water and land quality.

Cattle Care and Flock Care

Cattle Care and its sister programme Flock Care are Quality Assurance based codes of practice developed for the livestock industry. The ISO 9002 Quality Assurance standard was used as the basis for the two programmes along with the processes of HACCP. The Cattle care and Flock Care Code of Practice provide a framework at a national level for producers to be able to adopt quality assurance processes on their properties. The original programme was developed in 1994 as a quality and food safety system. During 1998 the two programmes underwent a major revision to amalgamate the management components into one management system, but is species specific in the livestock elements.

Cattle Care consists of three modules which are broken down into a number of mostly mandatory elements with a range of (compliance) points which producers need to meet in order to demonstrate compliance. The first module covers the basic, but essential management and training requirements for QA based programme. The second module addresses management of agricultural chemicals used on the property and the third module covers livestock handling and welfare. This third module is enterprise specific and as Barwell 1999 from Ausmeat puts it, "Cattle Care can be readily adapted to any agricultural enterprise seeking a quality assurance process" (Barwell 1999 pers. comm., 10 November).

Cattle Care and Flock Care are widely recognised across the Australian industry and an adaption of the Code is being considered by the grains industry in Queensland as a possible pathway for implementing a QA based programme for that sector (Barwell 1999 pers. comm.10 November). However, it should be noted that Cattle Care does not address environmental aspects and impacts, although module two is concerned with the management of chemicals which can be a major issue for some enterprises. However, generally speaking this is limited to on farm usage and veterinary care and does not extent to the wider environment.

The Cattle Care and Flock Care programmes do not incorporate a self assessment process like the LEAF or AgCare EFP programmes, the exception being property risk assessment which is generally conducted externally by someone with risk assessment expertise. Cattle Care does, however, incorporate an audit programme and accreditation process.

Given that Cattle Care and Flock Care are QA based programmes and do not include environmental aspects and impacts, it is thought at this stage that they would not likely be candidates for selection as a possible "standard" for further evaluation as a suitable standard for introduction to the cotton industry despite having widespread recognition.

Farmcare Code of Practice

The Farmcare Code of Practice for Sustainable Production of Fruit & Vegetables in Queensland, commonly referred to as the Farmcare Code, is a voluntary initiative of the Queensland Fruit and Vegetable Growers (QFVG), the peek industry body with a grower membership of 6,500. The Farmcare Code was jointly funded by QFVG and the Horticultural research and Development Corporation and has been endorsed as an approved Code of Practice under Queensland's Environmental Protection Act, 1994.

The Farmcare Code is an industry specific code and together with the overall "umbrella" Environmental Code of Practice for Agriculture put out by the Queensland Farmer's Federation, provides a way for rural industries in Queensland to meet their general environmental obligations (QFF 1998).

The Farmcare Code outlines seven areas of principles and practices for minimising environmental impacts. These areas are;

- Land and soil management
- Water management
- Biodiversity management
- Air management
- Noise management
- Waste management
- Integrated crop management.

The above areas are common to other agricultural sectors including cotton. However, the Farmcare Code does not constitute a management system, nor is it readily auditible. Nevertheless, the above elements represent some of the core requirements for an EMS and, subject to further review with other standards and programmes listed in this report, might form the basis for development of an appropriate standard for the cotton industry.

The National Association for Sustainable Agriculture Australia Ltd

The National Association for Sustainable Agriculture Australia Ltd (NASAA) claims to be Australia's leading organic certification organisation that is accredited by the International Federation of Organic Agriculture Movements (IFOAM).

NASAA operates and maintains a certification scheme for organic agricultural production and sets out standards that define the minimum conditions for certification in accordance with organic principles for agricultural production. The aim of the NASAA Standards and Certification Scheme is to improve and develop organic agricultural production of abundant food and fibre without contaminating or degrading the environment.

The minimum requirements for partial or full certification by NASAA require the following;

- Approved farm plan, farm map and record keeping system, and
- Objective evidence that the applicable guidelines in the standard have been met.

Whilst there are a number of common principles in the Standard when compared to the other programmes and models described in this report, organic certification focuses more on the system of production and its monitoring requirements to ensure the organic status is maintained rather than its environmental impact in particular resource use. Accordingly, the NASSA model is not seen as a suitable model for evaluation as a possible standard for the cotton industry.

The Forest Stewardship Council (FSC)

The Forest Stewardship Council (FSC) is an international body which accredits certification organisations in order to guarantee the authenticity of their claims. In all cases the process of certification will be initiated voluntarily by forest owners and managers who request the services of a certification organisation. The goal of FSC is to promote environmentally responsible, socially beneficial and economically viable management of the world`s forests, by establishing a worldwide standard of recognised and respected principles of forest stewardship.

Certification and labelling of forest products offer some important affinities for agriculture according to Alexander (1999), including concerns from producers and consumers on the proliferation of labelling schemes which may lead to confusion and the way in which international standards and principles are interpreted and refined at the national or regional scale.

The Forest Stewardship Council (FSC) has introduced an international labelling scheme for forest products, which provides a form of guarantee that the product comes from a well managed forest.

All forest products carrying the FSC logo have been independently certified as coming from forests that meet the internationally recognised FSP Principles and Criteria of Forest stewardship. The FSC approach involves third party auditing of the quality of forest management against performance standards, a "chain of custody" as Alexander (1999) puts it for tracing the forest product from the audited forest to the market. The forest inspections are carried out by a number of FSC accredited certification bodies, which are evaluated and monitored to ensure their competence and credibility.

FSC's scheme is based on specified performance standards detailed in a set principles and criteria for forest management. These principles are broad-based guidelines relating to forest and plantation management issues ranging from social to ecological concerns including community relations, worker's and indigenous people's rights, land tenure to those principles concerned with direct environmental impacts. The principles and criteria by themselves are not designed to be used as the basis for certification in the field, but to provide a consistent framework for the development of locally determined forest management standards. These standards need to be met by the forest operation before a certificate is issued (Alexander 1999).

The concept of timber certification has received considerable international attention as a market based mechanism for improving the prospects for the sustainable management of forests. Governments, NGOs and the timber trade around the world are actively involved in evaluating timber certification as a means of addressing the global forest crisis. In an attempt to draw a parallel with the agricultural sector a similar engagement of key players and exchange of information would admirably serve the industry especially in view of the proliferation of environmental farm programmes, schemes and initiatives here in Australian let alone the rest of the world.

Whilst the FSC scheme has a number of good points in particular issues relating to sustainability and labelling, no value is seen at this time in pursuing further evaluation of this scheme as a possible model for the cotton industry.

Marine Stewardship Council

The origins of Marine Stewardship Council (MSC) were a joint initiative of the World Wild Life Fund for Nature and Unilever – one of the world's largest buyers and processors of fish. At the centre of the MSC is a document which sets out a set of Principles and Criteria for Sustainable Fishing which will be used as a standard in a third party, independent and voluntary certification programme.

These have been developed by means of an extensive, international consultative process through which the views of stakeholders in fisheries have been gathered from around the world. The MSC Principles reflect a recognition that a sustainable fishery should be based upon;

- maintenance and re-establishment of healthy populations of targeted species;
- maintenance of the integrity of ecosystems;
- development and maintenance of effective fisheries management systems, taking into account all relevant biological, technological, economic, social, environmental and commercial aspects; and
- compliance with relevant local and national local laws and standards and international understandings and agreements.

Fisheries which conform to these Principles and Criteria will be eligible for certification by independent MSC-accredited certifiers.

The MSC promotes equal access to its certification programme irrespective of the scale of the fishing operation. The implications of the size, scale, type, location and intensity of the fishery, the uniqueness of the resources and the effects on other ecosystems will be considered in every certification. From the practical perspective of commercial fisheries, it would appear that the criteria for MSC certification is stricter than ISO 14001 and, therefore, will be harder to achieve and require more changes to their activities than would be the case for ISO 14001.

There are, however, potentially greater benefits that could come to the fisheries that achieve MSC certification due to its stronger criteria and product labelling advantages as well as price premiums and/or market exclusivity. Could a similar case be argued for agricultural enterprises?

The MSC and its certification process are largely still in their formative stages. It was only in mid-1999 that some fisheries were audited for certification. The process is still subject to change and refinement, however, its structure is likely to be similar to that for ISO 14001 with some important variations. The MSC has received a number of applications from certifying organisations to become accredited certifiers and is currently assessing the performance of these organisations. It is anticipated that by the end of December 1999 several of the certifiers will have been accredited.

Similar to the Forest Stewardship Council's certification programme a number of good points are noted in the MSC's certification scheme in particular sustainability and labelling. However, in light of other standards and schemes more specific to agriculture further evaluation of this scheme as a possible model for development of a cotton industry standard is not recommended at this time.

Australian Minerals Industry

Evaluation of the Australian Minerals Industry's Code for Environmental Management may seem a bit out in left field in relation to the agricultural sector, although both industries' activities directly impact on the land. Nevertheless, a number of correlations for agriculture can be drawn from the AMI Code.

The Code is a set of principles and processes that provide a framework to enhance the industry's environmental management. The Code facilitates continual improvement and periodic performance reviews to meet changing government and community expectations, with the bottom line objective of improved environmental performance. A key requirement is for signatory companies to prepare publicly available annual environmental reports that document their performance and implementation of the Code. These reports are considered vital in establishing credibility for the Code and for industry`s commitment to community consultation.

The Code does not prescribe specific environmental practices at mining and mineral processing sites. Rather, it sets out key principles for environmental management that allow signatories to progressively improve their performance. Signatories to the Code are committed to environmental excellence by;

- accepting environmental responsibility for all actions
- strengthening relationships with the community
- integrating environmental management into the way work is carried out
- minimising the environmental impacts of activities
- encouraging responsible production and use of products
- continually improving environmental performance, and
- communicating environmental performance

Whilst a few similar principles of the AMI Code have already been adopted by some sectors of the agricultural industry, the overall applicability of the AMI Code cannot be forcefully argued for agriculture, especially when compared to the Queensland Fruit and Vegetable Grower's Farmcare Code.

Compliance with codes of practice such as the AMI or QFVG principles are captured by the international standard for environmental management systems, ISO 14001. Organisations wishing to comply with the ISO 14001 standard, and who subscribe to a particular code(s) of practice, must demonstrate compliance with the code(s) to which they subscribe (ISO 14001, Clause 4.3.2).

Conclusions

The proposed standard needs to incorporate natural resource management features and take into account the needs and sensitivity of Australian ecosystems. The standard will need to be further evaluated to determine whether it will deliver multiple benefits in terms of sustainable use of resources, minimising environmental impacts and improved marketability of farm commodities. Delegates at the National Environmental Management Systems workshop held earlier this year in Ballina, NSW, defined the following expectations of an EMS (Francis 1999)

- The EMS must be uniform and standardised with farmer/producer ownership to monitor, track and manage their environmental system,

  and

- recognition of the need for an incentive or reward for the farmer.

With this in mind, and that the chosen standard needs to have the capacity to address the MDBC's natural resource management objectives, it is recommended that the NOSLaM Enviro-Ag scheme be evaluated in-depth for further developing the cotton BMP Programme as the standard for introduction throughout the cotton industry.

The NOSLaM model will provide the basis to address gaps in the cotton industry's BMP Programme in facilitating the development of an auditing and certification model that is compatible with ISO 14001, and as such, would potentially prove credible for growers, governments and consumers.

Notes

1 Brown (1) at page 34.

2 See Gunningham and Johnstone at page 22.

3 Setting detailed specifications that are intended to apply to a wide range of situations can be problematic. For example, detailed, specific requirements can quickly become outdated or redundant as technology and industry practices change, or they can be overly rigid and unable to accommodate variations in geography, climate or financial and human resources.

4 For example, Gunningham and Johnstone point out the value of non-mandatory, detailed guidance material to small to medium-sized employers, who may be lacking the expertise or resources required to give effect to general performance-based requirements (at pages 29–30).

5 For example, detailed guidance in the form of ‘specifications’ is given on the ‘design’ of vegetative buffer zones, field slope, tail drain depth, weather conditions for pesticide use, and insect pest thresholds.

6 *Environmental Protection Act (Qld) 1994*, section 36. This ‘negative’ duty to refrain from engaging in environmentally harmful activities can be restated as a ‘positive’ duty to carry out current activities in an environmentally safe manner.

7 Expected environmental outcomes under the Code include “*to conserve representative samples of of native species and ecosystems”, and “to conserve the integrity of waterways and the quality of water*” (at pages 7 and 14 respectively).

8 For example, the Draft Integrated Catchment Management in the Murray-Darling Basin (2001–2010) states that “*… targets are not the outcomes we seek. They are merely a way to measure progress toward achieving those outcomes*” (at page 6), and that “*targets need to be evaluated and refined as knowledge improves*” (at page 8).

9 At page 27.

10 At page 36.

11 At pages 34–35.

12 At page 22.

13 By encouraging the development of a workforce that is educated and trained in environmental issues, and that is personally involved in the implementation of environmental practices and procedures, a systems approach can develop environmental issues as central, rather than peripheral to the activities and management decisions of the enterprise, as well as encouraging initiative and increasing the likelihood of improved environmental performance.

14 For example, growers are audited primarily on their implementation of particular practices, rather than on their performance or management processes. Nonetheless in relation to performance, the programme has as an important aim, grower compliance with State legislation regarding pesticide use and environmental protection. Also, the BMP Manual lists the following goals for the cotton industry: the development of an industry of “whose participants are committed to improving farm management practices; whose participants have developed and follow policies and farm management plans that minimise the risk of any adverse impacts on the environment or human health” and “which can credibly demonstrate to the community, stewardship in the management of resources and farming operations” (2nd Edition, Introductory Booklet, at page 7).

15 A submission has been made by the cotton industry through Cotton Australia, for funding under the AAA FarmBis Australia programme for funding to develop such a training programme. A total grant of $110,000 has been sought, with total project costs being $254,000.