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Project Title: Farm Dam Management

Research Organisation: CRC for Irrigation Futures

Principal Investigator: Deborah Atkins

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Executive summary

This project brought together information on farm dam management with recent research on evaporation mitigation, new case studies and improved an online calculator to estimate costs with evaporation control methods. Activities were organised to make this information available to people and organisations through different methods.

Overall this project has improved the quality and availability of information on farm dam management.

The target audience for the project was agricultural advisors and consultants, Catchment Management Authorities and Natural Resource Management Boards and farm managers.

Information was disseminated through workshops, field days, media, conference displays and direct contact with the target audience. Over 240 people attended eight events held in Victoria and New South Wales.

A key part of the project was to provide training to irrigation and agricultural advisors who can then provide this information to farm dam managers. Advisors made up about half of the audience at workshops and field days.

The economic calculator "Ready Reckoner" available at the website has been updated and improved with three case studies and a tutorial.

Media coverage was generated through radio, newspaper and industry magazines after events and helped to promote the information. Radio interviews were broadcast in central, southern and western New South Wales, north-west and central Victoria and eastern and central South Australia.

A website has been developed where information on farm dam management and the online calculator is hosted. Fact sheets, links, reports, posters and case studies. The website will be managed by National Centre for Engineering in Agriculture when the Cooperative Research Centre for Irrigation Futures finishes in June 2010.

Case studies and brochures were developed on dam evaporation and seepage management and biodiversity. Brochures on the website and especially biodiversity will be made available at farm walks in Victoria in late 2010.

Project Objectives

1. To collate the most up-to-date resources on dam management

2. To create an integrated summary

3. To further develop the Dam Economic Ready Reckoner software and integrate an online tutorial

4. To improve the quality of advice given by advisors and consultants by offering information through the Farm Dam Resource Kit and training in using software

Background

Farm dams provide flexibility for growers to store water on-farm and optimise the use of water availability.

Farm dam management is becoming more important. The drought and subsequent water shortages has focused attention on managing water stored in farm dams. Furthermore, farm dams are being subject to greater controls in most jurisdictions.

Australia has in excess of 2 million farm dams storing more than 8,000,000 ML of water. Up to 40% of water is lost from Australian farm dams every year due to evaporation, drainage and seepage. These losses are estimated at more than 1,320,000 megalitres. This water is worth up to $660 million that could have otherwise been used to irrigate crops, boost environmental flows in rivers or provide water to residents each year.

Farm dam water quality also requires new management skills as farm dams are increasingly being used for on-site recycling of water and for aquaculture. Managers need to be able to understand and evaluate – dam use options (seasonal usage models and groundwater and surface water optimisation), physical interventions (earthworks), dam assessment techniques (PST, EM survey, topographic surveying).

Dam management brings together a wide range of disciplines; few consultants have this skill set, let alone operators of farm dams.

A typical farm dam in northern NSW and Queensland covers about 70ha and each year 1050 megalitres of water can be lost from that dam because of evaporation. The 1,050 megalitres could have been used to irrigate a lot of crops.

Providing decision support tools where advisors, consultants and dam managers can assess technical and financial options for reducing excessive losses from drainage, seepage and evaporation.

The integration of aquaculture with agriculture is a logical systems approach to enhancing the profitability and sustainability of irrigated farming.

Water used for aquaculture is available for other uses such as irrigation and improving biodiversity around the farm so is a very attractive prospect. It complements enterprises like horticulture and dairy without any net increase in water consumption.

For it to be a viable option, a new aquaculture enterprise needs extensive research on rules and regulations before looking at the production system. Each state has different licensing requirements. Information and contact details are available on websites.

On-farm water storages have immense potential to support more biodiversity. Creating better habitats in farm dams is one of the best opportunities to increase biodiversity in agricultural landscapes, making farming more ecologically sustainable.

Shallow water and waterplants, the two key components for increasing biodiversity, need not compromise existing management principles for farm dams.

On top of potentially supporting high biodiversity levels, farm dams can also play an important role in the cycling of nutrients and improving water quality. Fortunately, what is good for biodiversity also tends to be good for the water itself.

Many waterplants (and the micro-organisms they support) have an amazing ability to reduce the amount of suspended sediment, increase oxygen content, and trap or remove phosphorus and nitrogen, along with heavy metals, pesticides and other contaminants.

New brochures have been written to provide more detailed information on biodiversity for farm dams.

Achievements against activities and outputs/milestones

The project was successful in bringing together current information on farm dam management and making it available to people who would otherwise have not known about this information.

New material was developed on improving biodiversity around farm dams through a brochure on the principles of biodiversity and a brochure of case studies of biodiversity.

Feedback from participants at workshops and field days confirmed that this information was very valuable especially with prospects of reduced water available due to climate change.

Many people were unaware of methods to measure evaporation and seepage apart from a 'water in/water out' system. Less was known about the various techniques to reduce evaporation such as physical and chemical covers.

The economic Ready Reckoner developed in a previous NPSI project was improved and case studies and a tutorial added in this project. It was seen as a valuable tool in deciding whether to invest in evaporation mitigation methods. It also led to useful discussion on the value of water – the extra production that could be achieved if water was saved from evaporation and seepage.

The project has improved the quality of advice available to farm managers from advisors and consultants through workshops, conference presentations and field days.

Cooperation with CRCIF partners (Primary Industries departments in NSW and Victoria) allowed the information and tools to be passed on through established communication channels and enhanced the services offered by these organisations. It also allowed networking by NCEA in areas it would not normally work in (central NSW and north-west Victoria) and potentially establish future working arrangements.

Training

Training was provided to farmers and consultants through 5 workshops and 3 field days.

At the workshops participants learned of methods to measure evaporation and seepage from farm dams, the latest research being carried out on monolayers, physical covers available to control evaporation and demonstration of the economic Ready Reckoner using local examples.

Most participants were not aware of monolayer technology and were very interested in methods to measure evaporation and seepage. At this stage the cost of physical covers for dams is quite expensive for most farm operators so the interest in monolayers was quite high.

The workshops also made people aware that they could hire equipment or to employ consultants to measure evaporation and seepage. While the cost seemed high, the value of knowing how much water was being lost and the potential for increased production for any water saved was of interest to people.

The Ready Reckoner was demonstrated to participants and most people stated in feedback sheets that they would likely use it to assess their own situation.

Workshops

- Boundary Bend Victoria, March 2009 – this workshop attracted 13 farmers as well as 3 government advisors. The district pumps water from the Murray River into dams which then irrigate mainly olive and almond trees. Seepage from dams has been an issue in the district so there was considerable interest in seepage measurement and dam lining. Water allocation in the district has been reduced in the preceding years so the opportunity to save any water was of great importance.

  The workshop was aligned with the Irrigation Environmental Management Action Planning (iEMAP) program being conducted by the Mallee NRM Group.

- Mildura March 2009 – workshop attracted 13 advisors and consultants. There was very little knowledge about monolayers and measurement techniques. This workshop also led to follow up enquiries to presenter Erik Schmidt from NCEA.

- Orange NSW June 2009– 16 participants included mainly fruit growers who rely on rainfall runoff into dams. Other participants were consultants and DPI advisors. Very interested in covers for dams to prevent evaporation.

- Young NSW June 2009– 13 participants included fruit growers and DPI advisors interested in evaporation and seepage detection and evaporation mitigation.

- Sydney Irrigation Australia Conference and Exhibition June 2010 – 25 participants including advisors, consultants and irrigation retailers. Content covered information as in other workshops as well as information on setting up an aquaculture enterprise in a farm dam such as regulations and requirements.

  The presentation on aquaculture was important as there is limited extension of information on this information. The speaker had follow up interest from consultants.

Field days

- Farm Expo Wodonga Victoria February 2009 – attended by 80 landholders. Expo was organised by DPI and information presented was on evaporation mitigation method and the Ready Reckoner. Handouts were given to participants and DPI staff for further distribution.

- Swan Hill Irrigation Conference field trip June attended by 54 farmers, researchers, extension staff, consultants and irrigation businesses. The group visited a dam used for irrigating almonds. Information was made available on seepage measurement, evaporation mitigation and dam calculator.

  The farm manager had attended the March dam management workshop at Boundary Bend and was able to describe the information that was presented and how that information helped make decision about whether to use a cover or liner for a dam (decided not to invest at that stage).

- Integrated Agri-Aquaculture Workshop Mildura March 2010 – attended by 36 people, with at least 4-5 of them being known, practising fish farmers. There were

quite a few other farmer/industry people but many of them were just gathering information. There were also people from at least 3 education institutes, multiple state and local government agencies and a feed manufacturer.

Speaker from Victoria DPI covered information on dam management. Feedback was good. One of the comments was "Excellent workshop with good variety of topics and speakers. The variety enhanced it".

Communication

Media

June 2010

Media release forwarded to rural papers re NCEA research on monolayers and Ready Reckoner

January 2010

Article in Good Fruit and Vegetables January 2010 - Coverage of presentation given by Erik Schmidt re dam evaporation and dam management at Irrigation Australian Conference field trip, October 2009 in Swan Hill.

June 2009

Workshops promoted in Central Western Daily (Orange), Blayney Chronicle and the Young Witness

ABC interview done with Erik Schmidt re Orange workshop broadcast 17th June in central NSW and southern highlands

Articles appeared in The Land (NSW) and Central Western Daily

March 2009

ABC interview done with Erik Schmidt re Mildura workshops – broadcast to 6 regions across NSW, Victoria and South Australia (local stations from Bendigo, Broken Hill, Port Pirie, Mt Gambier and Port Lincoln

Publications

Contributed a page of information for Irrigation Essentials published by NPSI in December 2009

New brochure written about principles for improving biodiversity around farm dams

New brochure written about case studies on biodiversity

Newsletter

The website, Ready Reckoner and resources have been promoted in CRCIF monthly newsletter INFLO which is distributed to 2,103 people.

Poster presentation

A poster promoting the information available at the Farm Dam Management Website was presented during the poster session of the Irrigation Australia Conference Sydney June 2010. This poster will also become a resource on the website for use at other extension and advisory events.

The poster was voted "Best Poster" out of 53 posters at the Exhibition.

Mail out

Emails to be sent to all the NRM Groups in Victoria and New South Wales alerting them to the Farm Dam Management website and the resources available.

Resources

Ready Reckoner

The 'Ready Reckoner' uses specific information about climate, soil type and size and type of dam to calculate water loss from evaporation and seepage. It can compare the cost and effectiveness of installing shade-cloths, floating dam covers or chemical monolayers to save this water.

The value of water can be related to a range of factors (in terms of production and profit forgone), the revenue earned from availability of additional water, revenue from water sale or the cost of a water purchase. Mitigation of evaporation and seepage through technologies has been shown to be potentially economically viable.

Since the earlier version was improved and updated in July 2009, there have been 1849 visits to the Ready Reckoner site and 391 calculations conducted.

Farm Dam Management website

This new resource is designed to provide clear information to:

- Measure and manage seepage and evaporation
- Calculate costs in managing water losses
- Improve biodiversity
- Assess options for aquaculture
- Manage water quality, weed and algae

Material comes mainly from Primary Industry departments in New South Wales, Victoria and Queensland and other private and government sources. It is available as a download or link to a website.

This new website builds on an earlier 'Evaporation Control' site developed by the National Centre for Engineering in Agriculture (NCEA) through funding by the Queensland Department of Environment and Resource Management (DERM).

It brings together resources and offers links to information from organisations and individuals with expertise in farm dam management.

The CRCIF, NPSI and the CRC for Polymers have combined to focus research on the development and testing of improved chemical monolayers to reduce evaporation losses and also smart application systems to efficiently control and monitor monolayer coverage on the dam.

For more than 5 years the NCEA has been involved in researching the Measurement and Control of Evaporation losses from Farm Dams and Channels in Australia.

As a key player in the CRCIF - 'Dam Evaporation Project' the NCEA has developed technology to accurately measure and calculate seepage and evaporation losses for farm dams.

Using a combination of dam level measurement and software analysis of the storage water depth over time, the values for seepage and evaporation can be determined.

Other information on this site includes best practices in ring tank design, case studies of various product trials, information on measurement and mitigation technologies for both seepage and evaporation losses.

Case Studies

Five case studies were developed:

- Three scenarios using the Ready Reckoner – horticulture in the Lockyer Valley (South-East Queensland), cotton in Emerald (Central Queensland) and cotton production in Bourke (North-West New South Wales). These scenarios are worked out examples with explanations of how calculations were made and the assumptions that were used such as dam dimensions, number of months when the dam is holding water, whether seepage has been measured, etc.
- Managing dam seepage in two separate cases. This case study assesses the seepage of dams and gives recommendations for reducing the water losses from the dams
- Improving biodiversity around farm dams – this case study gives examples of techniques that can be used to improve the potential to support more plants and animals.

All these are available on the Farm Dam Management website and are available in the appendices

http://farmdammanagement.ncea.biz

Ready Reckoner website

http://readyreckoner.ncea.biz

Key results

Feedback from workshops and field days indicated the information was new and useful.

Responses from feedback sheets

What information will you apply to your farm?

Boundary Bend workshop March 2009

- Better understanding dam water losses and in the investigation on how we mitigate these
- Use of Calculator
- Perhaps look closely at seepage
- Evaporation mitigation system
- Will use web based model for losses to build sustainability case
- Maybe employ chemical evaporation control
- Will work with dam calculator and use scenarios to present costs at Board level to discuss and evaluate the justification for reducing evaporation from dams
- Will use web site based
- View field based study & data

Mildura workshop March 2009

- To assess the effectiveness of our schemes and particularly to help schedule the cleaning out of the base of our enhanced leakage pit

- Websites will be useful
- Will be able to use information with local growers
- Will help when expanding our advisory services to clients
- I am involved in large lake and wetland evaporation so probably not very relevant but still the content was very informative
- Information will help as I am planning on building a farm dam this year
- Will help in my advisory road
- Will use Ready Reckoner to look at savings and costs for various options
- This information will help in evaluating our storages
- Can calculate the economics of dam and channel covers

Orange workshop June 2009

- How to measure dam size – 2
- May have possible leakage rather than seepage in dam
- Economic calculator – 5
- Measurement of evaporation – 8
- Awareness of evaporation volumes – 2
- Applying some measurement
- Methods to reduce evaporation – 3
- Management of water movement from one dam to another
- Look at monolayer if we have another dry year
- Realising the value of water
- % use of existing storage
- Seepage measurement
- Seepage management

Young workshop June 2009

- A significant % to build on what already doing
- Measurement of seepage – 2
- Economic calculator
- Seepage management – 2
- Evaporation measurement – 2
- Evaporation management – 5
- Seek out Aquatain supplier
- Re-double efforts to maximise efficiency of irrigation systems & watering strategy

Overall the majority of interest was in the economics of using evaporation mitigation methods and so the Ready Reckoner was seen as an excellent resource. Visits to the site and calculations have had a big increase in use since June 2009.

The Farm Dam Management website is a valuable tool that brings together information from several state and federal government organisations. It will continue to be managed and updated by NCEA as new material and research becomes available. NCEA will continue research on chemical monolayers in addition to research on detection of monolayers and equipment to automatically re-apply chemical monolayers.

The Irrigation Australia Conference in June 2010 will be an opportunity to promote the resources by making brochures of the website and fact sheets from the website available at the CRCIF stand, during the dam management workshop and during presentations given by NCEA team.

The project has enabled 3 partners from the CRCIF to collaborate and disseminate valuable information and training to advisors and consultants that have never been available in the one place. New material has been developed and will be promoted through state agencies, industry organisation, CMA's and NRM groups.

Appendices

Fact sheets

- Seepage and evaporation
- Chemical covers
- Continuous plastic covers
- Suspended structures
- Structural / Management
- Modular covers
- Monolayer research
- Economic evaluation
- Biodiversity

Case studies

- Evaporation and seepage – Forest Hill, South-East Qld
- Evaporation and seepage – Moree, northern NSW
- Dam seepage – Lockyer Valley, South-East Qld
- Biodiversity

NB. These are not the only fact sheets on the Farm Management website. These are the ones that have been written or modified as a result of the NPSI project.