



IRRIGATION IN NORTHERN VICTORIA



GOULBURN-MURRAY IRRIGATION DISTRICT



INTRODUCTION

This booklet has been designed to assist irrigators interested in finding out more about managing or improving their current irrigation systems. It includes key contacts and weblinks for further information on a range of topics including irrigation methods and management techniques across the Goulburn-Murray Irrigation District (GMID).

The topics covered in this booklet include:

1. Whole farm planning	2
2. Planning approvals	3
Earthworks	3
Native vegetation	3
Cultural heritage	4
3. Broadacre irrigation systems in Northern Victoria	5
Border check (flood)	5
Pipe and risers	6
Centre pivot and lateral move sprinklers	6
Sub-surface drip	7
4. Horticultural irrigation systems in Northern Victoria	8
Considerations	8
<i>Soil type</i>	8
<i>Crop/plant variety</i>	8
<i>Automation</i>	8
<i>Water Source</i>	8
<i>Other crop requirements</i>	8
<i>Pumps and motors</i>	8
5. Drainage reuse	9
6. Automation	9
7. Soil moisture monitoring	10
8. Regional drainage	10
9. Use of groundwater	11
10. New irrigation developments	10

May 2020

Disclaimer

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

1. WHOLE FARM PLANNING – A GREAT PLACE TO START

Before you consider making changes to your irrigation infrastructure, it makes sense to consider what you want to achieve. To make good decisions, you need to have clear goals. These goals can be related to economic, environmental or social considerations or a combination of all these factors.

The best place to start is to prepare a Whole Farm Plan for the property.

WHAT IS A WHOLE FARM PLAN?

A Whole Farm Plan is a blue print for any future farm development. It includes all aspects of the physical layout such as: channels, drains, pipelines, outlets, supply points, paddock design, drainage reuse, remnant native vegetation, tree lines, cultural heritage, livestock management, laneways and other features.

WHY PREPARE A WHOLE FARM PLAN?

A Whole Farm Plan provides a guide for the landowner on the future development of their property. The Whole Farm Plan may be implemented immediately or staged over several years, depending on each landowner's individual goals and resources.

Through the Whole Farm Planning process, landowners can ensure protection and enhancement of environmental features and cultural values improved water management and increased water use efficiency, which leads to better production and overall farm management.

WHO CAN HELP ME PREPARE A WHOLE FARM PLAN?

An Irrigation Surveyor and Designer can be engaged to assist you with the preparation of a Whole Farm Plan. A list of local Irrigation Surveyors and Designers is available, please contact Agriculture Victoria.

WHOLE FARM PLAN INCENTIVE SCHEME

Financial incentives are available to assist with the completion of a Whole Farm Plan, subject to funding availability. The incentives are administered by Agriculture Victoria on behalf of the Goulburn Broken and North Central Catchment Management Authorities and is supported by the Victorian Government.

WHO TO CONTACT

To be eligible for the incentive an application must be made by the landowner and approved by Agriculture Victoria before commencing a Whole Farm Plan.

For further information contact:

Agriculture Victoria

Whole Farm Plan Coordinator

Kerang (North Central) - (03) 5473 0180

Echuca (Goulburn Broken) - (03) 5482 1922

2. PLANNING APPROVALS

There are a number of ‘approvals’ that landholders may need to obtain as part of undertaking irrigation system upgrades on their property.

These permits or approvals relate to:

- 1. Earthworks**
- 2. Native vegetation removal/clearing or any impacts to native vegetation**
- 3. Works within Cultural Heritage Protection zones**

EARTHWORKS

Landholders must discuss their proposed works with their local council to establish the requirements for approval of works before undertaking any earthworks. Earthworks on rural land must be planned and approved so that works completed on one property don’t cause problems for another property. Any changes must align with the Regional Catchment Strategy and meet local planning requirements.

Examples of earthworks include:

- Land-forming/laser grading
- Construction of laneways
- Construction of farm channels or drains
- Construction of above or below ground water storages

There are costs associated with obtaining approval. One of the best ways to plan for earthworks is to develop a Whole Farm Plan for the property. Within the local government areas of Greater Shepparton Council, Moira Shire Council and Campaspe Shire Council, Whole Farm Plans can be submitted to council to apply for approval. If the earthworks are approved by Council and referral authorities, there is no need to go back to Council and apply for individual permits when earthworks are carried out (as long as all earthworks are carried out according to the ‘approved’ plan).

NATIVE VEGETATION

Native vegetation provides habitat for plants and animals and delivers a range of ecosystem services that make land more productive (e.g. shade and shelter, pollination and, improved stock health) and contribute to human wellbeing (e.g. aesthetics, oxygen production, and carbon sequestration). Landholders are supported through the Whole Farm Planning process to understand both the legal requirements of Victoria’s native vegetation regulations, as well as voluntary revegetation and protection opportunities.

Native Vegetation Regulations

In Victoria, a permit is usually (exemptions may apply) required to remove, destroy or lop native vegetation (living and dead trees, shrubs, herbs and grasses) under the native vegetation removal regulations. Guidelines for the removal, destruction or lopping of native vegetation (the Guidelines, 2017) outline how native vegetation removal is assessed (required to be undertaken by an accredited assessor). Any application for a removal permit, must be submitted to Council for approval. Permits are separate to earthworks (WFP), and must be granted (including meeting conditions) prior to works. Applications can take time, and approval is not automatic. Any proposed native vegetation removal, should be carefully considered during the early planning stage of a farm development.

Revegetation and protection opportunities

Protection and enhancement of remnant vegetation (e.g. fencing remnants), and revegetation works (e.g. corridors for shade and shelter breaks), provide significant opportunities to value add to a whole farm plan. There are multiple benefits to landholders incorporating native vegetation (remnants, wetlands, grasslands and plantations) on their property. Ask your whole farm plan officer for further information on how native vegetation could be incorporated on your whole farm plan and if there are any existing opportunities for support (e.g. financial incentives/species lists).

For further information about revegetation and protection opportunities please contact:

Goulburn Broken CMA

(03) 5822 7700

www.gbcma.vic.gov.au/funding_opportunities

North Central CMA

(03) 5448 7124

www.nccma.vic.gov.au

Contact your council planner beforehand to confirm if a native vegetation planning permit is required:

Greater Shepparton City Council

(03) 5832 8730

www.greatershepparton.com.au

Campaspe Shire Council

(03) 5481 2200

www.campaspe.vic.gov.au

Moira Shire Council

(03) 5871 9222

www.moira.vic.gov.au

Gannawarra Shire Council

(03) 5450 9533

www.gannawarra.vic.gov.au

Loddon Shire Council

(03) 5494 1200

www.loddon.vic.gov.au

Swan Hill Rural City Council

(03) 5036 2333

www.swanhill.vic.gov.au

CULTURAL HERITAGE

The *Aboriginal Heritage Act 2006* and Aboriginal Heritage Regulations 2018 provide for the protection and management of Victoria's Aboriginal Heritage and is linked to the Victorian Planning Provisions. Protecting sites of Aboriginal cultural significance is important and the legislation provides protection for all Aboriginal places, objects and human remains regardless of their inclusion on the Victorian Aboriginal Heritage Register or whether they are located on public or private land.

Whole Farm Plans provide the opportunity to identify any issues and discuss alternative options to ensure the protection of cultural heritage.

For further information contact:

Agriculture Victoria

Irrigation Officers

Kerang - (03) 5473 0180

Echuca - (03) 5482 1922

Tatura - (03) 5833 5222

3. BROADACRE IRRIGATION SYSTEMS IN NORTHERN VICTORIA

The following provides a general overview of common broadacre irrigation systems in northern Victoria.

BORDER CHECK (FLOOD) IRRIGATION SYSTEM

Border Check or 'flood' irrigation is the most common irrigation system in northern Victoria. This type of irrigation distributes water via open irrigation channels to irrigation 'bays' which are defined by small earthen 'check banks'. Border check irrigation can be efficient on suitable soils, with appropriate layout and good management. Efficient irrigation is applying the water required by the pasture/crop for optimal growth with a minimum of water lost through deep drainage beyond the roots or excess surface runoff. The design and management of an efficient border-check irrigation layout depends on many interrelated factors, including:

- Soil type (clay, loam, sandy)
- Soil infiltration rate
- The slope of the irrigation bay
- The length and width of the bay
- The hydraulic roughness of the bay surface
- The flow rate of water applied, and
- The time/duration that water is applied for and time of cut-off.

What is good border check irrigation management?

Good irrigation management for border-check system means irrigating quickly (ideally less than 4 hours per bay), irrigating when required (when evaporation (E) less rainfall (R) is 50 mm for most soils) and providing sufficient drainage. There are six things that influence how fast a farmer can irrigate pasture:

- Available flow rate from the irrigation supply system
- Channel construction and structures
- Bay outlet size
- Weeds or dense pasture restricting water flow
- Height of irrigation bay compared to height of water in the channel
- Soil moisture deficit at the start of the irrigation.

What are the consequences of poor border check irrigation management?

Poor border check irrigation management and drainage can lead to an increased risk of water logging and impact production negatively.

On light/sandy soil the effects of poor irrigation management may not be as visually obvious. However, on these soil types there is a greater risk of water being wasted. The water can infiltrate through the soil profile, out of the reach of the roots. This can contribute to raised local watertables and cause salinity and waterlogging problems in adjacent areas.

For further information refer to Agnote:

- [Border check irrigation design](#)
- [Irrigation system selection and design guidelines](#)

For further information contact:

Agriculture Victoria

- Irrigation Officers
- Kerang - (03) 5473 0180
- Echuca - (03) 5482 1922
- Tatura - (03) 5833 5222

PIPE AND RISER IRRIGATION SYSTEM

Water in a pipe and riser irrigation system is distributed to the bay through a network of pipes, (as opposed to open channels as occurs with a traditional Border Check irrigation system). Usually the water is pumped through these systems however gravity systems can also be installed (where the system does not require a pump). Significant head or height of water at the source is required for gravity systems which is rarely obtainable in northern Victoria.

Key considerations for Pipe and Riser Irrigation?

The first question to consider is what flow rate do you want or need for now and into the future? Generally the response is in the range of 12-20 ML/day. This answer determines the diameter of pipe required and the pump specifications.

Irrigators should complete a Whole Farm Plan or modify their existing plan to reflect the pipe and riser system design. This will ensure the system is compatible with the proposed layout and considers future expansion opportunities for the system.

If the system is pumped, there will be ongoing operation costs per megalitre (ML) of water pumped. A relationship exists between pipe size, pump efficiency, head loss and energy costs that will impact the cost to pump a ML of water for the life of the system. If you get this wrong, the overall operation cost will be significantly higher than it needs to be. You should always aim to design a system that delivers the required flow while minimising energy requirements. This ensures the system remains as economically efficient as possible for the life of the equipment.

The success of a pipe and riser system will depend on the design of the system and must be considered during the preparation of a Whole Farm Plan.

For further information refer to Agnote:

- [Pipe and Riser Irrigation system](#)

For further information contact:

Agriculture Victoria

Irrigation Officers

Tatura - (03) 5833 5222

Echuca - (03) 5482 1922

Kerang - (03) 5473 0180

CENTRE PIVOT AND LATERAL MOVE SYSTEMS (CPLM)

Centre Pivot and Lateral Move (CPLM) systems are self-propelled sprinkler irrigation systems that apply water to crops, generally from above the canopy. Centre Pivot systems are anchored at one end and rotate around a fixed central point. Lateral systems are not anchored, and both ends of the machine move at a constant speed up and down a paddock.

CPLM systems require an energy source to move water from the source to the crop as well as energy to move the machine across the farm.

What are the benefits and limitations of Centre Pivot and Lateral Move systems?

The advantages can include: precise application, reduced water application variability, lower labour requirements, opportunities for fertigation and less need for landforming compared with border-check systems.

The limitations can include: costs, energy requirements, and skill requirements. CPLM systems are unable to pass over the majority of native vegetation. The removal of Native Vegetation is discouraged, the requirement to remove vegetation must also be considered and planned for as part of the farm development process.

What needs to be considered in the design stage?

System capacity is the most important design criterion for CPLM systems. In the past many systems were under-designed to minimise costs and they were not able to match peak crop water requirements. This has been the most common reason for CPLM system failure.

The system capacity of a Centre Pivot or Lateral Move system is the rate at which water can be supplied to the irrigated area, expressed in millimetres per day (mm/d). It is the main criterion the pump, pipes and sprinkler design is based on.

Adoption of CPLM systems should be discussed as part of the preparation of a Whole Farm Plan to ensure all of the issues relevant to the property and the landholder are identified and understood.

For further information refer to Agnote:

- [Centre Pivot and Lateral Move System Capacity](#)
- [Centre Pivot and Lateral Move Performance Check](#)
- [Irrigation system selection and design](#)

For further information contact:

Agriculture Victoria
Irrigation Officers
Tatura - (03) 5833 5222
Echuca - (03) 5482 1922
Kerang - (03) 5473 0180

SUB-SURFACE DRIP IRRIGATION

Sub surface drip irrigation (SSDI) systems involve the placement of permanent drip tapes below the ground which supply water directly to the crop root zone.

What are the advantages and disadvantages of this system?

This system has the potential to be the most efficient irrigation application system if properly designed, installed and managed. There is no wind disturbance and the uniformity of water application is high when compared with other irrigation systems. Water application is below the soil surface and only a small area is wet. There is no surface crusting, ponding water and surface run-off does not occur during irrigation. It can allow greater control and accurate scheduling. The application of light (low volume) irrigation is possible with this system and any size and shaped area can be catered. Labour requirements are less compared to other systems and there is potential for improved yield and quality of the crop.

The high capital cost is the main impediment to the adoption of SSDI technology with ongoing operating costs and difficulties with management a further concern.

The comparisons between SSDI, overhead irrigation techniques and border check irrigation systems are valuable. You could consider these comparisons during the preparation of a Whole Farm Plan.

For further information refer to:

- [Sub-surface Drip Irrigation systems](#)
- [Irrigation system selection and design](#)

For further information contact:

Agriculture Victoria
Irrigation Officers
Tatura - (03) 5833 5222
Echuca - (03) 5482 1922
Kerang - (03) 5473 0180

4. HORTICULTURAL IRRIGATION SYSTEMS IN NORTHERN VICTORIA

Under canopy micro-sprinklers or drippers are the most common irrigation systems for orchard production in Northern Victoria.

Sub-surface drip irrigation is also commonly used for vegetable and tomato productions systems.

CONSIDERATIONS

There are many aspects to horticultural irrigation development and upgrades that need to be considered. Undertaking a Whole Farm Plan will ensure that none of these are overlooked as part of your decision making. An overview of some of these considerations is summarised below:

Soil Type

The soil type will influence what type of crop is best suited and will inform the detailed design for an irrigation system to meet crop water requirements, infiltration rates, and irrigation cycle and schedule.

Crop/plant variety

The type of crop and sometimes the variety will influence the spacing from 'line to line' and also between emitters.

Another topic to consider is whether frost protection in winter or cooling in summer is likely to be required or desired?

Automation

Is a level of automation required?

Water source

The quality of the water will influence the amount of filtration required before the water enters the irrigation system. Dirty or cloudy water can quickly block up fine emitters.

Is the water source reliable or will you need to incorporate a storage dam for example?

Other crop requirements

Fertigation is the term used to describe incorporating fertiliser and nutrients in the irrigation water. The advantage of this is that there is less wastage with fertiliser application as it is delivered directly and closely to the plant roots, rather than generally distributed.

Pumps and motors

There are a number of aspects of pump and motor selection to be considered. These include: energy source to be used (diesel, electric or solar powered motors); pump efficiency (how much power is required to deliver a megalitre of water; and is the proposed system capable of delivering the volume of water?

For further information contact:

Agriculture Victoria

Irrigation Officers

Tatura - (03) 5833 5222

Echuca - (03) 5482 1922

Kerang - (03) 5473 0180

5. DRAINAGE REUSE SYSTEM

What is a drainage reuse system?

Drainage reuse systems are designed and constructed to collect excess irrigation and irrigation induced rainfall run-off water and nutrients from an individual property. The water is usually stored in an earthen 'sump' (like a dam or pond) which is often located at the lowest part of the property. Excess water from rain falling on the irrigated area or 'tail water' from over-irrigation flows to the 'reuse dam' via drains. This water can then be pumped from the reuse dam back into the irrigation system on the property and reused. This reduces the amount of water and nutrients leaving the property and adversely affecting natural waterways.

When should I plan a drainage reuse system?

The best time to plan for a reuse system design is during development of the WFP for the property. Re-use dams are restricted to a maximum size of 1 ML of storage per 10 ha of irrigated land that drains to the re-use dam.

Once you have a drainage reuse system, the best management practice is to aim at keeping the reuse system empty or as low as possible at the end of each irrigation. This will maximise the opportunities for the collection of rainfall runoff and reduce loss of water and nutrients off the property.

For further information refer to Agnote:

- [Drainage reuse system](#)

For further information contact:

Agriculture Victoria

Irrigation Officers

Tatura - (03) 5833 5222

Echuca - (03) 5482 1922

Kerang - (03) 5473 0180

6. AUTOMATION

Automatic irrigation is the use of a device that allows the flow of water from one irrigation bay, or set of irrigation bays, to be changed to another remotely. It can be used to:

- Start and stop irrigation through supply channel outlets
- Start and stop pumps
- Stop the flow of water from one irrigation area - either a bay or a section of channel - and directing the water to another area

What are the benefits of automatic irrigation?

Automatic irrigation systems can reduce the labour required to monitor irrigation flow in the field, improve lifestyle, allow for more timely irrigation, assist in the management of higher flow rates, provide more accurate cut-off, reduce run-off of water and nutrients and reduce the costs of wear and tear on vehicles used for irrigation management.

Where do I start?

There are different types of automatic irrigation systems. Developing a Whole Farm Plan for the property is a good way to begin preparing for automation. During the development of a Whole Farm Plan, landowners should consider the requirements for automatic irrigation so that they can be incorporated into the planning process from the initial stages.

For further information refer to Agnote:

- [Automatic irrigation](#)

For further information contact:

Agriculture Victoria

Irrigation Officers

Tatura - (03) 5833 5222

Echuca - (03) 5482 1922

Kerang - (03) 5473 0180

7. SOIL MOISTURE MONITORING

Soil moisture monitoring (SMM) devices provide information about the water status of soil. Knowing the soil water status can help you plan when to irrigate and how much water to apply. SMM is used to assist with scheduling irrigations to minimise plant stress and the economic losses that under-irrigation and over-irrigation can have on crop yield and quality.

There are two main types of commercially available soil moisture sensors: suction based and volumetric based systems.

Suction based sensors measure how tightly water is held within the soil. The measurement relates directly to how hard the plant must work to extract water and is therefore consistent across different soil types. Suction based tools that are commonly used are tensiometers and gypsum blocks.

Volumetric SMM systems measure the total amount of water in the soil. To estimate how much of this water is “readily available” to plants, the soil type needs to be known. Volumetric moisture monitoring tools can be used to guide not only when to irrigate, but how much water to apply. Capacitance probes and “total domain reflectometry” (TDR) capacitance spikes are examples of commonly used volumetric monitoring tools. Capacitance probes measure soil moisture at increments (usually 10 cm) down the soil profile to a depth of 0.8 m to 1.2 m.

There are many different SMM products on the market. Irrigation suppliers can provide general advice on SMM as well as providing SMM equipment. Other local farmers who are willing to share their experiences with SMM equipment can be a great source of information, particularly those who have used the technology for similar crop types .

For further information refer to:

- [Soil Moisture monitoring](#)

For further information contact:

Agriculture Victoria

Tatura - (03) 5833 5222

Echuca - (03) 5482 1922

Kerang - (03) 5473 0180

8. REGIONAL DRAINAGE

Effective drainage infrastructure helps to protect productive agricultural land from waterlogging and salinity impacts, maintains and enhances environmental values in the landscape and protects civil assets including roads.

The Shepparton Irrigation Region Drainage Strategy was reviewed in 2015 and identified a new approach to managing rainfall-driven waterlogging and drainage issues, as well improving on-farm management of irrigation run-off.

The renewed Surface Water Management Program (SWMP) is prioritising where limited funding for new Surface Water Management Schemes (SWMS) can provide the best drainage outcomes.

The renewed SWMP is being delivered in three complementary sub-programs:

1. Priority Construction Projects
2. Hybrid SWMSs
3. Farm Drainage Options

A key part of the renewed Strategy is the “Hybrid SWMS” concept, which aims to improve natural drainage by implementing Drainage Course Declarations (DCDs) under Victoria’s Water Act. DCDs allow artificial obstructions to water flow to be removed, and link fragmented drainage lines.

Further information on the renewed SWMP, including Frequently Asked Questions (FAQs) is available on the Goulburn Broken CMA website.

For further information contact:

Agriculture Victoria

Tatura - (03) 5833 5222

Echuca - (03) 5482 1922

Goulburn-Murray Water

Drainage Systems Team - 1800 013 357

Goulburn Broken CMA

(03) 5822 7700

reception@gbcma.vic.gov.au

North Central CMA

(03) 5448 7124

9. USE OF GROUNDWATER

Shallow groundwater is a valuable water resource used by many irrigators across the GMID, particularly in times of low water allocation and high water prices. Careful planning and management is essential for maintaining aquifer quality and avoiding the negative impacts of irrigating with saline water on crop or pasture yield and soil structure.

What do you need to consider when using groundwater?

Get your groundwater tested regularly, before and during the irrigation season. The recommended maximum salinity of irrigation water used on perennial pastures (white clover/ryegrass mix) growing on loam soils is 800EC.

Use groundwater earlier in the season when temperatures are milder. The ability of pasture to handle saline irrigation water is made worse by high temperatures. Avoid irrigating with groundwater at germination time.

Prevent the build-up of salts in the root zone when using groundwater. The periodic application of gypsum will help leach salts and maintain soil structure.

Maintain soil fertility on pasture irrigated with saline water. It can help you keep your clover productive. If the clover population is severely impacted by salinity, additional nitrogen fertiliser may be required to maintain productivity.

Don't over-pump your aquifer. Continually running your groundwater pump at rates above the aquifer's potential to recharge will increase the risk of drawing in more groundwater from adjacent aquifers which could be of higher salinity.

For further information refer to Agnote:

- [Irrigation with saline groundwater in the Goulburn Murray Irrigation District](#)
- www.salinitywatch.gbcma.vic.gov.au

For further information contact:

Agriculture Victoria
Tatura - (03) 5833 5222
Echuca - (03) 5482 1922
Kerang - (03) 5473 0180

10. NEW IRRIGATION DEVELOPMENTS

Irrigation Development Guidelines (IDG) assist landowners to meet the planning and licensing requirements for irrigation development. The Guidelines are in the form of an approvals process and a requirement for water-use licence and works licence applications.

The key purpose of the Guidelines is to ensure that irrigation development continues in a sustainable manner by minimising negative impacts on the environment and adjoining landholders. The Guidelines help mitigate the risks associated with applying water to land and ensure improved water efficiency through application of higher irrigation standards. They also guide the protection and enhancement of biodiversity and cultural heritage values.

Irrigation Development Guidelines apply to applications for, or variations to, water-use licences for irrigation purposes where the proposed irrigation development:

- Will occur on land for which there has never been a water-use licence.
- Involves an increase in the annual use limit in an existing water-use licence.
- Involves an increase in the area to be irrigated in an existing water-use licence.
- Applications for a new works licence (Section 67), or renewal or variation of an existing works licence for irrigation purposes.

For further information contact:

Agriculture Victoria

Echuca - (03) 5482 1922
Rutherglen - (02) 6030 4500

Goulburn Broken CMA

www.gbcma.vic.gov.au

North Central CMA

(03) 5448 7124
www.nccma.vic.gov.au

GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

PO Box 1752, Shepparton VIC 3632

T. (03) 5822 7700 | F. (03) 5831 6254 | E. reception@gbcma.vic.gov.au

www.gbcma.vic.gov.au



find us on [facebook](#)

follow us [twitter](#)

