ALEP

7

Aboriginal Landcare Education Program

Install Micro-irrigation Systems

Learning Guide

Greening Australia

CONTENTS

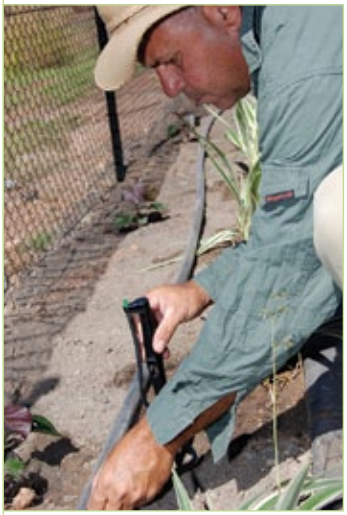
Student name:.....

Student number:.....

INTRODUCTION

Welcome to *Install Micro-irrigation Systems.* This learning guide covers information on how to install and maintain irrigation systems in both land management and horticultural situations. For example you might need to be able install micro-irrigation systems when working for councils, carrying out bush regeneration work, ranger work or when managing your own country.

Micro-irrigation can be used to water plants in a nursery, or to water plants that you have planted in the ground, maybe in a park, or in an area of bush. Training should be completed on the job or out in the field over an extended period of time



EQUIPMENT REQUIRED

To complete this training you will need the following:

1. Appropriate Personal Protective Equipment (PPE).
2. Safety gear for field work including first aid kit and water.
3. An adequate water supply for irrigation.
4. Pencils, paper, ruler and calculator etc. for planning.
5. Tools for installing irrigation such as shovels, mattocks, pliers and multigrips.
6. Micro-irrigation parts.

ASSIGNMENTS

There are three assignments you will need to complete.

Some of these assignments may go towards your final assessment.

Section	Assignment	Competent (C) Not yet competent (NYC)	Date Achieved
Getting Prepared	Assignment 1. Project Risk Assessment		
Designing a Micro-irrigation System	Assignment 2. Irrigation Plan		
Installing Irrigation	Assignment 3. Install and Check Irrigation		
Finishing and Maintaining the System			

1 GETTING PREPARED

Getting information at an irrigation shop

1A. COLLECTING INFORMATION

Information about irrigation systems can be obtained from many sources. Irrigation suppliers often have good information to hand out and can help you design your system. There is also lots of information available online.

1. Irrigation Australia has a range of contacts and resources about irrigation.

   www.irrigation.org.au

2. The Nursery and Garden Industry Association has a range of resources and material available for downloading including best practice water policy.

   www.ngia.com.au

3. Information specific to the NT can be found at the Northern Territory Horticultural Association. Download the water section of the *NT Sustainable Land Use Guidelines.*

   www.ntha.com.au

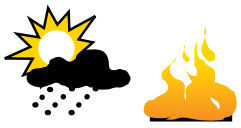
1B. INSTALLING IRRIGATION SAFELY

There are some dangers associated with installing irrigation. It is important that you be aware of some of the potential dangers so you can avoid getting injured or sick.

Some of the things you can do to keep yourself safe include:

1. Wear thick gardening gloves at all times.
2. Wear appropriate clothes for outdoors – i.e. at least long trousers, a hat and boots and put sunscreen on.
3. Watch out for snakes, spiders, wasps etc. and rusty iron or broken glass in amongst grass.
4. Keep safe distances away from other workers around hand tools.
5. Learn how to maintain and use hand tools correctly to avoid injury.
6. Keep the site tidy to avoid people tripping over and hurting themselves.
7. Always lift heavy objects correctly to avoid injuring your back (see Resource 1).
8. Extreme caution should be taken with motorised machinery such as trench diggers. Only properly trained people should use motorised machinery.
9. Always carry a first aid kit and make sure someone has a current first aid certificate.

Before you begin, use this checklist to confirm you have followed good safety procedures and have all the right resources.

SAFETY CHECKLIST ACTIVITY		✓
Long trousers, shirt and boots		
Hat (hard hat if necessary) and gloves		
Sunscreen, insect repellant and sunglasses		
Water		
First aid kit		
Notified others and have phone/ 2 way radio		
Checked weather, road and fire reports		
Student folder and notebook		
Permits (if required) and maps		

1C. WHAT IS MICRO-IRRIGATION?

Micro-irrigation refers to low-pressure irrigation systems that use drippers and sprays to deliver water to the plants. Low pressure is anything below 300 kPa. Micro-irrigation systems use components such as black poly pipes, drippers, sprays, sprinklers and water timers etc. Micro-irrigation systems usually use low density poly pipes and components.

1D. WHY USE MICRO-IRRIGATION?

How much water and for how long is one of the most important factors in establishing a successful garden or landscape.

Micro-irrigation systems put water right where you need it and are water saving alternatives to using a hose or sprinkler which waste water. An automatic timer allows you to leave your system for periods of time and your plants still get watered.

Micro-irrigation systems will deliver the following advantages:

- Apply water only where it is needed.
- Reduce water loss through evaporation and run off.
- Water all your plants at once.
- Encourage deep root growth.
- Save energy as they use smaller pumps and power sources.
- Limit weed growth between plants.
- Cheap and simple to install.
- Suitable for small or irregular shaped areas.
- Can be automated very easily.

A good micro-irrigation system should:

- Be based on flow rate (litres/hour) of water from the tap.
- Allow flexible watering times.
- Utilise the most efficient spray / dripper on the market.
- Be flushed and cleaned at the start of every dry season.

1E. MICRO-IRRIGATION PARTS

AT THE TAP

You should get help from a plumber or your ESO (Essential Services Officer) to set up this part of the system. The plumber can check to see if you need to install an isolating valve and backflow device before you start. This is because people can get sick if garden water gets mixed up with drinking water.

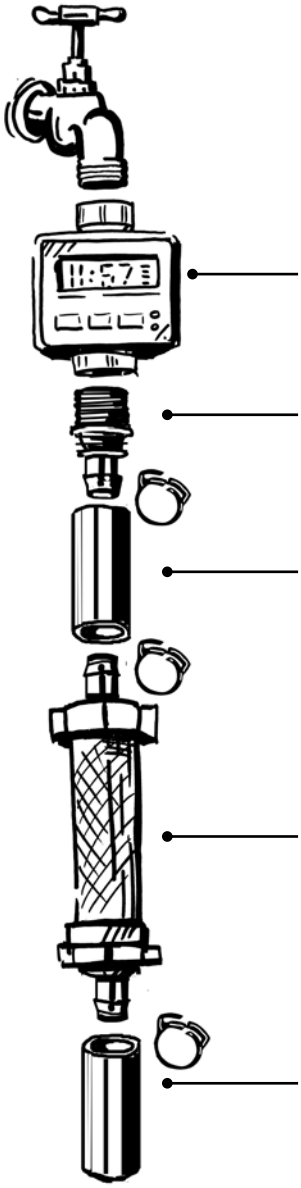
If a reticulated water supply is not available, a pump will be required to distribute water. The size and type of pump will depend upon how big your system is and the pressure you require.

> **If you are using a tap as your water source make sure everyone knows not to touch it, they should use a different tap for everyday needs (you may need to lock the tap).**

It is important to remember that the parts before the timer are under pressure all the time. Poly pipe with ratchet clamps is not strong enough to cope with this. Let your plumber, trainer or irrigation shop work out this part.

NOTE

There are lots of different products on the market – make sure you have all the connecting parts before you start.



Timer or controller

A timer will run the irrigation system automatically. The more complicated timers are called controllers and can water different sections at different times. Simple timers and some controllers are battery operated (make sure you buy the batteries). Other controllers run off electricity – you will need to get an electrician to install this type of controller safely.

Solenoid valves

A solenoid is like a switch, when it is on it will open the valve and let the water through. The timer will tell the solenoid when to turn on and open the valve. In a simple system there is just one solenoid valve which is part of the timer. In a complicated system with a controller, each section will have a solenoid valve.

Nut and tail

If you are not using a timer you can use a nut and tail to connect the tap to the main pipe directly (timers and controllers usually have a nut and tail built into them).

Filter

Clean water is essential for micro-irrigation systems. Even small amounts of dirt can block drippers and sprays. The filter should be cleaned regularly. There are a few types however screen inline filters are the most common.

Director

The director connects the timer or the filter to the main pipe.

Plumbing tape

Plumbing tape is used to seal pipe threads against leaks. It is a thin, white tape that fills in the gaps between the pipe threads.

Valve Box

Sometimes it is necessary to bury the solenoid valves (and/or timer) in a valve box to protect them.

PIPES, CLAMPS, JOINERS AND PLUGS

Main pipe

A typical low-pressure micro-irrigation system uses 13, 19 or 25mm poly pipe. It is available in rolls ranging from 20 metres to 100 metres. When soaked in very hot water the plastic pipe softens and is easy to push over the connection or joining pieces. See Resource 2 to work out which size main pipe is best for your project - based on flow rate.

Little pipe

4mm or 5mm poly pipe is used for the lines branching off to drippers or sprays which are normally located at the base of each plant or along a garden border. Little poly pipe is often called 'spaghetti' and is available in rolls of 5 metres and over.

Joiners

Joiners include t-junctions, elbows and straight joiners and can be for any size pipe. Take-off connectors are used to join the little pipes to the main pipe.

Clamps

It is essential to always use a ratchet clamp on all joints on the main pipe. These are usually plastic clamps that are placed around the pipe at a joint, and then closed by squeezing with pliers so they lock firmly together. Without these clamps the pipe will "blow off' the join from the water pressure. Clamps are very easy to use and are cheap to buy.

Risers

Risers are used to raise the spray above ground level.

Plugs

4mm or 5mm plugs (goof plugs) are used to stop holes where the little pipe went into the main pipe. Larger plugs are used to close the end on the main pipe off – make sure you use clamps as well.

EMITTERS

Drippers

Drippers give, slow frequent application of water at various rates and are very water efficient. Some have adjustable flow rates. Good for establishing native trees, fruit trees, isolated trees or shrubs, potted plants and for windy situations. Mostly used for watering individual plants. Suitable for clay soils where water penetration is slow. Ideal for watering plants that don't like overhead watering.

Sprays

Sprays include microsprays and spray jets that deliver small amounts of water. They can be used on shallow rooted plants in garden beds (especially for flowers and borders) and in shadehouses. They have no moving parts.

Sprays also include mini-sprinklers that deliver more water than drippers, microsprays and spray jets. They are useful for delivering high water rates over large areas such as under orchard trees, in large garden beds and in nurseries. They have moving parts.

Sprays are usually installed with risers to get them off the ground.

1F. TOOLS NEEDED

Using the correct tools will not only make the job of installing micro-irrigation systems easy but will also help to keep you free from injury.

The following basic tools will help you. Tick off the items you think you will need for your particular irrigation activity.

ACTIVITY		✓
Tape measures		
Paper, pencils, ruler and compass for plan		
Calculator		
Bucket		
Punch (get a few - they get lost easily)		
Pliers		
Multigrips		
Knife/ secateurs		

Hammer		
Trowel		
Rakes		
Wheelbarrow		
Mattock		
Shovels		
Trench shovel		
Motorised trencher		

PROJECT RISK ASSESSMENT

- Stop and think before starting work.
- What needs to be done so you can work safely?
- Complete the **What to do about it?** column – we have written one thing in each box – try and think of some others.
- Fill in all of the last row by adding a new hazard.

HAZARD **and what can happen = the risk**	**What to do about it?**
SUN EXPOSURE Risk of: Heat exhaustion and sunburn 	• Work in the shade in the middle of the day • • •
TRIP HAZARDS Risk of: Injury from falling over 	• Walk carefully - don't run • • •
USE OF MOTORISED EQUIPMENT Risk of: Injury from being caught in machine 	• Keep hands away from edges of machine • • •
WORKING WITH SOIL Risk of: Soil borne diseases 	• Wear gloves • • •
LIFTING THINGS Risk of: Injured back 	• Lift correctly bending knees and not straining back • • •
	• • • •

2 DESIGNING A MICRO-IRRIGATION SYSTEM

NOTE

Before you start make sure you have the permission of the person who owns the land. For some projects you will need written permission and/or permits.

Think about what type of system you need – for example native plants like drippers which provide nice slow deep watering. It is a good idea to draw out a plan of where you want your irrigation to run. A detailed plan will give you something to follow on the ground when you go to lay out your system. A good scaled plan will also help you work out what materials you will need and will also help in working out the cost. Many irrigation supply centres have free base plans to help get you started.

You could start by making a big plan on butchers paper to get a rough idea and then go and measure it all out properly to make the scaled plan.

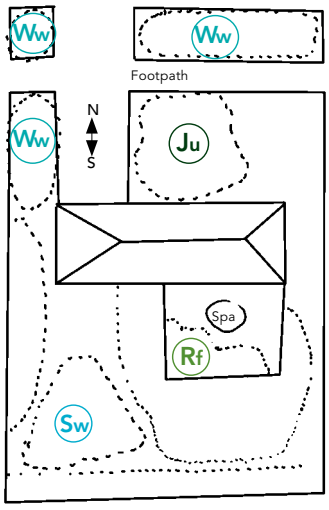
You will need a measuring tape to measure your project site, and squared paper, pens/pencils, a ruler and a calculator to make your plan properly. Ask your trainer for help in calculating it all out.

There are a few important points to remember when designing your irrigation system:

- The length of your system and the number of drippers or sprays you can attach is limited by the flow rate of water at your tap. For example if you have a really long pipe with lots of drippers you will only get a dribble at the end of the pipe. See **Resource 2** for instructions on how to measure your flow rate.
- You may need different sections to achieve your aims. For example do not place drought tolerant plants on the same section as rainforest plants. Each section will need its own water source (either a different tap each, or use a controller so each section takes its turn on the same tap).
- The layout of the pipes should be in loops to maintain an even pressure throughout the line.
- Don't mix drippers and sprays on the same section.
- If you need to completely water a whole area please see **Resource 3**.
- If you bury the pipes make sure you have a record or drawing of where the lines are laid so you can find them later.

Watering Zones

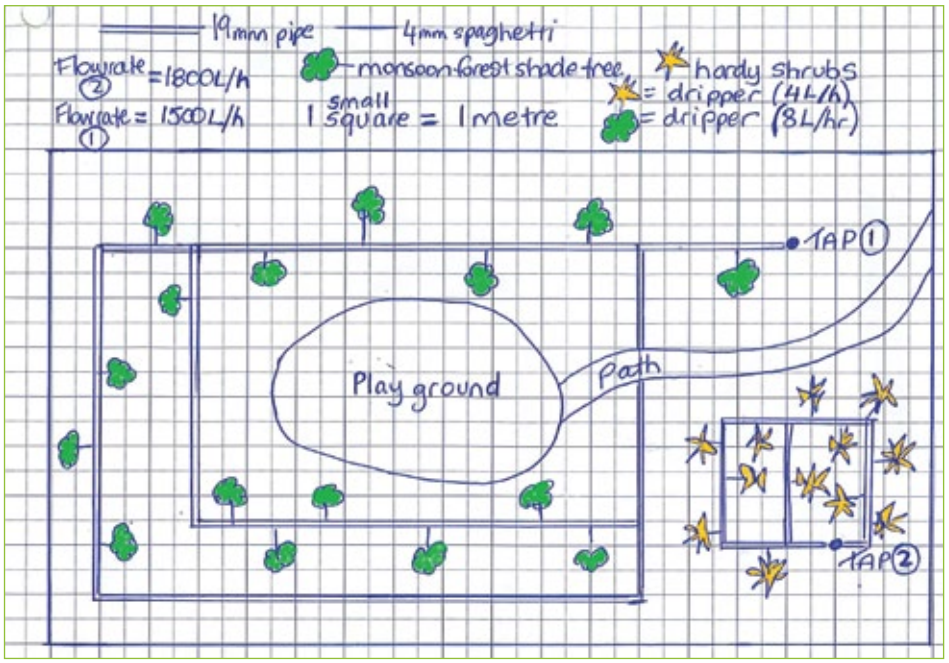
Ww Water wise
Sw Swamp
Ju Jungle
Rf Rainforest



This plan shows different sections needed for a house garden irrigation system

The plan to the right shows a more detailed scaled plan for a community park planting.

Get a good irrigation shop to help you work out what you need for your project.



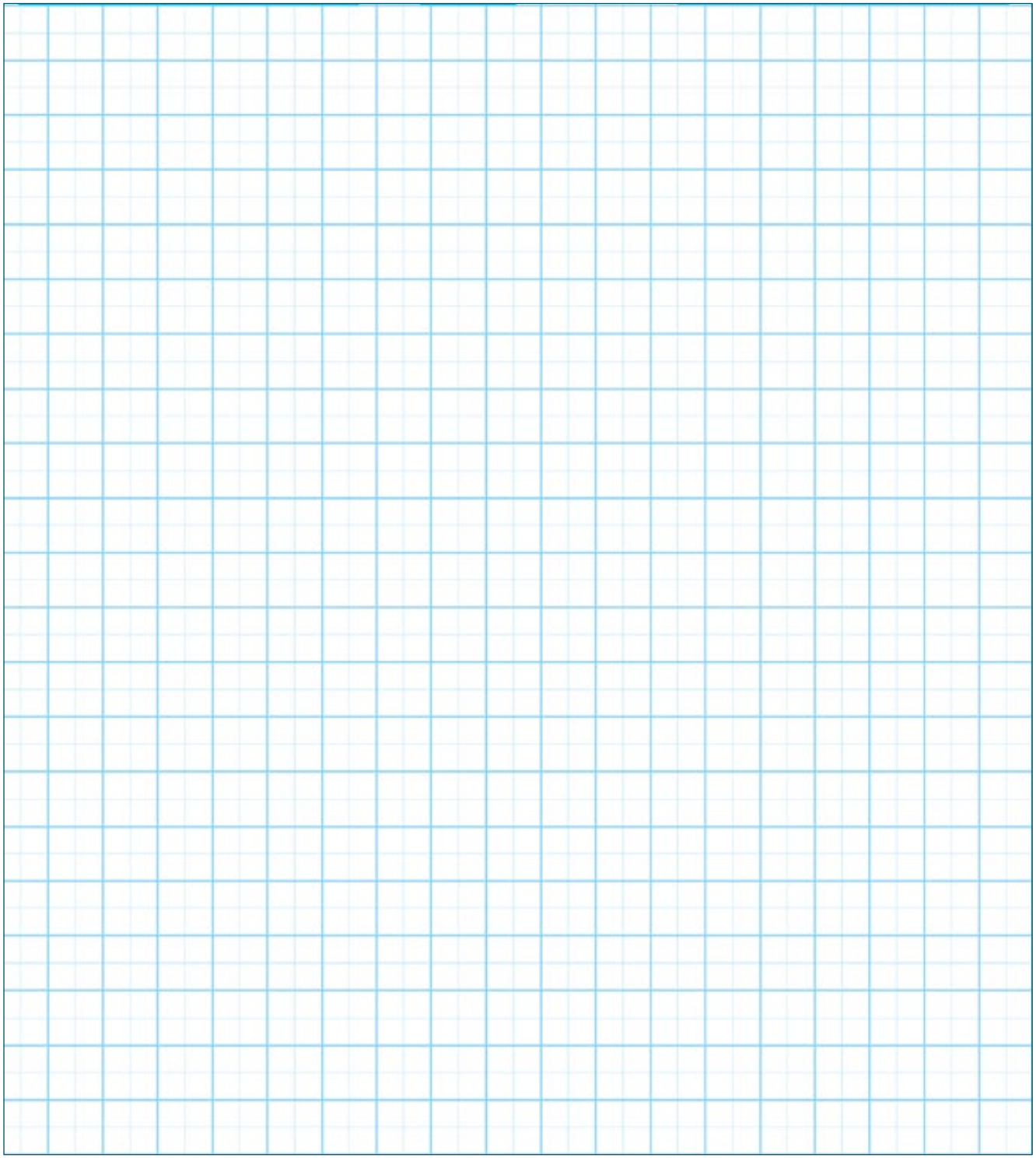
ASSIGNMENT 2 A2

IRRIGATION PLAN

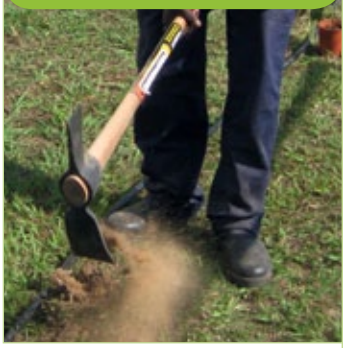
With your group, use the plan below to design an irrigation system for your site.

Make sure you do all the following:

- Measure out the site so you know how big it is.
- Work out the scale you will use and put it on the plan (ask for help).
- Work out your flow rate using Resource 2.
- Work out how many drippers or sprays you need, make sure you have enough flow rate for them, and then place them on the plan.
- Draw in all the main pipes and little pipes.



3 INSTALLING IRRIGATION



3A. DIGGING TRENCHES

Irrigation lines should be buried in the soil or at least covered with mulch to prevent damage from vehicles, dogs, rats, sun and fire. Before digging any trench for irrigation make sure there are no services underground. For instance telephone, power and water lines are often located underground.

DIAL BEFORE YOU DIG

Before digging a trench on your nature strip, call 'Dial before you Dig' service to make sure you won't dig into underground pipes and cables.

Phone: 1100

Fax: 1300 652 077

DIAL BEFORE YOU DIG www.1100.com.au

EQUIPMENT USED

Irrigation trenches can be dug with a wide range of tools including shovels, spades, mattocks, back hoes, rippers and trench diggers.

Only trained people should use motorised machinery.

SAFE DIGGING

Be careful when digging with a spade as wrongly twisting with a full shovel load of soil can easily damage your back. Remember wet soil is a lot heavier than dry soil.

ACTIVITY

With your trainer practice the correct lifting and turning technique when using a long handled spade.

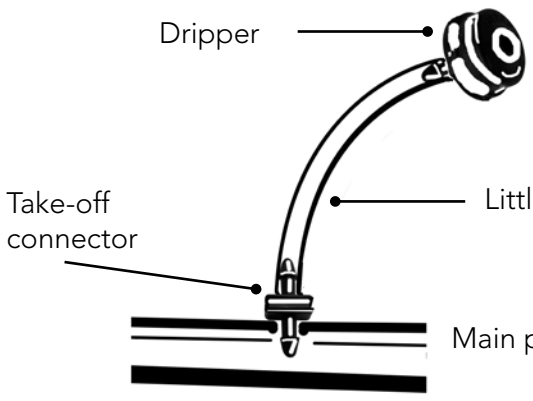
3B. LAYING OUT THE SYSTEM

Use your plan. Once you have worked out your design and chosen the types of parts you will use you can:

- Lay out the pipes in the desired shape. First put the main pipes in place and then place all the little pipes that will connect to the drippers or sprays.

3C. CONNECTING IT TOGETHER

- When connecting the main pipes, dip the ends in hot water to soften them so that they slip over the joiners easily.
- Put in elbows where the pipes need to bend at right angles, use t-junctions and straight joiners where needed.
- Connect all your pipes together in loops to make sure you get even pressure throughout the system.
- Attach clamps at every join (or the hose ends will blow off under pressure).
- It's a good idea to flush the system at this point to get any dirt out before you connect your emitters.
- Connect the little pipe and the drippers or sprays in the desired locations using your punch. Don't worry if you put a hole in by mistake – just plug it up with a plug.
- Secure the system to the ground using pins or bury the hose under the ground at a suitable depth to protect the pipe.
- Connect the tap assembly and filter to the water tap (see 1E). If you are using a timer talk to your trainer to work out what times are needed.
- Once you're connected, flush the system to test it (see 4A). Make sure sprinklers don't waste water by watering concrete.



After punching a hole in the main pipe use a 'take-off connector' to join the little pipe

ACTIVITY

Practice joining main pipes: use joiners and clamps and soak the ends in hot water.

4 FINISHING AND MAINTAINING THE SYSTEM

4A. FLUSHING AND CHECKING

You should flush and check your system as soon as it is finished to make sure it is working properly. Do one section at a time.

- Open the ends of the main pipe.
- Flush the system out with fresh water until it runs clear (a minute or so) – use as much water pressure as possible to help remove any dirt.
- Seal the ends of the main pipe (fold over and tie with wire, or use a plug and clamp).
- Manually check every joint for leaks and also check every dripper and spray for proper functioning.

4B. FINISH EARTHWORKS

Make sure all the trenches are filled in and the site is cleaned up properly.

4C. DISPOSAL OF WASTE MATERIAL

After installing irrigation and landscaping there is often a range of unwanted waste material left behind that needs to be dealt with. Things such as matting, old pipe, broken sprinklers, pots/tubes, unused root bound plants, soil, fertiliser, milk cartons/bags, plastic wrapping, stakes, mulch, and plant debris. It is best practice when finished to leave a completely clean site free of rubbish.

Methods of waste disposal could include:

- Organic waste: mulch and composting.
- Inorganic waste: plastic/metal/paper based materials may be recycled, reused or returned to manufacturer.

4D. TOOL MAINTENANCE

To make the next job easy and to prevent personal injury it is very important to keep tools in good condition. Follow the steps below each time the tools are used:

- Wash the mud and dirt off and oil any metal parts to prevent rusting. Steel wool and a light oil will remove any surface rust.
- Keep tools sharp and in good working order. Bevel the back edge of a spade off with a bench grinder or a coarse sharpening stone.
- Replace any broken handles. Never use bush sticks as handles as they often break causing injury.
- Sand and oil all wooden handles to avoid getting nasty splinters. Use 50% mineral turpentine and 50% raw linseed oil on wood.

4E. MAINTAINING THE SYSTEM

Maintain your system regularly to make sure it is working properly. Potential problems include:

- Dirty water can cause blockages.
- The sun, rats, vehicles, vandals and insects can damage the system.

Things you need to do include:

- Visually check your system every week or so – don't wait for your plants to die to discover there is a fault.
- Flush and check your entire system carefully once a year at the beginning of the dry season.
- Sprays and drippers can be removed and soaked in a bleach solution then replaced.
- Flush the system more often if needed – check with your trainer.
- Clean the filter after you have flushed the system.

ACTIVITY

Working on an existing irrigation system, practice flushing the system out.

ASSIGNMENT 3 A3

INSTALL AND CHECK IRRIGATION

Using your plan, install and check your irrigation system. Make sure you update the plan when finished.

Answer these questions, you can write the answers here OR tell your trainer the answers:

How many metres of main pipe did you use?

.....

How many metres of small pipe did you use?

.....

What size drippers did you use?

.....

How many drippers did you use?

.....

What size sprays did you use?

.....

How many sprays did you use?

.....

What other parts did you use?

.....

.....

Were there any problems when you checked the system – if so what were they?

.....

.....

.....

.....

.....

RESOURCE 1: BASICS OF GOOD LIFTING

Correct handling of materials is important to ensure a safe working environment. Improper lifting techniques can lead to back pain and learning the right way to lift will help you avoid this.

1. **Plan ahead**
   - Size up the object and test to see if it is possible to lift by yourself
   - Clear a path and make sure there are no obstacles in your way
   - Practice the lifting motion before you lift the object

2. **Lifting the object**
   - Place your feet shoulder width apart with your feet close to the object
   - Keep the object close to your body
   - Bend your knees and tighten your stomach muscles
   - Get a firm hold on the object and stand up slowly keeping your back straight
   - Let your legs do the lifting work
   - Take short steps and do not twist

3. **Putting the object down**
   - Keep the object close to your body
   - Bend your knees and keep your back straight
   - Let your legs do the work
   - Wait until it is firmly in place before letting go

RESOURCE 2: FLOW RATE

Step 1: Fill the bucket

- Time how long it takes to fill a **normal 9 litre bucket** with the tap turned **full on** – use a watch that shows seconds.
- Write down how many **seconds** it took to fill your 9 litre bucket

_____ **seconds**

Step 2: Calculate the flow rate

Get a calculator:

- **Enter** the first magic number **32400**
- Press ÷
- **Enter** the **number of seconds** you wrote down in **Step 1**
- Press **x**
- **Enter** the second magic number **0.8**
- Press **=**
- Write down the answer from your calculator

Flow rate is _____ litres per hour (L/h)

(It's a good idea to conduct a few flow rate tests and take the average of the results)

NOTE

If your flow rate is a lot higher than you need you will have too much pressure and the joins may blow apart. Use a tap to reduce the flow rate to what you need.

Step 3: What size main pipe to use?

Have a look at the **flow rate** from **Step 2:**

- If it is **less** than **1000** use a 13mm main pipe.
- If it is **between 1000 and 2000** use a 19mm main pipe.
- If it is **over 2000** use a 25mm main pipe.

NOTE

13mm pipes have a lot of friction loss and should only be used for small systems with very low flow rates.

Step 4: How many drippers or sprays?

On one section you should have either:

drippers

OR

sprays

(not both on the same section)

Drippers and sprays usually have a rate in litres per hour – find out the rate of the drippers or sprays you are using and write it here (the flow rate is usually written on the dripper – or your irrigation shop can tell you).

The rate for one dripper or spray is_____litres per hour (L/h)

Get a calculator:

Enter the **flow rate** from **Step 2:**

Press **÷**

Enter the **rate** for your dripper or spray **from above**

Press **=**

Write down the answer from your calculator here

_____

This is the maximum number of drippers or sprays that can be used on this section.

NOTE: THE MAGIC NUMBERS

We have used magic numbers to keep the maths simple in the field.

— The first magic number 32400 is 9 litres x 60 seconds x 60 minutes.

— The second magic number 0.8 is used to reduce the answer by 80% to account for friction.

The magic numbers are like *pi* when you're doing circle work – you just need to believe in them.

NOTE

*A **section** includes all the pipe running off one water source (either one tap OR one station on a controller).*

RESOURCE 3: COMPLETELY WATERING AN AREA

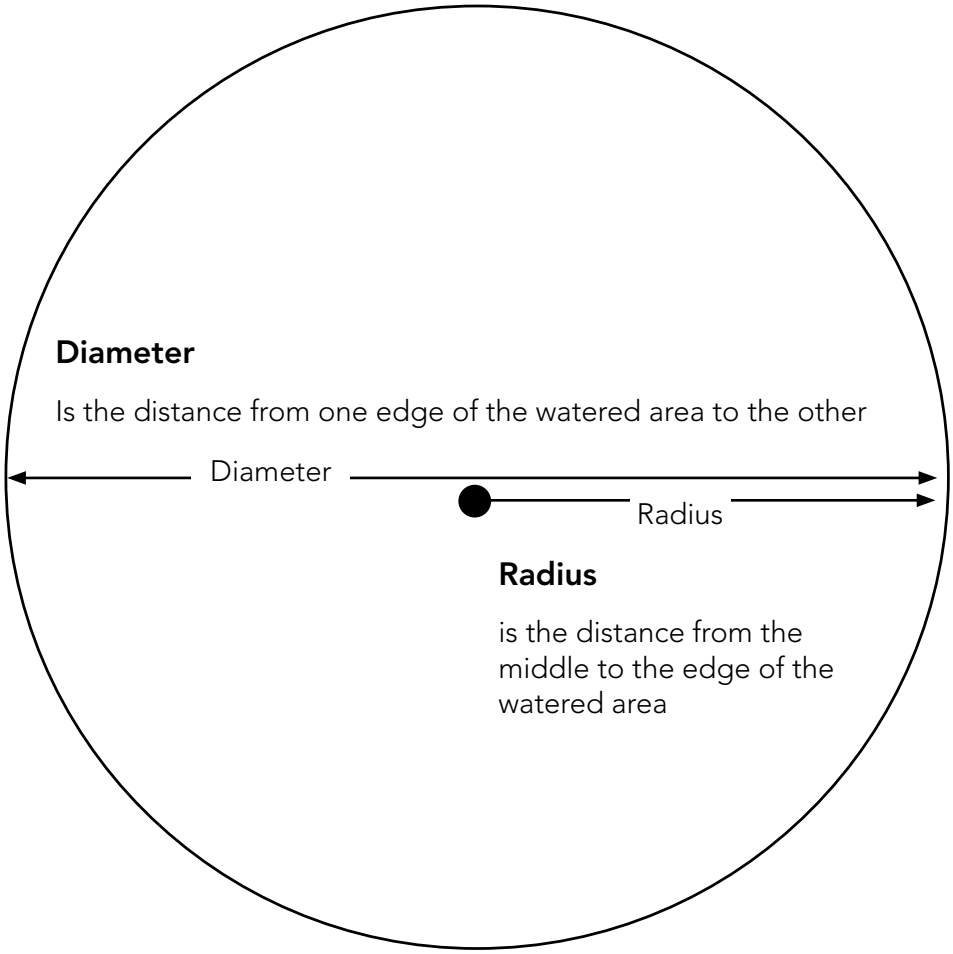
Sometimes you need to make sure an area is getting completely covered by your irrigation system. This might be for some landscaping and garden plantings, it is often when the spray product is a mini-sprinkler.

Radius and Diameter

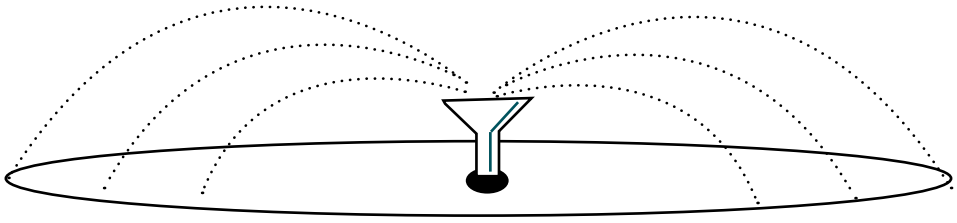
It is important to understand the difference between radius and diameter.

Most spray products list the radius they will water to. However sometimes diameter is mentioned so it is important you know the difference.

Radius is HALF the Diameter. Diameter is TWICE the Radius.



The circle represents the area the spray waters.



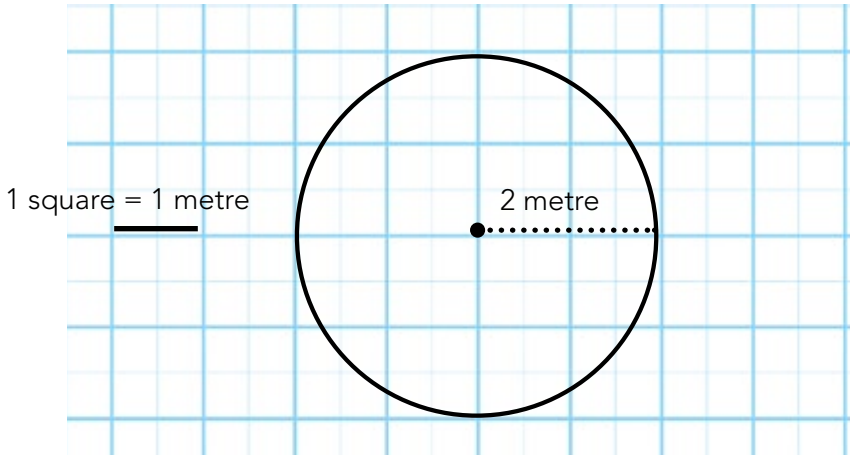
The little black dot represents your spray head.

Spray diagram

First use **Resource 2** to work out your flow rate and how many sprays you can use on one section.

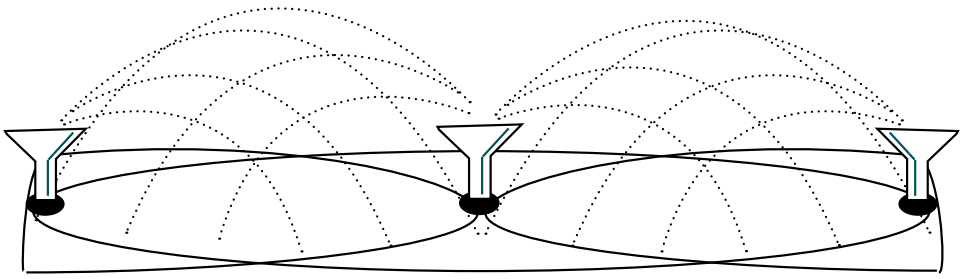
Then, on your irrigation plan draw each spray (little black dot) and the area it waters (circle). You can use a compass to draw the circles. The compass should be set at the length of the radius.

For example if you have used one square on your plan for 1 metre, and your spray has a watering radius of 2 metres, then the compass should be set at 2 squares.

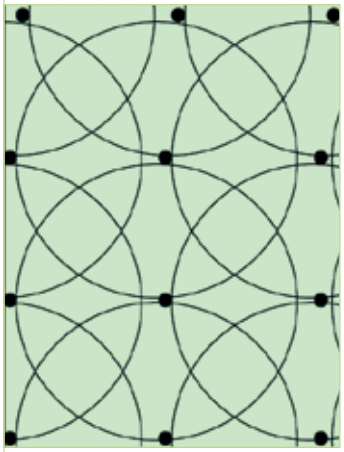


Head to head

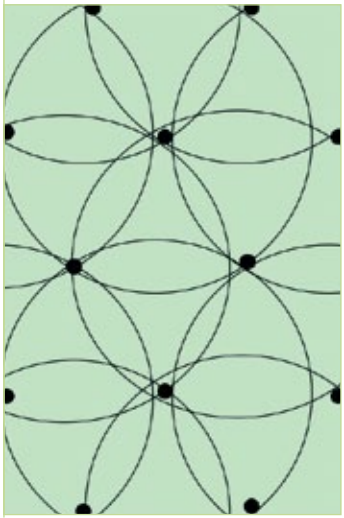
Sprays should be placed so that the water from one spray touches the next spray head, to do this the sprays need to be placed one radius apart. The irrigation mob call this 'head to head'.



On the plan below quarter circle sprays are placed on the corners, half circles along the edges and the full circles in the middle part. This is called a square spacing pattern, it is good for small areas as there is less overspray at the edges.



In a triangular spacing pattern, like the one below, the coverage is generally more uniform than for square placing, and is better for large areas.



ALEP

Aboriginal Landcare Education Program

ALEP Learning Guides. These full colour, step-by-step guides provide practical, easy to follow instructions. Based in the Top End of the Northern Territory, they can also be adapted to other regions.

GETTING READY

1. ALEP Learning Guides – Trainer's Guide
2. Carry Out Natural Area Restoration Works

RECOGNISING PLANTS

3. Recognise Plants
4. Collect, Prepare and Preserve Plant Specimens

GROWING PLANTS

5. Collect, Treat and Store Seed
6. Maintain Properties and Structures
7. **Install Micro-irrigation Systems**
8. Undertake Propagation Activities
9. Pot Up Plants
10. Tend Nursery Plants

MANAGING COUNTRY

11. Treat Weeds
12. Install, Maintain and Repair Fencing
13. Plant Trees and Shrubs
14. Perform Basic Water Quality Tests

In this learing guide, ***Install Micro-irrigation Systems*** **you will learn how to:**

- GET PREPARED TO IRRIGATE
- DESIGN AND INSTALL AN IRRIGATION SYSTEM
- MAINTAIN IRRIGATION

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For further information contact Greening Australia (NT) Ltd on
(08) 8947 3793 or info@nt.greeningaustralia.org.au or go to www.greeningaustralia.org.au

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