

# BACKYARD BIG SCRUB MAKEOVER

## Landscaping for Water Quality Guide

Presented by:



### DID YOU KNOW THAT LISMORE AND ITS SURROUNDING VILLAGES LIE WITHIN A DRINKING WATER CATCHMENT?

A catchment is an area of land that feeds water to a particular creek, river or other water body. In Lismore, water is pumped directly from the Wilsons River to the Nightcap Water Treatment Plant for treatment before it is distributed across the region as drinking water.

### WHAT WE DO IN OUR CATCHMENT AFFECTS THE QUALITY OF OUR REGION'S DRINKING WATER!

Every lawn, front yard and garden plays a role in how clean and healthy our local waterways are. The rain that washes off your lawn may flow directly to a creek or river, or it may travel through a network of swales and stormwater drains before it empties into a waterway. Whether you live on a small block in the heart of Lismore or a larger acreage in one of the surrounding villages, the amount and quality of water that leaves your property has an impact on our local waters and the quality of our region's drinking water.

### ARE YOU WILLING TO IMPLEMENT A FEW SIMPLE TECHNIQUES TO HELP PROTECT WATERWAYS AND DRINKING WATER QUALITY?

The right combination of landscaping for water quality techniques can help filter out pollutants and soak up excess stormwater. Not only can these techniques help ensure that the water leaving your property is as pure as possible, but they can also add a dimension of beauty to your yard that will provide blooming color, enjoyable scenery, and important habitat for birds, butterflies and other native animals!



# 1/ HOW CAN A BACKYARD AFFECT WATER QUALITY?

In urban areas, impervious or hard surfaces (such as roads, carports, driveways, paths and roofs) reduce the amount of rainfall that can soak into the ground. When rain falls on these hard surfaces and cannot soak into the ground it becomes stormwater.

In Lismore and surrounding villages, stormwater flows either directly across the landscape into creeks and rivers, or it travels through a network of drains and underground pipes before it empties into our waterways, carrying with it a range of pollutants and increasing the potential for erosion. When this happens within a drinking water catchment it affects river health and drinking water quality by introducing:

- sediments from erosion and runoff that harms aquatic life, clogs streams and burden the drinking water treatment process;
- pathogens from pet waste and inadequate septic systems;
- nutrients from lawn and garden fertilisers that can promote the growth of aquatic plants and cause toxic algal blooms; and
- chemicals from garden pesticides, herbicides, automotive fluids or car washing detergents.

*"Stormwater from a single backyard, . . . quickly adds up at the catchment level."*

# 2/ WHAT IS LANDSCAPING FOR WATER QUALITY?

Landscaping for water quality is about using landscaping techniques to filter out pollutants and soak up excess stormwater, reducing the amount and improving the quality of stormwater as it leaves your property.

Landscaping for water quality uses techniques that:

- maximise the beauty of your property;
- are environmentally responsible; and
- protect the quality of our waterways and our drinking water catchment.

Landscaping for water quality can transform an average lawn into an outdoor space with appealing design and purpose while minimising harmful impacts on the environment. Depending on your personal preference and style – your new landscape elements can be less maintenance than a typical lawn, or provide you with new gardening activities.

This guide contains information to help you to create a backyard landscape that influences water sources within our catchments helping to protect:

- the health of our waterways;
- our local drinking water supply; and
- land, wildlife and people.

# 3/ TECHNIQUES IN LANDSCAPING FOR WATER QUALITY

The right combination of landscaping for water quality techniques can see stormwater collected and filtered by landscape features, preventing stormwater from carrying pollutants into drains and waterways.

These landscaping techniques are discussed in further detail below and may include:

- creating backyard buffers;
- using Water Sensitive Urban Design (WSUD); and
- choosing appropriate landscaping materials.

## BACKYARD BUFFERS

Buffers are gardens of densely planted native species placed between hard surfaces at the location where stormwater leaves your property. While the size of buffers can vary, wider buffers have a greater ability to stabilise soils, filter pollutants, and absorb stormwater.

Providing backyard buffers can:

- improve the quality of water entering our waterways by using plants to reduce and filter stormwater that contains pollutants from soil, fertiliser, bacteria and detergent;
- enhance biodiversity by using plants that provide valuable habitat for wildlife whilst enhancing their movement across the landscape;
- prevent erosion by increasing the infiltration of water into the soil, slowing water flow and cushioning the force of falling rain;
- reduce flooding by reducing water levels in creeks and rivers during flood events;
- enhance property values and the aesthetics of your garden;
- provide personal satisfaction by making changes that protect our natural resources;
- show best attributes using plants to screen undesirable views and frame good ones; and
- save time and money using plants that reduce the need for watering, maintenance, fertilisers and other chemicals.

## ♦ BACKYARD BUFFERS: WHAT YOU CAN DO!

There are a number of simple and effective ways you can provide backyard buffers around your home such as:

- ✓ **Create a backyard Big Scrub.**
- ✓ **Create a filter strip.**
- ✓ **Care for your lawn .**

### CREATE A BACKYARD BIG SCRUB

Landscaping for water quality using backyard buffers is about maintaining the vegetation that already exists on your property as well as adding more layers of native vegetation, particularly endemic native plant species suitable for your site. In Lismore and surrounding villages this means using Big Scrub rainforest species, many of which are suitable for the urban backyard.

The Big Scrub rainforest was once the largest expanse of subtropical rainforest in Australia. Of the original 75,000 hectares now less than one per cent of scattered rainforest fragments remain. Creating a backyard Big Scrub helps prevent erosion from stormwater by increasing the infiltration of water into the soils, slowing water flow and cushioning the force of falling rain. It also improves conservation and biodiversity in the Big Scrub landscape and is important for our water future.

When creating your backyard Big Scrub remember to select species suitable for your backyard. Consider the height and spread of the plant at maturity and ensure the species selected are suited to your situation.

### FILTER STRIP

Filter strips are a type of backyard buffer that can be used in a wide variety of places in order to improve water quality. Examples of filter strips in the backyard include flower beds with ornamental grasses, perennial gardens, and “no-mow” zones. As rainwater passes through a filter strip, the low growing vegetation slows the movement of water, allowing sediment to settle out, and excess nutrients and pollutants to be filtered by the plants. The plants also help absorb some of the rainwater, resulting in less stormwater from your property!

#### **In your backyard you could plant a filter strip:**

- along a swale or drainage area helping to slow and filter stormwater;
- along the property boundaries to help clean the water leaving your property; and
- around the borders of lawn or vegetable gardens to reduce erosion and keep soil and nutrients on the lawn/vegetable garden and out of the stormwater.

### LAWN CARE

Well-managed lawns are an environmental asset. They can help protect, or even improve, water quality by acting as a filter to capture and break down many types of pollutants and nutrients. Poorly managed lawns, whether by neglect or through the overuse of fertilisers and pesticides, can be an environmental liability.

In your backyard manage your lawn to protect water quality by:

- mowing high (never more than a third of the plant as you mow) so as to not weaken root systems, making it harder for weeds to compete with grass;
- fill in any weak spots using a rake to work up and improve the soil then reseed with grass seed;
- only water if necessary, and only in the early hours of the morning and never during a drought;
- leave the lawn clippings for earthworms to incorporate into the soil, improving both its drainage after storms and ability to hold water during drought; and
- don't spray or fertilise without checking to see if the problem justifies treatment. Caring for your lawn properly will result in healthy root systems, enabling it to tolerate some insect damage and outcompete weeds.



## WATER SENSITIVE URBAN DESIGN

In Lismore and our surrounding villages, development can have a negative impact on the health of our waterways. Rain or floods can also negatively affect waterway health. Water Sensitive Urban Design (WSUD) seeks to minimise the impacts of development using a holistic approach to town planning and development, which embraces the management and conservation of water.

WSUD can be incorporated in your backyard to capture, treat and reuse stormwater. By utilising WSUD in your backyard, you can help to significantly improve the quality and quantity of water entering our local waterways.

Incorporating WSUD in backyard design can:

- filter pollutants from stormwater before it enters our waterways;
- reduce the volume of stormwater entering our waterways;
- improve the health of our waterways and our local water supply;
- minimise demand on the reticulated town water supply system;
- Incorporate collection, treatment and/or reuse of stormwater;
- mitigate the impacts of floods;
- enhance the beauty of your backyard;
- filter sediment, pathogens, nutrients and chemicals; and
- maintain healthy waterways for future generations to enjoy.

### WATER SENSITIVE URBAN DESIGN: WHAT YOU CAN DO!

There are a number of simple and effective ways you can implement WSUD in your backyard such as:

- ✓ **Build a raingarden.**
- ✓ **Install a rainwater tank.**
- ✓ **Use landscaping materials for water quality.**

#### RAINGARDENS

Raingardens (also known as bio-retention systems), are garden beds that use a coarse or porous soil mixture of sand or gravel beneath a bed of native plants to capture, filter and treat stormwater from your driveway or roof. Raingardens reduce flooding by sending the water back underground rather than into the street. In addition, raingardens promote biodiversity by providing habitat for wildlife.

When building a raingarden in your backyard remember:

- On flat sites, raised planter boxes make ideal raingardens. On steeper areas with enough depth for drainage, raingardens can be excavated.
- Try to capture and treat stormwater from the greatest impervious area.
- Locate the raingarden as close as possible to the roof downpipe and stormwater drainage system to minimise the plumbing work needed.
- Choose native plants with deep fibrous roots that can tolerate short periods of wet conditions, followed by longer dry periods.

#### RAINWATER TANKS

Installing a rainwater tank is one of the easiest ways to reduce the amount of stormwater leaving your property, by collecting runoff from your roof and storing it for later use. Rainwater tanks come in all shapes and sizes and can be simply fitted with a tap and connected to a hose for watering the garden and for washing pets and vehicles. Your rainwater tank could also be connected internally providing water for toilets and laundry.

Installing a rainwater tank at your place is a simple way to:

- store runoff from your roof for use during dry periods;
- prevent erosion on your property from gutter downspouts;
- reduce your water bill;
- irrigate your garden with minimal effort; and
- contribute to regional water conservation.



Rous Water offers a rebate for the installation of a rainwater tank. Eligible residential town water customers may be eligible for up to \$1000 for installing a rainwater tank for use in the garden, or more if the tank is connected internally to the washing machine or toilet. Visit [www.rouswater.nsw.gov.au](http://www.rouswater.nsw.gov.au) for further information.

## **USING LANDSCAPING MATERIALS FOR WATER QUALITY**

### **Porous Materials**

Think about all of the hard surfaces that cannot absorb water, such as driveways, carports, rooftops, patios, and paths. These areas will increase rainwater runoff rather than absorbing it! Use porous materials designed to allow water to soak through the surface and seep back into the ground.

When constructing hard surfaces in your backyard remember to:

- Use stone, brick or stepping stone walkways rather than concrete (preferably with plants in between). This also benefits nearby plants and trees by allowing both air and water to reach the root zone underneath the paved area.
- Use gravel, crushed stone, or porous pavement rather than concrete for your driveway or carport.
- Construct patios and decks out of wooden planks, with a gravel or sand layer below, so that rainwater can drip through and soak into the ground.
- Consider traffic type (vehicle or pedestrian) and frequency, existing soil type, location, aesthetic preference and cost.

### **Mulch**

Mulching around plants and trees on your property can provide a number of benefits to the soil, including increased rainwater absorption, protection from erosion and extreme temperatures, improved soil moisture retention and suppressed weed growth.

Many different types of natural and synthetic mulches are available for landscaping and include:

- lucerne straw and sugar cane mulch most commonly used in vegetable gardens or small fruit plantings;
- woodchips, bark chunks, and pine needles used in garden beds or around trees;
- fine mulches, such as bark granules, wood shavings and tea-tree mulch are attractive when used in annual or perennial beds; and
- fine gravel or crushed stone mulches mostly used in rock gardens.

## **4/ DESIGNING YOUR GARDEN**

This section is designed to help you plan a simple and effective garden landscape for water quality. These steps can either help you to rethink the landscaping on your entire property, or to incorporate into the existing landscape.

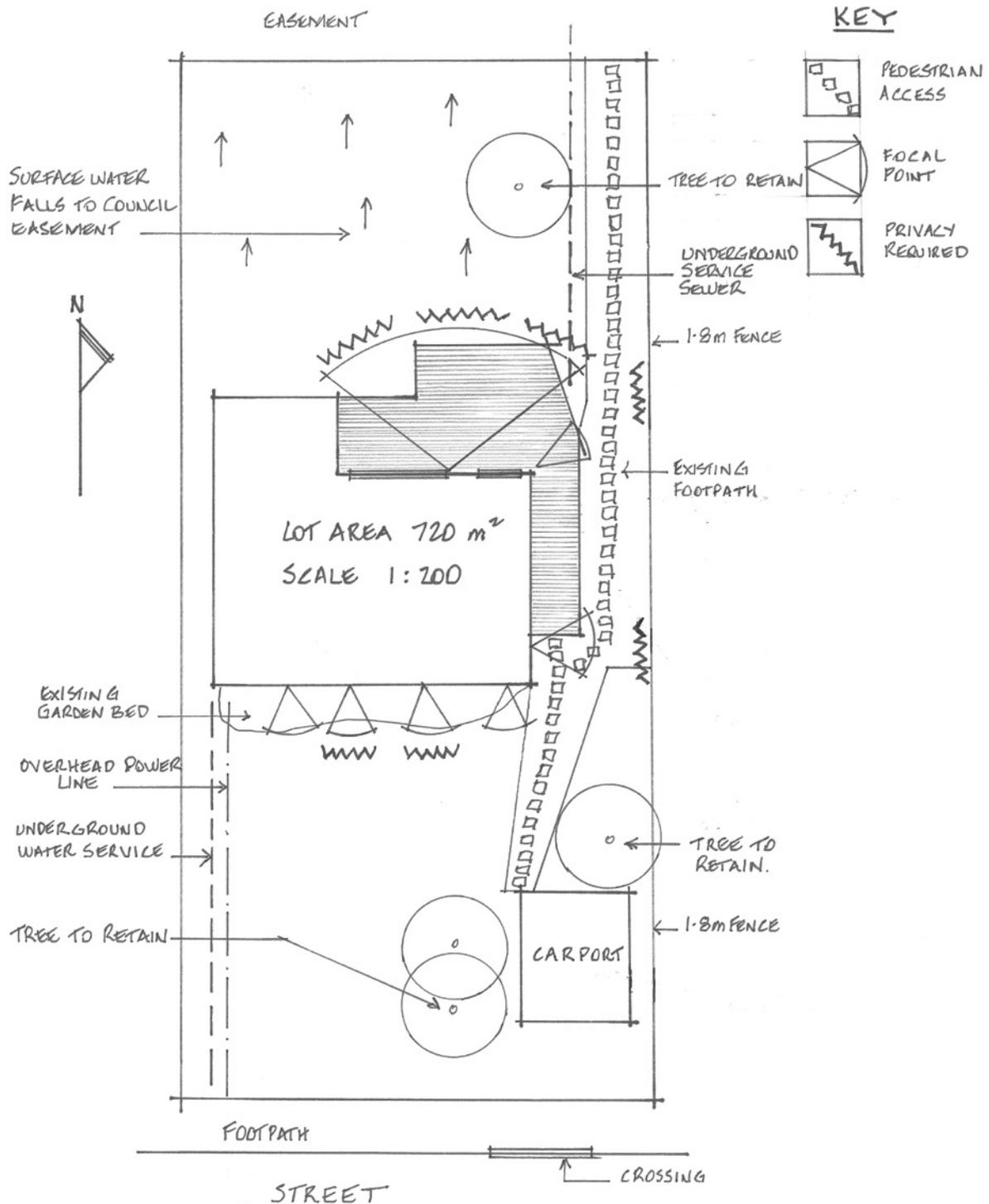
### **ASSESS YOUR PROPERTY**

Assess your property – what you can do!

The steps involved in assessing your property are discussed in further detail below and include:

- ☑ **Developing a base map.**
- ☑ **Identifying slope and water flow patterns.**
- ☑ **Identifying views/outlook.**
- ☑ **Identifying wind direction.**
- ☑ **Considering other features.**





## PLAN OF EXISTING SITE CONDITIONS

### DEVELOP A BASE MAP

The first step in designing any garden is to identify the existing characteristics of the site. A base map provides an inventory of the key features of your property.

- Include the footprint of all existing built structures, such as the house, shed, retaining walls, driveways, pathways, paved areas, patios and decks.
- Identify property boundaries and fences.
- Include services e.g. overhead power lines and underground water and sewer pipes.
- Identify Council easements.
- Identify existing trees, shrubs, lawns and/or gardens beds.
- Illustrate the water pathways with arrows, and identify areas where water collects.

## IDENTIFY WATER FLOW PATTERNS

Identify how water moves around your property.

- Go outside immediately after a big rainstorm and following the path of water flow.
- Look for leaves, twigs and soil patterns created by the movement of water.
- Illustrate the direction of water movement on your base plan with arrows.
- Identify water flow pathways from their source (usually upslope) to the point where the water exits your property (usually downslope).
- Identify areas where water collects (wet/boggy areas).

## IDENTIFY SOIL TYPES

Determine what type of soil you have and identify modifications to the soil, as appropriate, to ensure infiltration.

## IDENTIFY SUN/SHADE

Identify shady and sunny areas at different times of the day.

## IDENTIFY PREVAILING WINDS/BREEZE

Mark wind direction on your base map by identifying the direction of cooling summer breezes and the direction of cold winter winds (typically south west) – best for larger trees and wind block plantings to shelter the property.

## DEFINE THE OBJECTIVES

Once you have a base map to work with you can then identify the opportunities for change in your garden.

- Identify problem areas to address and mark the location of these on the plan (e.g. is a privacy screen from adjacent properties needed? Are there wet/boggy areas? Is erosion a problem?)
- Make a list of the different functional areas you wish to include in your garden design (e.g. outdoor dining and BBQ area, children's play equipment/swings, edible garden, dog/cat enclosure, open lawn for children's play, planted buffer, septic dispersal field).
- Think about how these areas relate to one another and whether certain areas should be co-located or linked by a pathway.
- Define your objectives. What are you trying to achieve?

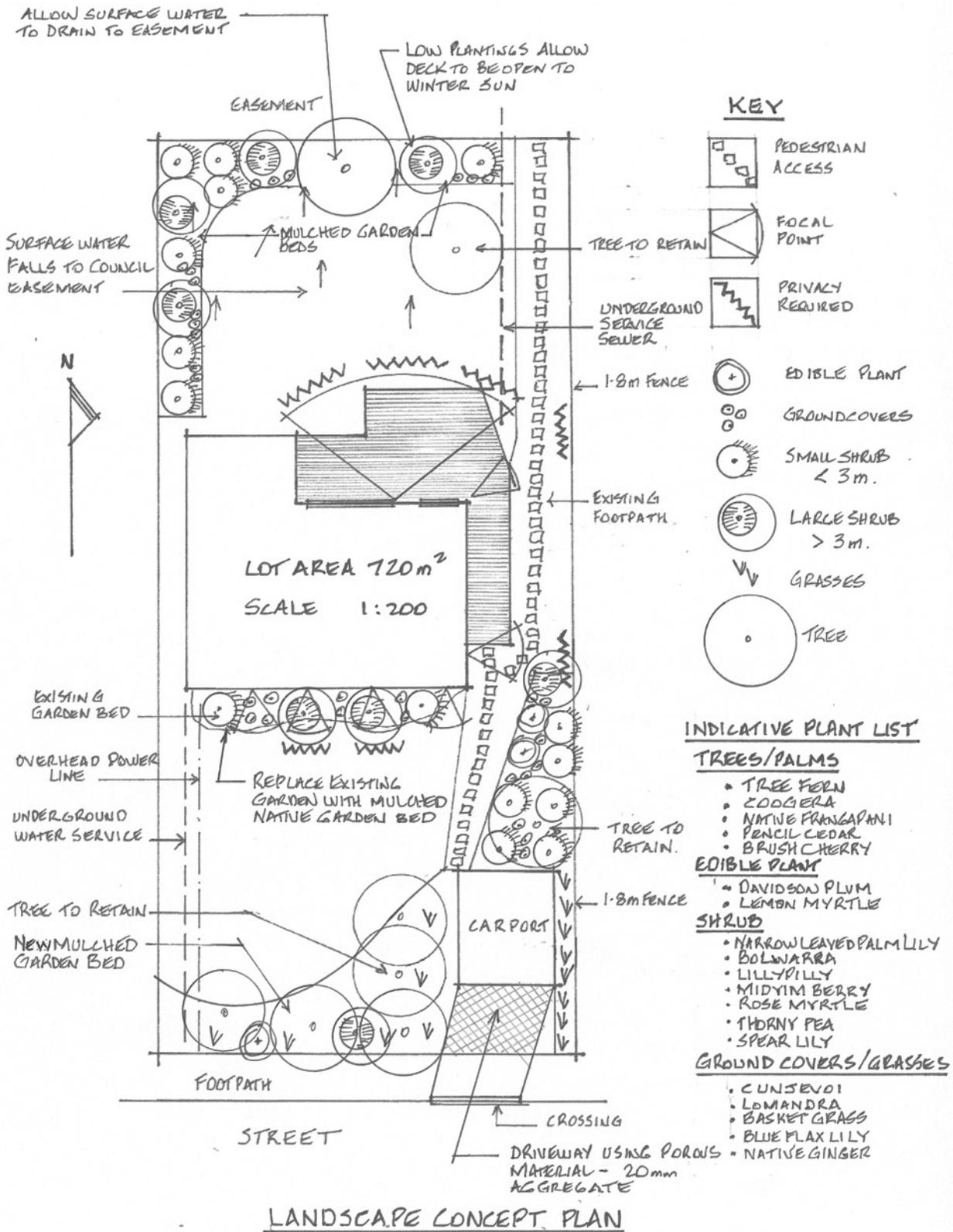
## OBJECTIVES FOR WATER QUALITY

There are some simple concepts central to landscaping for water quality.

- Create a buffer by considering landscape features that will collect, store, and disperse rainfall that falls on your property. To do this you will want to minimise hard surfaces and lawn or create a buffer using native vegetation or a raingarden. Divide areas of lawn and hard surfaces with suitable Big Scrub Rainforest species and gardens. Plant trees, shrubs and ground cover at runoff sources such as buildings, drives, and walkways.
- Encourage infiltration through capturing stormwater and holding it long enough for it to soak into the ground.
- Incorporate landscape features such as rock-gardens, patios, pathways and other landscape features provided the stormwater that comes from them is captured.

*"Remember the desired outcome is to collect, store and disperse stormwater."*





## CREATE A LANDSCAPE CONCEPT PLAN

Once you have considered all your needs and defined your objectives, the next step is to develop a concept plan. This is a simple bubble diagram that helps you to consider where the different functional areas will be located and how they will connect and relate to one another.

- Use some tracing paper (or kitchen baking paper) placed over your base map.
- Draw simple bubble shapes to define the location and extent of each functional area.
- Draw dotted lines to show pathway connections between the bubbles.
- Draw arrows to indicate the direction of stormwater flow.
- Create different versions of your concept plan to consider the pros and cons of different options.
- Once you have decided upon a preferred option, you can then work the plan up into more detail.

## DESIGN CONSIDERATIONS:

### Outdoor Rooms

- Think of the different functional areas of the garden as a series of outdoor rooms.
- Shrub “walls” can separate one functional area from another.

### Focal Points

A good design has a few focal points but not so many that they are all competing with each other.

- Where are the best locations to place striking specimen plants, sculptures or water features?
- Allow for plenty of plain, green, bushy plants to support the more eye-catching elements.

### Water Quality

Locate garden landscaping for water quality strategically in low areas and at the ends of water flow pathways to capture and store stormwater. Break up stormwater from water flow sources with buffers of native vegetation, raingardens, rainwater tanks and porous landscaping materials. Incorporate your property needs creatively into the design.

- Capture rainwater from roofs in a rainwater tank.
- Create a raingarden to filter and treat stormwater and as a landscaping feature.

*“The best way to get a garden that functions with the surrounding environment is to create an initial design giving you an overview of what to aim for, even if funds only allow realising the design gradually over time.”*

## PLANTING PLAN

### Remember...

- Select plants that fit the conditions on your property: not all Big Scrub rainforest species will be suitable for your garden but there are plenty that will be. Seek advice if you are unsure.
- Use multiple species and a blend of plant heights to keep colour alive, maintenance down, and interest year round.
- Well-defined garden edges instil a look of care; remember this is your garden – make sure it looks good!

### Structure

Structural diversity is a crucial element in creating an assortment of habitats in your garden.

- Try to choose a variety of plants and layers, i.e. groundcovers and grasses, vines and scramblers, shrubs, small and tall trees, that will in turn maximise the range of wildlife that will come to nest, rest and play in your garden.
- Flowering species will attract butterflies, insects and nectar loving birds.
- Brightly coloured fruits will attract birds, possums and other mammals.
- Dense pockets of growth amongst rocky areas will provide habitat for frogs, lizards and worms.
- Plant a thorny shrub such as the thorny pea to encourage small birds to nest and take up residence.

### Trees

Although many rainforest trees grow very tall or have canopy and buttresses which cover wide areas, there are some that are in fact quite small or can be pruned to fit comfortably into a smaller garden and make beautiful displays. Trees are an essential element of design. Some people are lucky to inherit beautiful specimens of mature trees which can be incorporated into the design and provide vital habitat and stepping-stones in a fragmented urban landscape.

- Be considerate of neighbours.
- Try to get as much information about heights and habits as you can, including root growth.
- Think about planting a Davidson plum, lemon myrtle or native frangipani.

### Shrubs

Shrubs and groundcovers establish better when planted at the same time as trees. Shrubs are excellent fillers of the garden – choose plenty of bushy green foliage and limit the ‘showy’ plants. Mark on the plan areas which require screening from winds or views – these can be thickly planted with shrubs.

- Smaller birds favour bushy, shrubby growth for protection from predators.
- Think about planting small bolwarra, rose myrtle, brush senna, lillypilly or Midyim berry.

### Edible Rainforest Plants for the Home Garden

There are a great variety of edible Big Scrub rainforest plants, many of which can be grown successfully in the home garden.

- Think about planting native ginger, finger lime, bolwarra or lillypilly.



### Vines and Creepers

Climbers are amazing plants that are able to grow and expand to fill the space available to them, and as such are incredibly useful in the home garden. Vines have great variety in their methods of climbing including tendrils, twining stems, prickles, thorns and even climbing roots. Many have interesting foliage, magnificent flowers and/or fruit so are well worth growing.

- These plants can cover bare patches, screen areas, add vertical elements to the garden, and give protection to other plants where needed.
- Think about planting Birdwing butterfly vine, twining guinea flower, common silkpod, native hoya and wombat berry.



### Groundcovers

Lower plants soften hard edges and create great habitat for frogs and lizards. They also add to the garden design and can minimise weed growth.

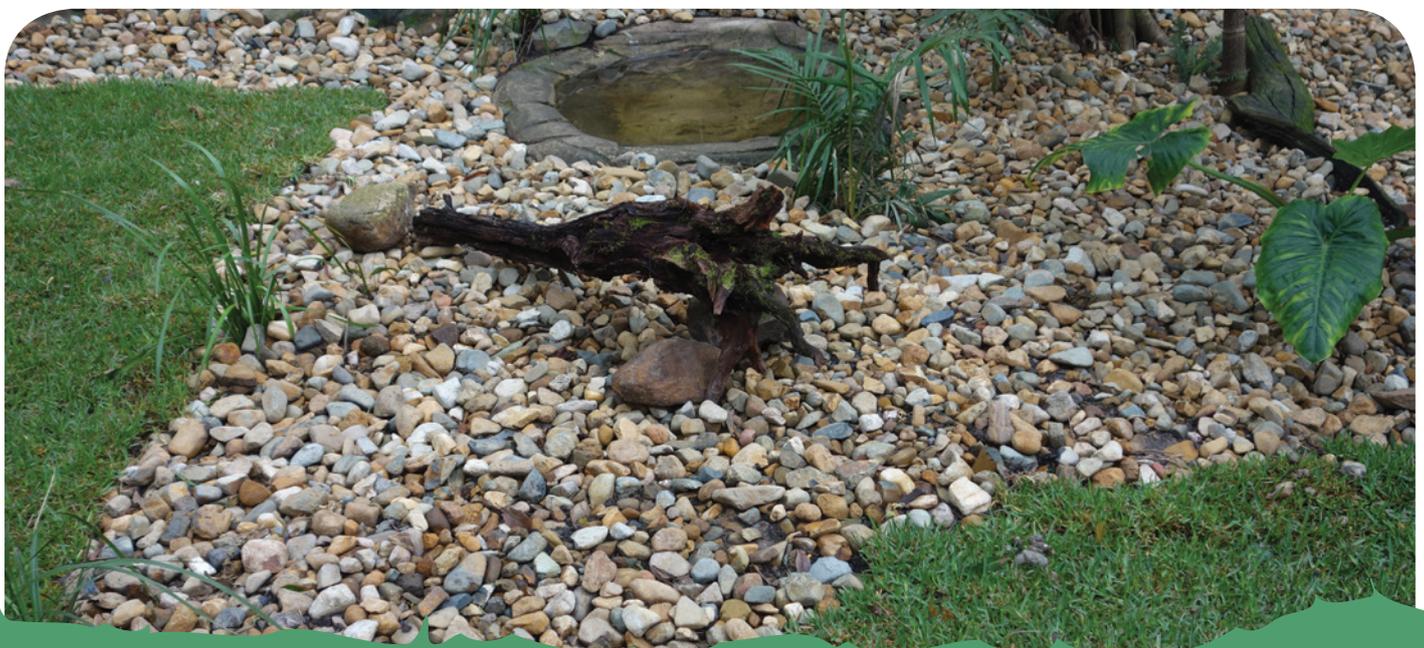
- Some Big Scrub rainforest groundcovers worth considering include native violet, arrow-leaved violet, warrigal greens and basket grass.

### Lawns

Lawns are great for open areas to play or entertain and to create a sense of space. They are however labour intensive, so consider native groundcovers that are less intensive and plant out the rest. Edging around lawns also saves many hours of weeding out invasive grasses from the garden beds and makes mowing easier.

### Materials

Try and be creative – recycle materials where possible. Hard surfaces should drain into garden beds and lawns rather than creating large volumes of stormwater.



# 5/ INSTALLING YOUR GARDEN

## Getting help

Help can be obtained from your local council, friends and family, landscape designers, experienced gardeners, websites and nurseries. There are also a lot of great books and websites out there to help guide your installation.

Enlist the help of friends or family or get some of the work done by paid professionals to ensure the job is done properly if you aren't sure how to go about it yourself.

The following basic guides will give you an idea of how to go about installing some aspects of your garden. Links to resources for further details have been provided at the end of this guide.

## BASIC RAINGARDEN GUIDE

### Before you start

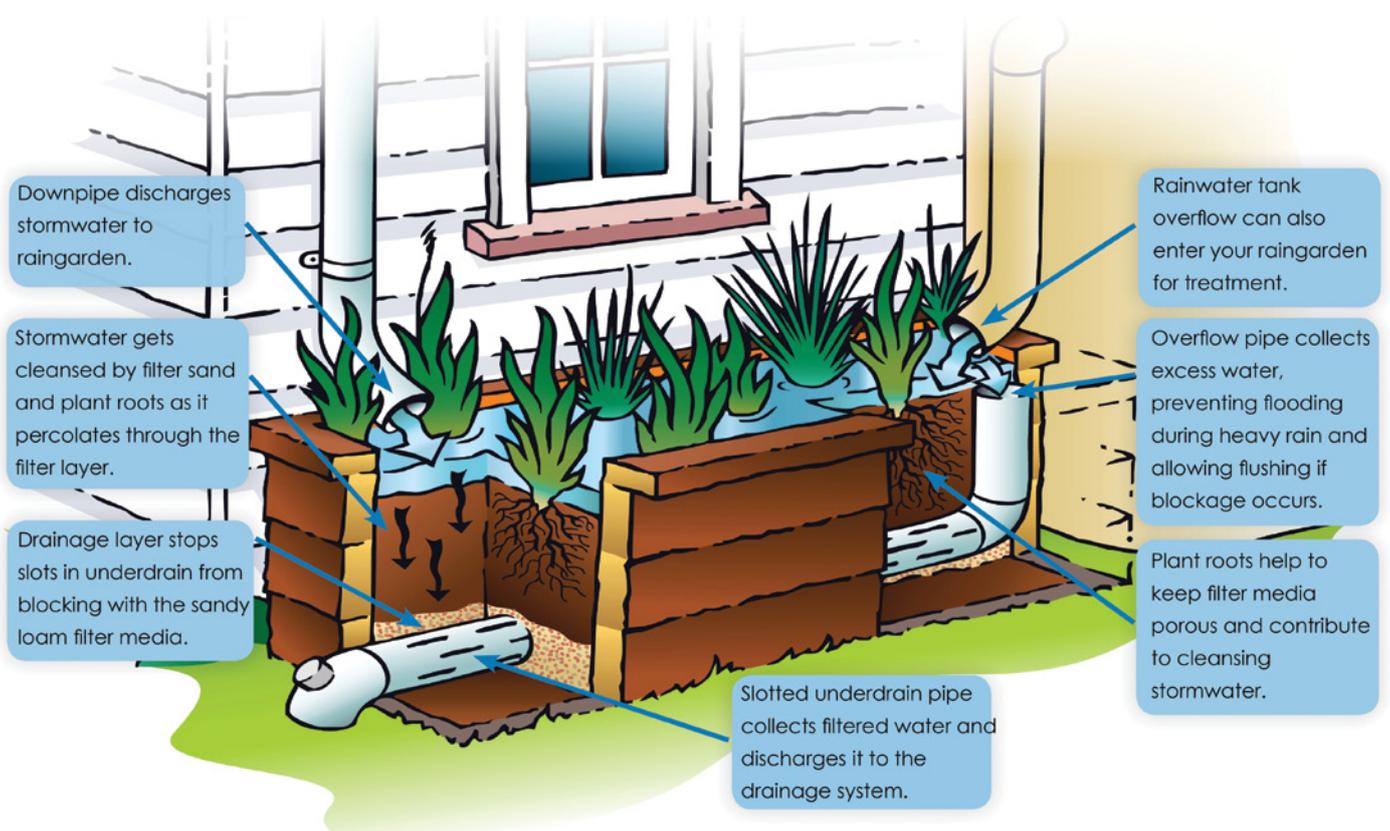
- All connections or modifications to existing stormwater pipes need to be done by a licensed plumber.
- Don't build over a septic system and be aware of any underground services before excavating your raingarden.
- Gather the required materials you need to build your raingarden.

### Build your raingarden

- Either construct a planter box or excavate a trench for your raingarden and line with a PVC liner.
- Connect your drainage pipes and contact your licensed plumber to connect your drainage pipe to the stormwater outlet.
- Add layers of sand or fine gravel followed by sandy loam and compact.
- Add your plants and mulch followed by a good watering.

### Finishing and Maintenance

- Use rocks or stones to limit erosion from downpipes.
- Water daily for the first few weeks.
- Weed as necessary.
- Avoid using herbicides, pesticides or fungicides.
- Prevent the soils from being compacted.



## **BASIC PLANTING GUIDE**

### **Before you plant**

- Check your soil type – does it match the description, type of garden and plants in your zone? Does the soil need any 'conditioning' (mulch, fertiliser, organic matter) before planting?
- Choose plants that best fit your microclimate (e.g. full sun/shade etc.)
- Prepare the site – do preliminary weeding, dig all the holes and have plants, mulch and water on hand.

### **Planting**

- Check with the nursery where you purchase the plants about specific planting tips for your selected species. Reputable online gardening websites can also be a great source of information.
- Dig each hole slightly deeper and at least twice as wide as the pot size. Make sure that the surface of the root ball is well covered and level with the surrounding soil
- Planting can occur from spring to fall, but for best results plant during the spring.
- Water generously when planting and then once a week for the first few months (depending upon season).
- Mulch around the plant 10cm thick and a 50cm radius to retain moisture and discourage weeds. Make sure you avoid placing mulch directly against the stem of the plant as this can cause collar rot.

### **Finishing and Maintenance**

- To minimise weeds, consider groundcover species to spread out between grasses, trees and shrubs.
- Big Scrub rainforest gardens don't need any fertiliser and shouldn't need watering once established!



## FURTHER INFORMATION & RESOURCES

### GETTING HELP

Help can be obtained from your local council, landscape designers, experienced bush regenerators, websites and nurseries. There are also a lot of great books and gardening magazines out there to help design your garden – why not put a scrapbook together of all the elements you wish to include? Most importantly, spend time in your garden, get to know the microclimates and plan your garden around its' strengths and limitations.

### LOCAL NURSERIES

#### Burringbar Rainforest Nursery

[www.burringbarrainforestnursery.net](http://www.burringbarrainforestnursery.net)

Ph: (02) 6677 1088

Upper Burringbar, NSW, 2483

#### Eastern Forest Nursery (wholesale)

[www.easternforestnursery.com.au](http://www.easternforestnursery.com.au)

Ph: (02) 6629 0353

848 Bruxner Highway, Lismore, NSW, 2480

#### Ragged Blossom Native Nursery (Bangalow)

[www.raggedblossom.com.au](http://www.raggedblossom.com.au)

Ph: (02) 6687 1309

Bangalow, NSW, 2479

#### Firewheel Rainforest Nursery

[www.firewheelnursery.com.au](http://www.firewheelnursery.com.au)

Ph: (02) 6689 5246

387 Dorrroughby Road, Dorrroughby, NSW, 2480

#### Mullumbimby Creek Native Nursery

[www.mcnativenursery.com.au](http://www.mcnativenursery.com.au)

Ph: (02) 6684 1703

Lot 2 Yankee Creek Road, via Wilsons Creek Road, Mullumbimby, NSW, 2482

### USEFUL WEBSITES

#### Big Scrub Landcare

Contains useful information about the Big Scrub rainforest including online articles and an online shop.

[www.bigscrubrainforest.org.au](http://www.bigscrubrainforest.org.au)

#### Friends of Lismore Rainforest Botanical Gardens

Contains useful information about rainforest species endemic to an area within 200km of Lismore including a Plant Use Chart for download.

[www.friendslrbg.com.au](http://www.friendslrbg.com.au)

#### Water by Design

Water by Design offer a range of guidelines and factsheets to assist with all stages of the delivery of WSUD.

[www.waterbydesign.com.au](http://www.waterbydesign.com.au)

#### Rous Water

Contains information about catchment health and our region's drinking water.

[www.rouswater.nsw.gov.au](http://www.rouswater.nsw.gov.au)

#### Lismore City Council

Contains a list of native plants that can be used to meet the BASIX requirements and useful information about WSUD.

[www.lismore.nsw.gov.au](http://www.lismore.nsw.gov.au)