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Guidelines for management of farmland adjacent to the Busselton wetlands

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Oldfield, W, Department of Conservation and Land Management, and Department of Planning and Infrastructure. (2002), *Guidelines for management of farmland adjacent to the Busselton wetlands*. Department of Primary Industries and Regional Development, Western Australia, Perth. Bulletin 4503.

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Department of
Agriculture



GUIDELINES FOR MANAGEMENT OF FARMLAND ADJACENT TO THE BUSSELTON WETLANDS



In conjunction with:



Department of **Conservation and Land Management**
Department of **Planning and Infrastructure**



**THIS DOCUMENT HAS BEEN DEVELOPED TO COMPLEMENT THE
BUSSELTON WETLANDS CONSERVATION STRATEGY**

Cover photos



1. Wonnerup Estuary from the northern end looking south west. Wonnerup estuary is one in a chain of wetlands parallel with the coast around Busselton.
2. A crop of carrots being grown at Ludlow. The Ludlow sands are comparable with Spearwood sands on which much of Perth's market Gardens are based. Suitable soils and available ground water from the Leederville aquifer provides the opportunity for market gardening. Horticulture is a significant and important land use around the wetlands.
3. Grazing. Grazing of cattle for beef and dairy production is by far the greatest land use adjacent to the wetlands and within the catchment. Stocking rates have generally increased over time in response to increased costs of production and returns for product. Management of stock around the wetlands and within the catchment to reduce nutrient run-off is an important role of land managers in caring for the wetlands.
4. Swans. The most notable and most abundant of migratory birds is the Black Swan. Native of Western Australia, these birds fly in to the estuary during winter, make their nests and raise their young during spring and generally disperse again by mid summer when the water levels are dropping and the wetlands drying out.

The Busselton Wetlands are a chain of wetlands that lie parallel with the coastline of Geographe Bay tucked in behind the fore dunes of the coast on which most of Busselton township is situated. The Busselton Wetlands are the natural compensating basin of the catchment behind extending to the Whicher Range. They receive winter run-off water from rural and urban areas and all that is carried with it. They provide very significant wildlife habitat for migrating birds and many other native fauna and they have significant historical and cultural value.

Being in such close proximity to the expanding town of Busselton, the wetlands are under increasing pressures of urbanisation and changes to more intensive land uses. Changes in land use include urban housing development, rural residential development and in some instances more intensified agricultural activity.

The main issues for the maintenance of quality of the wetlands are nutrient levels and habitat value. If nutrient levels can be reduced and habitat value for native fauna improved, many of the other values of the wetlands will also be addressed. Farmers and land managers have an important role to play in addressing these issues and hence the reason for producing this guide which outlines many of the current best practices related to farming around wetlands.



Bulletin No. 4503
ISSN 1326-415X
May 2002

Department of
Agriculture



GUIDELINES FOR MANAGEMENT OF FARMLAND ADJACENT TO THE BUSSELTON WETLANDS

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Department of **Planning and Infrastructure**



GeoCatch

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BUSSELTON WETLANDS CONSERVATION STRATEGY**

DISCLAIMER

The Chief Executive Officer of the Department of Agriculture and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from use or release of this information or any part of it.

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ACKNOWLEDGMENTS

The preparation of this document involved consultation with inputs and comment from many people. Special thanks to members of the landowner reference group, Bill Scott, Mary McGreggor and Keith Forrest, members of the Busselton Wetlands Conservation Technical Working Group, Chris Bishop (DEWCP), Richard Pickett (DEWCP), Phil Williams and Brad Rayner Department of Agriculture, Bernie Masters and the Busselton Wetlands Conservation Strategy Steering Committee.

BACKGROUND

In the process of developing the Busselton Wetlands Conservation Strategy, the Technical Working Group saw the need for a more landowner oriented publication which illustrated the current best management practices. Many of the concepts in this document have been discussed with landowners adjacent to the wetlands and they and the Technical Working Group have reviewed draft versions of this document.

The Busselton Wetlands Conservation Strategy is being prepared in consultation with landowners in the Wetlands and the wider community with the intent of gaining broad support for the strategy. The strategy will highlight the significance of the Ramsar wetlands as a site of International importance. It will also recognise the past and present contribution by adjoining rural landowners in maintaining the conservation values of the wetland system and the need for future cooperative involvement by those landowners.

Preliminary discussions between the Steering Group of the Busselton Wetland Conservation Strategy and landowners adjacent to the Busselton Wetlands, identified that they are concerned about the health of the wetlands and are open to discussing, adopting and adapting agricultural best management practices on their land.

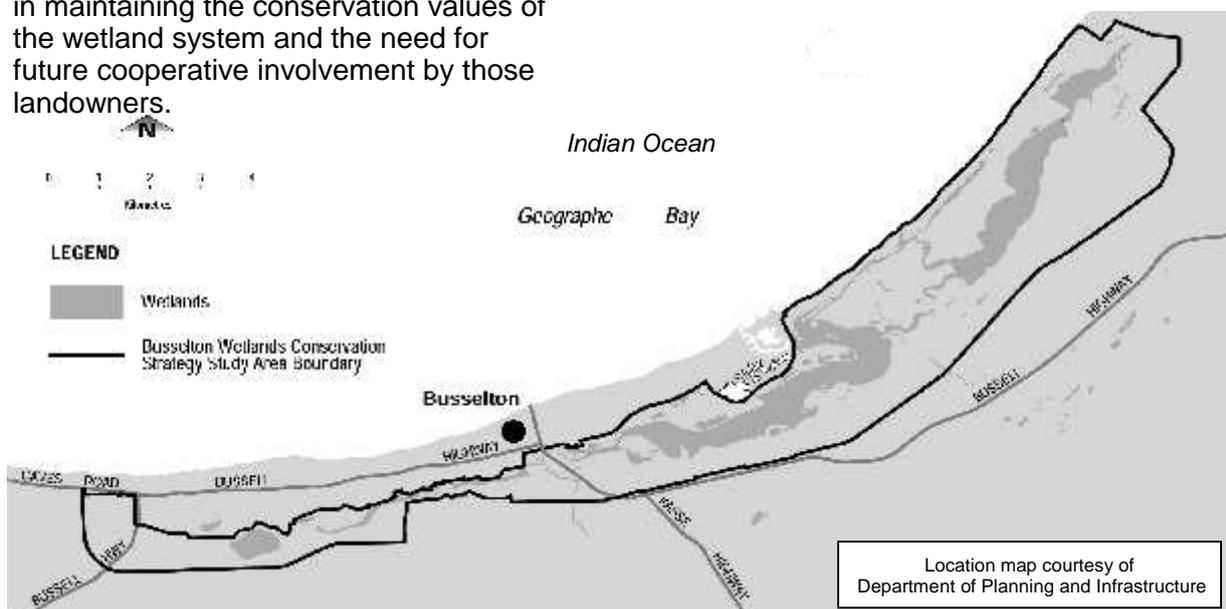
INTRODUCTION

This document aims to summarise and provide guidelines to currently understood best management practices on these lands in relation to agricultural land use and land management.

The approach used in this document is to use farming operations as headings under which there is discussion on the currently accepted best practices and descriptions of benefits for landowners and the wetlands. For further information and advice, references have been made to various contacts and other publications. This document will also assist many people without farming experience because the support of local residents, conservation groups, councilors and others is a necessary part of managing the wetlands/farming system.

Study area

Busselton Wetlands Conservation Strategy study area covers the coastal plain wetlands from Wonnerup and Vasse Estuaries westward to the Buayanyup Drain.



FENCING OPTIONS FOR WETLANDS

Management units

Placement of fences is very important for the management of land and stock on farms. Inappropriate placement can lead to mismanagement of land, loss of productivity and land degradation. For example, stock access to permanently wet areas can lead to reduced water quality.

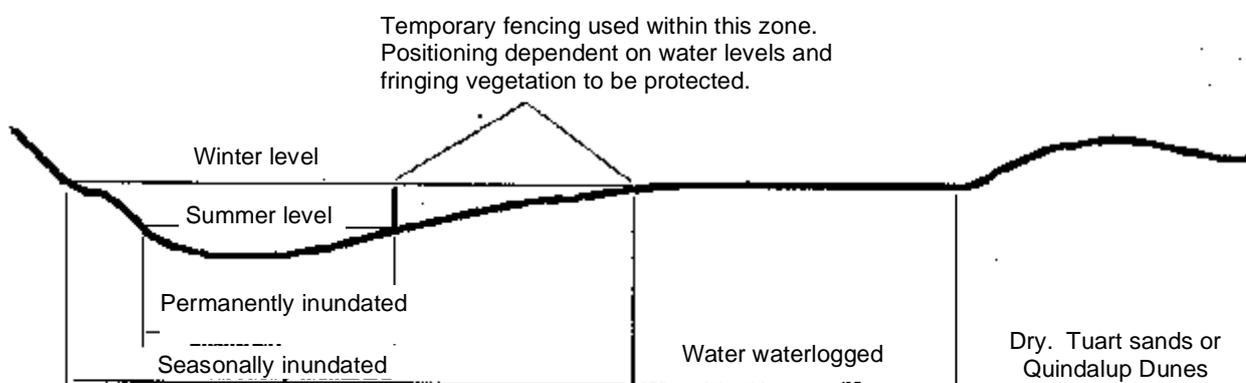
Appendix 1 summarises the main soil units found around the Busselton Wetlands system. Each soil has different characteristics and capabilities and as a result require different management. Since it is desirable for one management technique to be applied to a paddock, it is easier if the land is fenced to similar land management units.

Adjacent to wetlands there will be land that is:

1. **Permanently inundated.** These areas are generally unsuited to stock grazing and stock in these areas can have a big impact on water quality and wetland health. The type of plants that grow in this area are generally of little value as stock fodder. Stock access to inundated areas disturbs the soil, destroys the vegetation and allows animal wastes to go directly to the wetland system.

Where property boundaries are sometimes in the middle of permanently wet areas, fencing on the boundary is impractical. In some cases, the waterline is used as a paddock boundary. This works for some stock, whilst others will wade through and wander onto other properties, getting into inaccessible areas or getting completely bogged in the black ooze.

2. **Seasonally inundated and waterlogged.** These areas are highly productive during the dry season and are suited to stock grazing when the conditions are dry. If stock are put in the paddock when the land is too wet, it will quickly become pugged and very rough for working. For these reasons, stock are removed from these areas during these times. A fence placed at the interface between the permanently wet area and this area will enable the landowner to manage grazing in this area during summer to achieve a high level of production with minimal impacts to the wetland.
3. **Dryland.** These areas are well drained and generally are not waterlogged or inundated at any time of the year. Their most productive time of year is during the wet season when the other areas described above are under water or not suitable for grazing.



A simplified cross-section of the wetlands to illustrate the areas described above.

Fence construction options

There are a number of options available for the enclosure of stock. Fences in wet areas, particularly estuarine, will deteriorate very quickly. Therefore the landowner is well advised not to spend a lot of money putting in an expensive fence. Fence constructions are generally best kept to the simplest form. Some options include:

1. the use of temporary electric fencing, using tape and insulated poles that can be put in by hand; or
2. putting in big strainer assemblies and pine posts, which withstand the annual inundation, and running four or five barbed wires between them and replacing these as they corrode; or
3. as for option two but only running two or three plain wires, one or two of them electrified, on wide spaced pine posts. Each year, as the water line moves up and the stock are removed, the lines are coiled up and stored until next summer.

- Ability to opportunistically graze summer moist areas with no impact on wet areas.
- Reduced impacts on the wetlands (nutrients, vegetation damage, pugging).



Seasonally inundated paddock in winter.



Dryland pasture.

Caution

Barbed and electric wire can harm wildlife. Where stocking rates are not heavy, four to five plain wires are generally adequate. If the stock are putting pressure on the fence then electrifying the middle wire of the fence will deter stock and will be least hazardous to wildlife. The top and bottom wires are where birds and small animals most often come in contact with a fence.

Benefits from simpler fencing options

- Maximum productivity and ease of management of each land unit.
- Ease of stock management. Stock not straying or becoming lost or bogged in the wetland.
- Avoiding the possibility of stock ingesting salt water or toxic algae.



Fencing on boundary of dryland and wetland.

STOCK AND PASTURE MANAGEMENT

Timing of grazing on the seasonally inundated areas

Timing of grazing is a very important tool both for the productivity of pastures and the reduction of impacts to the wetlands.

During the wet season stock should be kept off seasonally inundated areas because:

- productivity is low (the gain from grazing them is low);
- stock trampling will pug the soil, destroy pasture plants and make working the paddock more difficult; and
- animal wastes will go directly into the wetlands.

During the dry season, the soils in these areas are moist. This is when perennial grasses (Kikuyu and couch are most common) can utilise the soil moisture to best effect and when they are most productive.

Control grazing

As with most pastures, controlled grazing will lead to higher levels of pasture production on both dry and seasonally inundated areas. Further advice on how this can be achieved can be obtained from the Department of Agriculture Dairy Program at the Bunbury office on 9780 6100.

Further information

'Profit from Pastures - Improving the Management of Pastures in the South West of Western Australia.'

A publication on control grazing of pastures by the Department of Agriculture Dairy Program.

Weed control

Herbicides are a common management tool used to control weeds and reduce competition for more productive pasture species. They are mostly used during the establishment phase of pasture renovations and to control problem weeds such as dock. There are hundreds of

chemicals available on the market and specialist advice should be sought to find the correct one. Also the landowner should check that the chemical will not have harmful off site effects that may affect wildlife on the adjoining wetlands. All chemicals must be used in accordance with label recommendations.

Burning

Sometimes pastures will need to be burnt because the grass has become rank and is unpalatable to stock. Burning is a standard practice to remove this dry material and/or prepare a paddock for a hay crop. The pasture is either slashed or just left until it is dry enough to burn. Removal of this material promotes vigorous fresh growth that is of greater feed value. This operation is generally done in autumn, prior to the break of the season, when the fire risk is low.

Checklist for burning

- ✓ Obtain approval to burn from the Local Fire Control Officer and notify the shire, (during fire permit season).
- ✓ Notify your neighbours of burning activities on your property.
- ✓ If your land adjoins Department of Conservation and Land Management land, notify them also. Private property adjoining this land can be very important as habitat for native animals. As part of the management of the Busselton Wetland Reserves, Department of Conservation and Land management officers are willing to provide advice on burning of paddock areas so that the result will be beneficial for both the landowner and the wildlife.

Precautions

- Ensure trees and other wetland vegetation, not intended for burning, are protected from fire damage.
- Clearly segregate areas to be burned.
- Attend and manage the burn.
- Conduct the burn in small enough sections to ensure escape opportunities for wildlife.

Benefits of good stock and pasture management

- High levels of production from pastures in the growing season.
- Reduced spread of weeds in productive pastures.
- Minimised degradation to soils and pasture plants through stock trampling.
- No direct inputs of animal waste because stock are excluded from inundated areas.
- Reduced disturbance to nesting swans during winter.
- Inundated areas available for waterfowl during winter.



FERTILITY OF PASTURES

The following information is summarised from Bulletin 4357, 'Fertilisers for pastures on the Swan Coastal Plain' by Ken Angell which is available from the Department of Agriculture. This publication outlines currently recommended nutrient inputs for pastures on the Swan Coastal Plain.

Apply only the nutrients needed

Landholders are encouraged to soil test every two years and use the combination of fertilisers that will most closely provide the nutrients required. Instructions on how to soil tests are provided in the soil test kits which are commercially available from farm suppliers.



A typical commercially available soil test kit.

Apply the nutrients at a more strategic time (dependent on accessibility of the paddock)

Avoid major leaching of nutrients by applying them at times of enhanced plant uptake. A split application of fertiliser will achieve optimum growth of pastures, e.g. P, K and S three or four weeks after germination followed by a later application of mainly K and S in August. K and S are mainly required for spring growth.

Three to four weeks after germination, plant roots are more developed therefore increasing uptake and reducing leaching of nutrients. Fertilising at this time of year is difficult because of the possibility of subsequent storm events which may flood the paddock and wash away the nutrients just applied. Landholders need to carefully consider the weather patterns to reduce the risk of losing these nutrients. (Do not to dress soggy waterlogged paddocks. High solubility of N and P means most of the nutrient would be washed away.)

Use a slow release fertiliser source

Less water soluble fertilisers that dissolve slowly or break down gradually can better meet plant demand and so reduce losses through leaching. This is particularly useful if only one application can be made during the growing season. Some slow release fertilisers are becoming available but their eventual use by farmers will depend on:

- rate at which they dissolve;
- ability to be combined with other soil amendments; and
- cost.

Experience with commercially available products is limited at this stage.

Benefits arising from diligent use of fertilisers

- Reduced costs of production by reducing nutrient losses from the paddock.
- Reduced nutrient inputs to the wetlands and the subsequent effects of eutrophication.



FERTILITY AND NUTRIENT MANAGEMENT ON HORTICULTURAL AREAS

Phosphorous is generally the limiting nutrient in fresh water bodies whereas nitrogen may be the primary limiting nutrient in coastal water bodies. Both these elements are used to promote horticultural crop growth.

Horticulture has often been accused of being a major contributor to eutrophication of surface water bodies because of its higher fertiliser use. Fertiliser use is an essential and costly component of production in horticulture. Efficient use of fertilisers reduces costs of production and leads to greater profitability; therefore there is a relatively strong financial motivation for reducing nutrient losses in the industry.

Codes of Practice for vegetable production on the Swan Coastal Plain have been prepared by the Department of Agriculture and by the Vegetable Growers, Market Gardeners and Potato Growers Associations. They provide current information on the management of land and water resources in order to:

- promote the adoption and continuing development of sustainable horticultural practices;
- define acceptable management practices to minimize future land use conflict;
- promote self regulation and avoid the need for imposed regulation by government;
- provide accurate information on horticultural management practices; and
- provide people new to horticulture with guidelines on establishing and managing their properties.

Further information

'Codes of Practice for vegetable production on the Swan Coastal Plain'. Miscellaneous Publication 37/99, July 1999.

Available from Department of Agriculture.

The following is a brief summary of factors affecting movement of two nutrients, nitrogen and phosphorous, through soils and which are considered to have the greatest impact on water bodies.

Phosphorus

Site selection for placement of horticultural production is the most important factor in the control of phosphorus. Soils with iron and aluminium oxides have an ability to retain residual phosphorous (that not used by the crop) whereas deep white bleached sands do not.

Some of the soils found around the Busselton Wetlands, such as the Abba fertile flats and Ludlow soils, have the ability to retain phosphorus. Provided these soils are freely draining and there is an adequate buffer distance (20 m) between the horticultural activity and the wetter soils (Quindalup wet flats), the risk of phosphorous pollution of the wetlands via the groundwater will be minimal. Run-off and associated loss of P attached to soil particles rarely occurs on well drained sandy soils because rapid infiltration rates prevent water run-off. From a production point of view, horticulture is not suited to other soil types around the Busselton wetlands because of waterlogging.

Nitrogen

Nitrogen is poorly held by all sandy soils of the Swan Coastal Plain. Heavy rainfall and over watering readily leach nitrogen from the root zone of crops. In market gardens on sandy soils in other parts of the Swan Coastal Plain it has been shown that nitrate levels under production areas are high. However, levels decrease rapidly with increasing distance from the production areas. Through the process of denitrification, nitrogen is lost to the atmosphere. Soils high in organic carbon and with low redox potential's create the suitable conditions for this process. Around the Busselton wetlands, the Ludlow topsoils are high in organic matter and the Quindalup flats contain dark organic siliceous sands, both providing the potential for denitrification to occur.

Best management practices for application of nitrogen

- Use small frequent applications (i.e. seven to ten days), rather than large infrequent applications, to improve plant utilisation of applied nitrogen.
- Avoid over watering. Water in excess of what the soil can hold will move below the root zone taking nitrogen with it. Over watering and poor irrigation design are major causes of nitrogen leaching.
- Use plant analysis to test the nitrogen status of crops and determine rate of subsequent applications.
- Fertigation can be used to apply nitrogen more frequently. However, it must be designed well so that the nutrient is distributed evenly.
- During establishment of the crop, use droppers rather than sprinklers, to deliver the nutrient to where the plant roots are.
- Match nitrogen rates with crop growth stage and with crop requirements.
- Do not apply high rates of poultry manure because much of the nitrogen is leached within four weeks of application.

Benefits of best practices in horticulture

- Higher profitability because of optimum production from minimum nutrient (cost) input.
- Better utilisation and reduced loss of nutrients through correct site selection.



SHADE AND SHELTER

Shade and shelter in the form of permanent trees and shrubs can enhance the farm environment for production benefits and provide habitat for native fauna.

Shade and shelter can be planted in blocks, rows or individually. The most common format for planting shade and shelter is in rows along paddock boundaries. Provided the fences are in the right position, this type of planting is very effective.

Establishment

Appendix 2 provides an overview for seedling establishment. Site specific advice can be sought through the Department of Conservation and Land Management office in Busselton on 9752 1677.

Caution

The use of mounds for seedling establishment has the potential to redirect flows of run-off water and cause inundation. Frequent breaks should be made in the mounds so that natural surface flows are not diverted or withheld. Mounds should be orientated so that they do not cause water erosion.

Shelter for stock

Windbreaks will significantly reduce the chill factor of cold winter winds. To be most effective, windbreaks should be planted perpendicular to the prevailing wind and have about 50 per cent porosity. On the lee side of an effective windbreak, stock use less energy to maintain body heat which means they convert more of their food into body weight.

Windbreaks for horticulture

The horticultural soils of the Swan Coastal Plain are generally sandy and subject to wind erosion because horticultural operations involve a high degree of soil cultivation. One method of reducing the wind erosion risk is to plant windbreaks.

Cover crops

In large commercial operations, cover crops play an important role in protecting soil from wind erosion. After the harvest of crops when the soil has been disturbed and exposed, cover crops are put in. They can also be irrigated for a short period to get them established. When it is time to put in the next crop, the cover crop is ploughed to build-up soil quality.

Species selection

Landowners are encouraged to select local native species for revegetation around the wetlands. In some cases, they may not grow as vigorously as introduced species, but they have other benefits which may not be immediately obvious. Local native species provide habitat for local native fauna. This is the main reason for promoting their use. In most situations, a local native plant can be found that will achieve the land owners objectives for shade and shelter.

A useful list of flora in the Busselton Wetlands was produced by A. and S.R. Tingay in May of 1980. They have identified most of the vegetation within the Busselton Wetlands Conservation Strategy area. This work was reviewed in 2000 by Ray Froend and Associates. Information from both studies is available through the Department of Conservation and Land Management office in Busselton.

Appendix 3 contains a list of typical native plant species of estuarine wetlands in south-west Western Australia.

Tried and proven

In certain situations an introduced plant may be preferred because of its ability to establish in difficult conditions or its resistance to pests and diseases.

Appendix 4 contains a list of plant species suitable for growing at Wonnerup by the Department of Conservation and Land Management Busselton. They can provide advice on the right plants to use and can direct landowners to successful tree plantings on other nearby properties. Contact 9752 1677.

Alternatively landowners may go and view the Vasse Wonnerup LCDC arboretum which is located opposite the Yoongarillup Hall on Vasse Highway. The arboretum enables landholders to view the form, size and characteristics of thirty different species of trees and shrubs for use on farms.

Vasse Wonnerup LCDC Arboretum

Further information

'A Haven from Storm and Drought the role of trees in sustainable agriculture.' A compendium of case studies of the benefits of windbreaks and contains some information on species and design. Available from Greening Western Australia.

'Windbreaks for horticulture on the Swan Coastal Plain' Farmnote 43/99 outlines design, management and species selection for windbreaks in horticultural situations.

'Stubble needs for reducing wind erosion' Farmnote 87/94. Provides a set of photo standards which help the farmer identify what constitutes adequate soil cover.

'Wind erosion: Monitoring the paddock status' Farmnote 45/93. Details the steps in the prediction process.

Farmnotes can be accessed at the Department of Agriculture offices or on the Department of Agriculture's website: www.agric.wa.gov.au

'Creekline revegetation for wildlife' Wildlife notes No. 1 January 1997, Department of Conservation and Land Management.

Available from the Department of Conservation and Land Management Wildlife Branch at Busselton on 9752 1677.

'A guide to wetland emergent plants of South Western Australia.'

J. Chambers, N.L. Fletcher and J. McComb, Murdoch University, 1995. ISBN 0-86905-401-5.

'Geographe Bay Catchment natural resource atlas'.

Published by the Department of Agriculture. Available from the GeoCatch Network Centre.



Landscape

The local Department of Conservation and Land Management officers are willing to provide advice and assistance on landscaping and ensuring that landowners do not lose the visual amenity of the wetlands. With careful planning, views of the landscape and shelter benefits can be achieved.

Considerations for revegetation

- What is the purpose of the planting? Shade and shelter, creating a sense of place (recreating the natural landscape), providing habitat for native fauna. Seek relevant advice for the type of planting.
- Species selection (appropriate for the intended use and proposed site).
- Preparation for planting.
- Orientation of the mounds so that they do not cause water erosion.
- Order seedlings well in advance.

Benefits of shade and shelter

Production

- Shade on hot summer days reduces heat stress on stock.
- Shelter on cold winter days reduces stock energy losses from high wind chill factor.

Land value

- Permanent native vegetation is an asset to a property. It provides a feature on the landscape and as a result can increase the land value.

Conservation

- The use of local native species in revegetation provides habitat for native fauna and increases biodiversity.



STREAM PROTECTION AND REVEGETATION

A vegetation belt between the permanently and seasonally inundated areas can buffer the wetland from direct input of paddock debris. Floating material is caught by the plants. It deposits in the row, breaks down and the nutrients are taken up by the plants.

Streamlining

'Streamlining' generally describes the activity of managing a waterway in a way that promotes the establishment of permanent native vegetation along the banks and stabilisation of the waterway.

Where a waterway runs through a paddock, stock access is managed by fencing it off. Streamlining may also involve revegetation to stabilise the banks. This can significantly improve water quality.

Assistance with the purchase of materials for Streamlining works may be available through various funding bodies. Landowners should enquire about funds for Streamlining at the GeoCatch office or with their local Landcare Group.

Benefits of streamlining

- Improved farm production through shade and shelter benefits.
- Easier management of stock in and around waterways.
- Improved water quality through reducing the amount of nutrients getting into waterways, estuaries and Geopraphe Bay.
- Improved water quality through prevention of erosion, sedimentation and meandering waterways.
- Provision of corridors and bush habitat for movement of native animals.



WATER MANAGEMENT

Drainage

The key element linking water logging, salinity and nutrient loss is water. The key to solving them is to understand and manage water movement.

In a paddock situation, it is possible to use pasture species that are waterlogging and salt tolerant but some form of water management is generally also required.

Drainage used to good effect on-farm can reduce waterlogging, reduce the incidence of salt affected areas and as a consequence enhance pasture production. However, many farmers now believe that the drainage is now too effective on the Swan Coastal Plain and removes too much winter rainfall too quickly.

Whilst large quantities of salt have existed in the landscape over geological history it is generally agreed that the symptoms of salinity have become more pronounced since clearing. Recent discussion on

salinity on the Swan Coastal Plain suggests that it is not just the removal of native vegetation that has caused this but the drainage of winter rainfall. The natural systems were sluggish. Faster removal of the winter rainfall through drainage reduces the dilution and suppression effects that used to occur in the natural system. The removal of permanent vegetation exposes the soil surface to sunlight and increases the concentration effects of evaporation.

A summary of the degradation effects that can occur as a result of drainage are outlined in the following cause and effect table. The potential for these effects to occur should be determined before deciding whether or not to drain.

If a proposed drainage project is not going to lead to any of the above effects or if the effects it will cause can be managed by some other means, then the following technical and financial aspects of the proposal should be considered.

Table: Impact that may occur from drainage

Cause	Effect
Agricultural drains are typically bare earth channels. They are designed to carry water faster than the natural drainage. Faster moving water is more erosive and carries more sediment. Drains made too deep, steep and/or narrow for the volume of water they are expected to carry will be subject to water erosion.	Water erosion of the drainage channel.
Improving the upper part of the drainage system and not the lower part will cause a greater build up of water in the lower end. The Busselton Wetlands are at the lower end of the catchment. Flood gates exist to prevent the ingress of sea water during high tides and storm events and enhance the capacity of the wetlands to accommodate run-off from the catchment.	Flooding around discharge areas.
Reduced suppression of winter watertables by freshwater; Reduced dilution and removal of salts stored in surface soils; and Concentration of salts stored in surface soils by evaporation due to increased exposure of the ground (removal of permanent vegetation).	Salinity which leads to loss of productivity in crops and pastures.
Nutrients travelling in water in a bare earth channel as compared a natural watercourse. Because drains are typically bare earth channels designed to carry water faster, nutrients in the water are less likely to be assimilated by the waterway environment because they have less time to reach the bottom end of the system and little plant material to take them up.	Transport of nutrients to wetlands causing algal blooms.
The most productive time of year for annual pastures is spring. Fast removal of winter rainfall means there is less water around at spring when it is most needed. Crops and pastures in well-drained areas can hay off one week to one month earlier than areas where water is held back.	Early drying out of the soil profile leading to reduced production.

CONSIDERATIONS FOR DRAINAGE

- How often does waterlogging occur to the subject area? Does the benefit derived from draining justify the cost of the works?
- Will the drainage works encourage salinity or limit water availability for pastures in springtime?
- What capacity of drain is required? A shallow wide profile is preferable to a narrow deep one so as to reduce potential for erosion. Well timed construction works and seeding of disturbed areas can minimise erosion from newly constructed drains.
- Is the slope of the land too steep to carry the water without eroding the channel?
- Should a structure be put in place to reduce direct input of nutrients and debris into the drainage system and manage the flow of water in the drain? For example, retention basins/settling ponds, streamlining, check and drop structures.

Drainage design

In grazing areas, most water erosion occurs within drainage channels. This problem can be addressed through good design of waterways. Computer programs are available to estimate flows and design structures with the correct dimensions to carry the flow without erosion. Also, a gentle batter on either side of the drain will enable plants to re-establish and cover up the bare earth.

Contacts for advice

Contacts for professional advice on drainage design can be sought through the Department of Agriculture, Bunbury.

On the Swan Coastal Plain, horticulture is generally carried out on freely draining sands which have high infiltration rates. It is unusual for run-off and subsequent erosion to occur on these soils. However, some practical actions which farmers can apply to minimise the risk of erosion, should a particular paddock have the potential to cause run-off, are outlined in the following publication.

Further information

'Preventing erosion and soil structure decline' Miscellaneous publication 23/97 Department of Agriculture. This is a compilation of practical techniques to reduce soil erosion on horticultural soils.



Drainage in paddock.

Notification of intent to drain

The Busselton Wetlands are within a Gazetted Drainage District and therefore landowners are allowed to drain wet areas of their property where and when appropriate. However, persons intending to do drainage work must always notify downstream neighbours, including the Department of Conservation and Land Management and the Busselton Shire. Landowners wanting to drain into a Water Corporation facility (i.e. the drainage network) need to seek appropriate approvals from the Water Corporation and should contact the Irrigation and Drainage Division in Busselton on 9753 1308.

The Department for Environment, Water and Catchment Protection (DEWCP) has responsibility for safeguarding the quality of the State's water resources. Under the new Water Law, the DEWCP requires all landholders intending to construct a drain to notify them regarding the drainage proposal. This allows the Commission to assess the potential of the proposed drain to flood or pollute other water bodies, erode or fill up with sediment or degrade natural habitat of aquatic fauna. It also allows them to provide advice and support on drain construction and management.

Since the Department of Environmental Protection amalgamated with The Water and Rivers Commission, DEWCP is also responsible for administering the Lakes Environment Protection Policy (EPP). The Vasse and Wonnerup estuaries are registered under the Lakes EPP.

Unless other prior approval has been given, the following are prohibited activities:

- filling in to lakes;
- carrying out of excavation or mining operations in lakes;
- Discharge or disposal effluent into lakes; or
- drainage of water into or out of lakes.

This policy relates to new proposals only and came into effect in 1991. Proponents of any of the above activities should advise and seek approval from Department of Environment, Water and Catchment Protection. For further information on the Lakes EPP, contact the DEWCP Regional Office in Bunbury on 9721 0666.

Checklist for drainage

- ✓ Have you determined the effects of your drainage proposal?
- ✓ Have you considered:
 - cost/benefits;
 - details of slope of the ground, capacity and design of the drain required;
 - seeking technical advice on design;
 - how you will reduce nutrient movement into waterways;
 - how you could manage the water within the drain to your benefit early and late in the growing season;
- ✓ Have you notified downstream neighbours?
- ✓ Have you notified the Department of Environment, Water and Catchment Protection?
- ✓ If a Water Corporation drain is involved in your proposal, have you notified the Water Corporation?
- ✓ Is the wetland or lake into which you wish to drain water, covered by the Lakes EPP? If so, have you notified the Department of Environment, Water and Catchment Protection?

Benefits from good water management

Good water management arises from professional drainage design and communication with downstream neighbours in the design phase.

Benefits include:

- a design that will benefit all those affected;
- reduced impacts of erosion, sedimentation, salinity and nutrient loss;
- reduced costs to maintain a well designed drain;
- reduced nutrient loss from the farm; and
- improved utilisation of water on farm.



CHEMICAL USE

Weed and pest control using chemicals is a specialised subject. Farm suppliers can advise on the right chemicals for the job. Chemicals must be used in accordance with label recommendations.

Safety aspects

Prior to purchase of some of the more dangerous farm chemicals, all users are required to have completed Farm Chemical Users Safety Course. These courses are available through Farmcare who can be contacted on 9341 5325.

Emergencies

All chemical users should have the poisons information 24 hour help line number, 13 11 26, in a prominent place.

If for some reason there is a spill or an accident, advice for remedial action can be given immediately through this service.

Protection of non-target organisms

The labelling of farm chemicals is very detailed and includes information for the protection of wildlife and livestock.

A part of the label relates to the protection of non-target organisms. It lists specific hazards to fish, bees and aquatic

environments as well as spray drift. Users of chemicals around wetlands should take particular notice of this section. If the risks of using a particular chemical are high, an alternative method or chemical should be sought.

Checklist for spraying

- ✓ Considered all options for weed and pest control. Use the least hazardous method that has the most effective results.
- ✓ Sought instruction on safe chemical use.
- ✓ Know emergency procedures.
- ✓ Conditions are suitable for spraying, i.e. reduced spray drift, sufficient time elapsed to become rain fast, withholding periods for stock, etc.

Benefits from correct chemical use

- Reduced cost to landowners through effective weed and pest control.
- Low risk to wildlife and native vegetation.



DECLARED WEEDS AND VERMIN

All rural and rural residential landowners have a responsibility to control declared weeds and vermin on their property.

Identification problems

In situations where weeds and pests cannot be easily identified through your rural suppliers, approach the Department of Agriculture office in Busselton on 9752 1688. Staff at the office may identify the specimen or arrange for it to be identified at Head Office in Perth.

Declared weeds

Department of Agriculture is primarily concerned with declared weeds because of the impact they have on agriculture. Weeds can also have a major environmental impact by invading the surrounding parks and bushland.

For example, Arum Lily which is most common in this area is a declared weed

that is having a major impact in Local National Parks. If left uncontrolled, each flower easily produces more than 200 seeds and an average sized plant several thousand seeds per year.

A list of weeds considered a major threat to farming and or the environment in the Busselton Wetlands area can be found in **Appendix 5**. This list is adapted from the Geographe Bay Catchment Weed Plan. A simplified brochure of priority weeds and how to control them has been produced and is available at GeoCatch.

Vermin control

Rabbits and foxes are most common around the Busselton Wetlands.

A strategic approach is recommended for the control of rabbits and foxes where neighbours coordinate their vermin control activities at the most effective times of the year.

The most effective way to control rabbits is by laying bait trials of 'One Shot 1080 Oats' during late summer. To control foxes, the most effective and safe way is to use eggs containing 1080 poison.

Regulations for the safe handling and use of poisons for the control of pests are administered by the Department of Agriculture.

To carry out a vermin control program, landowners should seek the support of neighbours and make a single approach to the Agriculture Protection Officer at the Busselton office of the Department of Agriculture. Phone 9752 1688.

Kangaroos are not vermin, they are a protected native animal, but sometimes their numbers need to be reduced. The control of kangaroo populations is closely regulated. Landowners feeling that kangaroos are impacting on their livelihood or causing degradation, because of over population, need to seek an assessment and apply for a license through the Department of Conservation and Land Management to be able to cull kangaroos on their property.

Benefits of combined vermin control

The benefits arising from a properly coordinated vermin control program are:

- greater awareness among the community of the problem;
- community commitment to collectively deal with the problem which results in:
 - more effective control;
 - longer period before the pests return;
 - reduced threat to indigenous fauna;
 - reduced threat to small domestic stock from foxes; and
 - reduced threat to revegetation projects from rabbits.

Procedure for control of vermin

1. Determine the severity of the problem (phone your neighbours and obtain their support).
2. Seek advice on timing, notification and poison requirements of your program from the local Agriculture Protection Officer.
3. Notify the surrounding neighbours of the program (depending on the size of the program, this may extend to a community notice or a general awareness article in the local press).
4. Distribute the poison as per an agreed plan.
5. At the end of the baiting period, remove and dispose of unused baits and poison as per the regulations and do a quick tally of the vermin controlled to determine your level of success.



Revegetation next to the wetlands.

FUNDING AND RESOURCES

There is often a variety of funding opportunities for landowners intending to carry out revegetation and nutrient reduction works projects.

Funding opportunities change from year to year and the GeoCatch Network Centre can provide current details of funding opportunities and other resources.

Thanks to the dedication of volunteers of the Leschenault and Geographe Catchment Community Nurseries, local provenance native seedlings for private and public conservation works are available. Contact GeoCatch for details on 9754 4331.

Local provenance seedlings from Leschenault and Geographe Catchment Community Nurseries

Eligible groups

Groups and landholders within the Leschenault and Geographe Bay Catchments.

Theme

To conserve local native vegetation by making available seedlings for revegetation, particularly along rivers and streams. Donations to the nurseries accepted.

Guidelines

Tree and understorey lists available through LCDCs or direct from nursery. Order forms should be completed by November each year and can be submitted via your local LCDC. Other conditions apply.

Contact persons

Leschenault
Phone: 9791 4670
Nursery located Johnson Road (off Estuary Drive), Bunbury.

Geographe
Phone: 9754 4331

Note: Volunteers always needed to assist in the nurseries.



APPENDIX 1

SOILS

The initials for each soil system are the classifications given by the Tille and Lantzke Land Capability Study for Busselton to Augusta, Land Resource series No. 5. Each soil is given a rating of its suitability for particular land uses. A high rating means the soil is well suited to the purposes described.

Ludlow soils

L - Ludlow flats (Tuart Sands or Spearwood sands): Yellow and white sands over limestone. Colour ranges - red/brown, yellow and pale yellow/grey. The coloured sand is coated with both iron and aluminium oxides. The colouring is largely due to the amount of iron oxide coating the sand. The greater the coating of oxides, the greater the capacity of the sands to retain phosphorus. Soil moisture availability is a limitation on this soil. However, with irrigation, this soil is very good for market gardening, viticulture and orchards and has a high rating for forestry.

Lw - Ludlow wet flats: Flats with poor subsoil drainage in winter. This unit has a Class 2 rating for horticulture. The limitation of low water availability in summer and waterlogging in winter can be overcome with irrigation and drainage. The soil is also good for forestry after addressing fertility but it has a lower rating for grazing due to low soil moisture in summer.

Lv - Ludlow vales: Narrow flood plains of sandy alluvial soils. This unit is flood prone which is a limitation for all types of horticulture but is suitable for grazing and forestry.

Lwr - Ludlow rocky flats with high winter watertables.

Lvw - Narrow swampy small depressions.

Lvg - Wet clayey vales: Narrow floodplains along creeks and rivers.

These units are generally minor and have a low rating for all land uses except grazing but waterlogging salinity and water availability can still be limiting.

Abba soils

A, A2, adw, Afw, Avw, Aw - Abba sands: Duplex sand over clay. This soil unit is not immediately adjacent to the wetlands. However, it occurs through much of the catchment from where watercourses entering the Busselton Wetlands have come. These soils have a high rating for grazing.

AF, Af, Av and Afw - Abba fertile flats (Marybrook loams: Well drained fertile red/brown sands and brown sands grading down over clay with good moisture and nutrient availability. This unit has a high-class rating for all land uses with some of the wetter areas being improved with drainage to alleviate waterlogging.

Quindalup soils

Qw - Quindalup wet flats: Poorly drained wet flats around the edge of the estuaries. Dark calcareous sands and mixed estuarine deposits. This soil have a moderate capability for grazing with salinity being a potential limiting factor, low capability for market gardening and forestry with waterlogging being a limiting factor and very low capability for viticulture and orchards. Grazing is the only land use on this soil type. Landowners cannot manage salinity as the area is prone to tidal influences and inundation by sea water. However, landowners have influenced the Water Corporation in their management of the flood gates.

APPENDIX 2

ESTABLISHMENT OF TREE SEEDLINGS

Have you been preparing for the arrival of your seedlings?

Getting it right the first time will avoid you having to go back next year to do fill ins and will encourage you to do other areas in the future. These notes are designed to provide a checklist for consideration by people wanting to do tree plantings.

In three words successful tree establishment involves:

- preparation;
- timing;
- observation.

The following is a brief summary of the things you should be thinking about to ensure high survival rates and a pleasing result.

Preparation

Assess the site:

- Is it sloping and prone to erosion?
- Is it non-wetting and therefore needs scalping or a wetting agent?
- Is it going to be under water for short periods of the year?

Answers to these will influence the way you prepare the site.

Ripping

All sites respond to a ripping.

Clays should be ripped at a time of year when they are fairly dry (autumn). Its hard going, but done at this time the clay will fracture and provide spaces for the roots to penetrate. Smearing, which occurs when the clay is wet, seals off the spaces.

Sands benefit from ripping because they may be compacted. Ripping them provides a preferred pathway for downward root development which is important if the seedlings are not going to

be left high and dry in the middle of summer.

Weed control

Couch is difficult to control and will compete strongly with your seedlings for soil moisture. Make sure you have well and truly killed it before planting. Seriously consider not planting a site if the couch has a good hold and give yourself another season to strategically eradicate it.

Options

- Scalp the soil surface with a grader just prior to planting so that runners are totally removed.
- Rotary hoe the couch, bringing the runners to the surface. Those that are buried in the process will then grow more vigorously giving you a better chance to kill them with herbicide.

Mulch can be useful to control weeds and is an ideal method for establishing small areas of plants.

Once ripping and mounding has been done, wait for a germination of weeds, then spray with a knockdown, usually 2 L/ha Glyphosate, and a residual, usually 6-10 L/ha Simazine. Unless you have had experience with herbicide sprays for tree preparation, consult the Department of Conservation and Land Management or use a local contractor to do the spraying. Weed control with herbicides is very site specific.

Avoid spraying wash areas and flow lines. Grass is important for erosion control and it also leaves something for the black beetles to eat (if there are any).

Mounding or scalping

Mounding

Use a commercial moulder which is designed for the job. The discs and press wheels press out air pockets which can form during the mounding operation.

On sloping country, mounds should be put on the contour so that they do not run with water and cause erosion.

Leave breaks in the mounds every 10-30 metres so that water cannot build-up behind them creating mini dams that will overflow at the lowest point. Also leave breaks at low points in the paddock where you know water runs in the winter to stop erosion of these areas.

Flat, poorly drained wet sites need to be ripped and mounded before it rains to enable access with machinery and to allow the mounds to settle before planting. Clay sites should be ploughed prior to mounding to ensure the mounds form without clods.

Free draining loams have been shown to benefit from a small mounding.

Scalping

Deep sandy dry sites with non-wetting soils may need to be scalped. Mounding on these sites can leave the seedlings high and dry in the summer months. Scalping can be done during the planting season. The scalping action removes all weed competition from the new seedlings and the furrow left behind forms a water catchment. Most tree planters have a scalping blade on the front that will achieve this and enable seedlings to be planted in one pass.

Caution

Scalped sand is highly erodible therefore it is recommended that scalping be done on the contour..

TIMING

Care of seedlings prior to planting

If possible, get your seedlings in the ground as soon as you have taken delivery of them once the ground is moist. If you have to store them for a while make sure that the trays are off the ground so that they do not take root and keep them watered and out of the wind.

Timing

In all cases where herbicides have been used for weed control, allow 50 mm of rainfall and/or two weeks before planting out your seedlings to ensure the herbicides do not kill the trees.

On dry and well drained sites the trees should be planted as early in winter as possible, i.e. once the ground is wet. This will give the tree maximum time during the wetter period for the roots to establish.

On wet sites, planting may be left until late winter, especially if the site is under water for long periods. Planting seedlings into waterlogged soil usually gives poor survival.

Fertilising seedlings is generally recommended but caution must be taken to avoid killing them with kindness. Fertilising can be done during planting or preferably up to six weeks after planting to allow seedlings time to settle in. A fertiliser tablet or the equivalent, e.g. NPK Blue at ~ 50 grams per tree, should be buried 15 cm into the ground 30 cm away from the stem.

Contractors

If you have no suitable equipment for ground preparation or are too busy at the time the seedlings need to go in, then it could be worthwhile hiring the equipment or getting somebody else in to do the job.

Fencing to exclude stock is the most important after care that trees can be given. Make sure the fencing is adequate to keep the stock out, particularly in the middle of summer, when the only thing green in the paddock is the trees.

OBSERVATION

The job does not finish once the trees have been 'barged in the ground'. A certain amount of care but mostly observation is required to get the seedlings through their first season. Make a point of getting out whenever you are passing or every two weeks to have a closer look at what is happening to your new seedlings. Something small or very

elusive may be chewing away at them without you noticing.

Grasshoppers: Start looking in October for grasshopper nymphs and spray them early while they are not highly mobile. Some farmers spray areas adjacent to their farms to ensure the grasshoppers are kept at bay. Approach your neighbour if you have identified a breeding site on properties adjacent to yours that you know will cause problems for your planting.

If **Black beetle** is known to be a problem on your planting site, it can be reduced prior to planting by ploughing up the area to expose the eggs, larvae or beetle and then spraying with chlorpyrifos or other residual pesticides. Incorporating this into the soil by ploughing again or harrowing is recommended. Obviously this working of the soil is to be avoided where possible but this may also be tied in with the strategy to kill couch and kikuyu. Incorporation of sprays after planting is impossible so this must be done before.

Alternatively there is a granule which may be applied by hand around the base of the seedling and with adequate rainfall, is taken into the soil where the beetle lives.

For specialised advice on control of Black beetle, contact Manjimup Department of Agriculture on 9777 0000.

Rabbits: Poisoning with 1080 oats should be done in summer prior to planting and each summer until the seedlings are up to one metre high. Alternatively poisoning with tablets and warren ripping at this time of year may be the only alternative but is a more expensive option. Contact the Department of Agriculture on 9752 1688 for advice.

TREE PLANTING CALENDAR FOR THE GEOGRAPHE AREA

February-April (up to the break of season)

Remove rabbits within at least 250 metres of the planting site by poisoning and destroying warrens and harbours, e.g. burn wood heaps, slash bracken fern areas known to harbour rabbits and rip warrens where possible. Poison with 1080 oats. To make poisoning more effective, graze the area down hard, prior to laying the poison, so that 1080 oats are easily seen by rabbits and there is little else for them to eat.

Rip a mound wet sites that are not trafficable in winter so the planting program is not held up.

Break of the season

Use the method that will suit your situation to control weeds.

Wet sites

Wait for the first germination of weeds then use knockdown and residual herbicides to kill and suppress germination later in the season. Wait two weeks and/or until 50 mm of rain has fallen after spraying before planting your seedlings or else tree deaths may be caused by the herbicides still active in the soil; or for small plantings, mulching may be a practical alternative. This involves covering the surface of the ground around each seedling with a layer of mulch to smother weeds and will help to retain soil moisture during summer.

Dry sites

Trafficability on dry sites in winter is often not a problem. Ripping, furrowing or scalping can be done just prior to planting or, with the right equipment, the planting can also be done in one pass. Scalping or furrowing the site will give a clean weed free area to plant into. However, on sites where you know the weed burden is high, a residual spray should be applied to reduce weed germination later in the season.

Generally, the earlier the seedlings go in the better the survival rate, so try and organise your planting for as soon as the soil is moist. If you cannot get to the dry sites before the end of the winter consider getting someone else to plant them.

August to October - post-planting

Keep an eye out for insects that attack young seedlings, monitor the planting site regularly, e.g. every two days to begin with and every week throughout the rest of this season. There are many insects that could be a potential problem for young seedlings. However, they are often very seasonal and may or may not cause problems. The only way you can protect the seedlings is to be on guard and ready to act when and if the problem arises.

September to November - Wingless grasshoppers

Wingless grasshoppers do not migrate from their breeding area until they are at least 1 cm long. Killing them during this period is critical to controlling them. It is also more effective and cheaper than waiting for them to grow and become more mobile.

Identify all breeding areas, keep an eye on them and be ready to spray when the time is right. Areas to inspect for grasshopper hatchings include sandy rises particularly around the base of Marri, drain banks and where grasshoppers were first noticed thick in the previous season. Ref: Wingless grasshoppers and their control. Farmnote 62/90.

December: Planning and ordering

Determine your seedling requirements for next season and order them so that your seedling supplier has time to grow the ones you want.



A successful tree planting.



APPENDIX 3

LOCAL NATIVE PLANTS LIST FOR THE BUSSELTON WETLANDS

Adapted from: 'Native Vegetation of estuaries and Saline Waterways in South Western Australia'. Published by the Department of Environment, Water and Catchment Protection and Department of Conservation and Land Management 1997.

Scientific name	Common name	Comment
Trees <i>Casuarina obesa</i> <i>Eucalyptus rudis</i> <i>Melaleuca cuticularis</i> <i>Melaleuca raphiophyla</i> <i>Melaleuca thymoides</i> <i>Melaleuca viminea</i>	Swamp sheoak Flooded gum Salt water paperbark Swamp paperbark Myrtle Mohan	Plant seedlings or direct seed on sites with no weed competition. Easy to establish.
Shrubs <i>Atriplex hypoleuca</i> <i>Frankenia pauciflora</i> <i>Myoporum caprarioides</i>	Saltbush Sea heath Slender myoporum	
Sedges and rushes <i>Baumia juncea</i> <i>Bolboschoenus caldwelli</i> <i>Carex inversa</i> <i>Gahnia trifida</i> <i>Juncus kraussii</i> <i>Lepidosperma gladiatum</i> <i>Schoenoplectus validus</i>	Bare twig rush Marsh club rush Knob sedge Coast saw sedge Sea rush Coastal sword sedge Lake club rush	Easier to establish by transplanting from established areas to similar areas in the landscape.
Samphires <i>Halosarcia halocnemoides</i> <i>Halosarcia indica</i> <i>Halosarcia lepidosperma</i> <i>Sarcocornia blackiana</i> <i>Sarcocornia quinqueflora</i>	Shrubby samphire Samphire Samphire Samphire Bladed samphire	Colonise salty areas very well. Enhance establishment by controlling stock grazing.
Herbs <i>Hemichroa pentandra</i> <i>Samolus junceus</i> <i>Samolus repens</i> <i>Suaeda australis</i>	Trailing joint weed Brookweed Creeping brookweed Seablite	Allow natural regeneration or transplant runners and shoots.
Grasses <i>Poa porphyrocladus</i> <i>Sporobolus virginicus</i>	Marine couch	Allow natural regeneration or transplant runners and shoots.

APPENDIX 4

PLANT SPECIES SUITABLE FOR GROWING AT WONNERUP

Compiled by R.A. Hingston, Department of Conservation and Land Management, Farm Forestry Unit, Busselton.

Scientific name	Common name	Comments	Height by width
<i>Agonis flexuosa</i>	Peppermint	Local	10 x 6
<i>Acacia saligna</i>	Golden wreath wattle	Mild salt tolerance, local	5 x 3
<i>Acacia melanoxylon</i>	Blackwood	Timber	20 x 10
<i>Callitris priesii</i>	Rottnest Island pine	Local	6 x 3
<i>Casuarina cunninghamiana</i>	River oak	High salt tolerance	30 x 10
<i>Casuarina obesa</i>	Swamp oak	High salt tolerance	12 x 5
<i>Casuarina equisetifolia</i>	Drooping sheoak		8 x 4
<i>Casuarina stricta</i>	Australian bottle brush		4 x 3
<i>Calistemon phoeniceus</i>	Lesser bottle brush		3 x 3
<i>Calis. Kings Park Special</i>			4 x 3
<i>Eucalyptus camaldulensis</i>	River red gum	Timber, mild salt tolerance	18 x 13
<i>Euc. camal. var. albacutya</i>			
<i>Eucalyptus calcicola</i>	Hamelin Bay mallee		6 x 5
<i>Eucalyptus cornuta</i>	Yate		20 x 10
<i>Eucalyptus gomphocephala</i>	Tuart	Local, timber, Mild salt to tolerance	30 x 20
<i>Eucalyptus leucoxylon</i>	Yellow gum		12 x 8
<i>Eucalyptus leucoxylon var. rosea</i>	Red flowering bum		6 x 5
<i>Eucalyptus melliodora</i>	Yellow box	Timber, mild salt tolerance	20 x 15
<i>Eucalyptus occidentalis</i>	Flat topped Yate	High salt tolerance	18 x 10
<i>Eucalyptus rudis</i>	Flooded gum	Local, timber, mild salt tolerance	15 x 15
<i>Hakea bucculenta</i>	Red pokers		4 x 3
<i>Hakea multilinea</i>	Grass leaf hakea		4 x 4
<i>Melaleuca culticularis</i>	Salt water paperbark	High salt tolerance, local	8 x 6
<i>Melaleuca raphiophyla</i>	Swamp paperbark	Local	8 x 8
<i>Melaleuca incana</i>	Grey honey myrtle	Local	3 x 3
<i>Melaleuca laterita</i>	Robin red breast myrtle	Local	2 x 3
<i>Melaleuca hamulosa</i>		Local	3 x 4
<i>Melaleuca priessiana</i>	Priess's paperbark	Local	
<i>Melaleuca nesophyla</i>	Western tea myrtle		5 x 6
<i>Melaleuca lanceolata</i>	Rottnest Island tea tree		6 x 5
<i>Melaleuca leucadendron</i>	Broad leaved paperbark		
<i>Melaleuca armillaris</i>	Bracelet honey myrtle		4 x 3
<i>Viminea juncea</i>	Broom bush	Waterlogged	3 x 3

APPENDIX 5

AGRICULTURAL AND ENVIRONMENTAL RATING OF WEEDS IDENTIFIED IN THE GEOGRAPHE CATCHMENT WEED PLAN

Note: This weed list was determined through consultation with a Department of Agriculture representative, local experts and weed survey results determined from a questionnaire sent out by GeoCatch. The ratings given are as determined by the Department of Agriculture and the Department of Conservation and Land Management respectively.

Scientific name	Common name	Agricultural rating	Environmental rating
<i>Erogrostis curvula</i>	African Love Grass	Nil	High
<i>Solanum linnaeanum</i>	Apple of Sodom	Declared	Moderate
<i>Zantedeschia eathiopica</i>	Arum Lily	Declared	High
<i>Robinia pseudo-acacia</i>	Black Locust	Nil	Low
<i>Acacia decurrens</i>	Black Wattle	Nil	Mild
<i>Rubus fruticosus agg.</i>	Blackberry	Declared	Low
<i>Ferraria crispera</i>	Blackflag	Nil	Unrated
<i>Pteridium esculentum</i>	Braken	Nil	Unrated
<i>Asparagus asparagoides</i>	Bridal Creeper	Nil	High
<i>Typha orientalis</i>	Bullrush	Nil	High
<i>Rumex sp.</i>	Docks	Nil	Unrated
<i>Emex australis</i>	Doublegee	Nil	Low
<i>Trachyandra divaricata</i>	Dune Onion Weed	Nil	Mild
<i>Foeniculum vulgare</i>	Fennel	Nil	Unrated
<i>Hypochaeris glabra</i>	Flat Weed	Nil	Moderate
<i>Freesia hybrid</i>	Freesia	Nil	High
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Nil	High
<i>Gladiolus tristis</i>	Gladiolus	Nil	Low
<i>Phytolacca octandra</i>	Inkweed	Nil	Mild
<i>Gomphocarpus fruticosus</i>	Narrowleaf Cotton Bush	Nil	Moderate
<i>Homeria flaccida</i>	One-leaf Cape Tulip	Declared	High
<i>Asphodelus fistulosus</i>	Onion Weed	Nil	Mild
<i>Cortaderia selloana</i>	Pampas Grass	Nil	High
<i>Echium plantagineum</i>	Paterson's Curse	Declared	Low
<i>Mentha pulgium</i>	Pennyroyal	Nil	Low
<i>Chondrilla juncea</i>	Skeleton Weed	Declared	Low
<i>Hypericum perforatum</i>	St John Wort	Nil	Low
<i>Limonium lobatum</i>	Statice	Nil	Low
<i>Chamaecytisus palmensis</i>	Tagasaste	Nil	Mild
<i>Verbascum vergatum</i>	Tiggy Mullein	Nil	Low
<i>Homeria miniata</i>	Two-leaf Cape Tulip	Declared	Moderate
<i>Cyperus erogrostis</i>	Umbrella Sedge	Nil	Moderate
<i>Ehrharta calycina</i>	Veldt Grass	Nil	High
<i>Leptosperma laevigatum</i>	Victoria tea-tree	Nil	High
<i>Watsonia bulbifera</i>	Watsonia	Nil	High
<i>Raphanus raphanistrum</i>	Wild radish	Nil	Mild