



# MANAGING PHYTOPHTHORA DIEBACK

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## *Guidelines for Local Government*

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PREPARED BY THE  
DIEBACK WORKING GROUP  
2000

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Support and financial assistance provided by



Managing Phytophthora Dieback Guidelines for Local Government supported by:



Local Government  
Supervisors  
Association (WA)



Institute of Public  
Works Engineering  
Australia, WA Division

# The Dieback Working Group



## BACKGROUND

In 1996, the Canning Catchment Co-ordination Group initiated a working party to develop a draft policy on managing Phytophthora dieback. Local Governments located in the areas of Perth most prone to Phytophthora dieback, and relevant State Government Departments, were requested to provide a representative to participate in the preparation of this document.

The “Dieback Working Group” was formed in 1996. The Dieback Working Group met on four occasions to develop a draft document for Local Government, based on the Department of Conservation and Land Management's Hygiene Manual (1992). In 1998, the Working Group obtained funding from the Natural Heritage Trust to appoint a project coordinator. The role of this coordinator was to facilitate the adoption of this policy document within Local Government, and to raise awareness of Phytophthora dieback within Local Government and the wider community.

Since its formation, the Dieback Working Group has sought to:

- increase awareness and understanding about Phytophthora dieback,
- encourage the adoption of Phytophthora dieback prevention and management policies, and
- encourage the implementation of management procedures to minimise the spread and impact of the pathogen

## MEMBERSHIP

- City of Armadale
- City of Canning
- City of Cockburn
- City of Fremantle
- City of Gosnells
- City of Melville
- City of Swan
- Department of Conservation and Land Management
- Department of Environmental Protection
- Department of Land Administration
- Eastern Metropolitan Regional Council
- Friends of Ellis Brook Valley
- Ministry for Planning
- Roleystone Dieback Action Group
- Shire of Kalamunda
- Shire of Mundaring
- Shire of Serpentine Jarrahdale

## ACKNOWLEDGEMENTS

Funding for this publication and for the Dieback Working Group has been provided by the Bushcare component of the Natural Heritage Trust. Generous support and assistance has also been provided by the Shire of Kalamunda. Special thanks to staff at the Shire of Kalamunda who assisted with the preparation of the Phytophthora Dieback Management Procedures.

Thanks to Andrew Del Marco, Wayne Van Lieven, Colin Leek, Martin Pearce, Dr Libby Mattiske, Ron Van Delft, Rosalind Murray, Institute of Public Works Engineers of Australia (WA) and the Local Government Supervisors Association (WA) for reviewing the guidelines.

Front cover photograph of *Banksia grandis* by Michael Morcombe.

Guidelines compiled by Sharon Lewis and Dr Ian Colquhoun.

Contributions provided by John Nicolson (Eastern Metropolitan Regional Council) and Kevin Vear (Department of Conservation and Land Management).

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Managing Dieback – A Guide for Landholders and Community Conservation Groups.

# FOREWORD

The death of native plants caused by the introduced pathogen *Phytophthora cinnamomi* greatly decreases the bio-diversity of Western Australia's valuable bushland and has the potential to drive rare plant species and their dependent fauna to extinction. Apart from these biological costs, disease caused by the pathogen known as Phytophthora dieback also has a number of other costs for Local Government. The death and local extinction of trees and wildflowers greatly diminish the recreation and aesthetic values of bushland and roadsides. There is also the cost of 'cleaning up' dead trees, ensuring public safety, and rehabilitating areas that are damaged by Phytophthora dieback.

The major threat of Phytophthora dieback to our native bushland has been recognised by both the State and Federal Governments who are committed to supporting the efforts of Local Government to protect the environmental values of land managed by them.

Local Governments are continuing to play a major role in the conservation of bushland. However, due to the complexity of the issues involved, managing the spread of Phytophthora dieback has always represented a significant challenge.

'Managing Phytophthora Dieback – Guidelines for Local Government' has been prepared under the auspices of a Western Australian based local government working group, specifically to meet the needs of Local Government. The adoption and implementation by Local Government, of the Phytophthora Dieback Management Procedures listed in this document, will be an important step in reducing the impact of Phytophthora dieback on bushland reserves. The direct involvement of Local Government agency staff and community conservation groups in the implementation of these procedures will help to ensure its success.

We acknowledge the efforts of the Dieback Working Group in producing these guidelines, and congratulate them for their dedication to this important issue. In particular we recognise the foresight of the Shire of Kalamunda in sponsoring this important initiative.

We commend these guidelines to Local Government.

The Hon. CL Edwardes  
Minister for the Environment

The Hon. P K Omodei  
Minister for Local Government

# A WORD FROM THE CHAIRPERSON

I believe that this document marks a major step forward in the conservation of bushland reserves and other bushland areas that could be affected by the operations of local government. The bushland reserves in the metropolitan area are the real jewels of the region, whether they be for conservation of species and ecosystems, or amenity value for the local community. In the southwest, bushland reserves contribute significantly to the conservation value of the region, and provide important areas for recreational activities. We know *Phytophthora dieback* greatly decreases the biodiversity of bushland and has the potential to drive rare plant species to extinction. Deaths of trees and wildflowers also greatly diminish the amenity and aesthetic value of bushland.

Before the mid-1960's the cause of *Phytophthora dieback* was unknown so inadvertent spread of the pathogen was a common occurrence. Nowadays, we are in a far better position to manage bushland to minimise the spread and impact of the pathogen - we know the cause of the disease and we know how the pathogen spreads. I believe that the phrase 'inadvertent spread' can no longer be used as an excuse when plants start dying in a previously healthy area. I believe that local governments have a responsibility to care for their bushland areas within their boundaries using the most effective and practicable methods available. This publication outlines these methods, and I am confident that adoption of the disease control methods will minimise the risk of local government operations increasing the spread and impact of this disease.

Earlier versions of these guidelines never progressed to the implementation stage. I think this occurred because of the concern that implementation would be a major imposition to routine work, and the costs would be a major draw on a limited budget. Dispelling these types of concerns is never easy but I believe:

- the costs will be zero for most operations because of the absence of bushland near the operations,
- the costs will be low for other operations near bushland because the procedures will call for minimal changes eg. change of the schedule, change of supplier, change to the location of infrastructure (track, etc.),
- where more intensive procedures are required, eg. near reserves of high conservation value, these would have been prescribed anyway as part of the environmental management plan for the reserve.

The major threat of *Phytophthora dieback* to our native bushland is recognised by the Federal Government (Environment Protection and Biodiversity Conservation Act 1999) and State Government. The adoption of a *Phytophthora dieback* management policy and procedures by local governments will be an important next step to combat this devastating disease. The involvement of community conservation groups and local government staff will ensure this next step is a successful one.

**Dr Ian Colquhoun**  
Chairperson  
Dieback Working Group

# INTRODUCTION

The impact of *Phytophthora dieback* (the plant disease caused by the pathogen *Phytophthora cinnamomi*) in native vegetation of Western Australia, is a significant and serious environmental problem:

“*Phytophthora* is of such great seriousness and importance, that it is comparable to salinisation in farming areas” (Review of Dieback in Western Australia – Report to the Western Australian Minister for the Environment, Podger, F, James, S.H, and Mulcahy, M.J, 1996).

“The arrival and spread of dieback is now seen to be a biological disaster of global significance for conservation of areas of great biodiversity. A number of plant species face extinction unless recently formulated programs of phosphite treatment are effectively implemented and maintained” (Review of Dieback in Western Australia – Report to the Western Australian Minister for the Environment, Podger, F, James, S.H, and Mulcahy, M.J, 1996).

The Commonwealth Endangered Species Protection Act (1999) lists dieback caused by *Phytophthora cinnamomi* as one of five ‘Key Threatening Processes’ endangering Australian species and ecological communities.

Local Government has an important role to play in managing *Phytophthora dieback*. Activities undertaken by Local Governments such as road and drain construction, road and drain maintenance, and bushland reserve management, have the potential to introduce *Phytophthora dieback* to a previously uninfected area, or increase its rate of spread.

These guidelines provide the information required for a Local Government to adequately address the issue of *Phytophthora dieback*. The guidelines include:

- Basic information about the pathogen (*Phytophthora cinnamomi*).
- The goal and objectives for *Phytophthora dieback* management in Local Government.
- A standard policy which can be adopted by each Local Government.
- Recommended actions to implement the policy.
- *Phytophthora Dieback Management Procedures* for road and drain construction and maintenance, bushland reserve management, fire protection and planning (developments/subdivisions).
- A suggested format for *Phytophthora Dieback Management Plans*.
- Information regarding staff training, a training session plan and course notes.
- Contacts who can provide further information.

These guidelines have been developed in conjunction with the Department of Conservation and Land Management, the Department of Environmental Protection, community conservation groups and Local Government. Information provided by all these groups has ensured that these guidelines contain the most up-to-date, practical

and cost-effective management techniques. Most importantly, these techniques have been developed specifically for Local Government.

Each page of these guidelines is numbered and date stamped. Updates to the guidelines will be necessary, and will be provided by the Dieback Working Group. Suggestions for updates to the guidelines should be made to the Dieback Working Group.



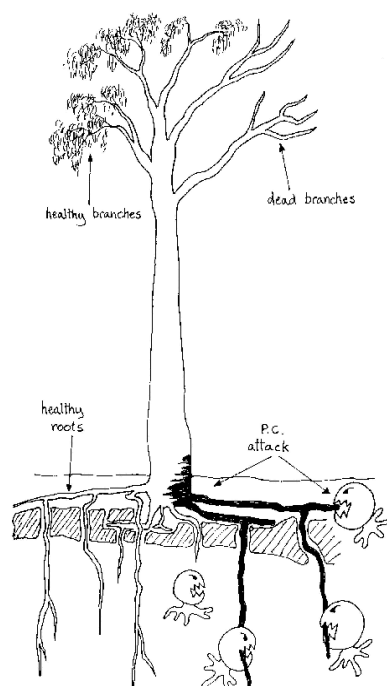
# PHYTOPHTHORA DIEBACK

## WHAT IS PHYTOPHTHORA DIEBACK?

The term Phytophthora dieback refers to the deadly plant disease caused by the pathogen *Phytophthora cinnamomi*. In the past, Phytophthora dieback has been known as 'dieback' and 'Jarrah dieback'. Unfortunately, these names have contributed to incorrect information and confusion about the pathogen. For example, in other parts of Australia, the term 'dieback' is used to describe tree decline caused by salinity, drought, insect damage, attack by other fungal pathogens etc. Therefore, to overcome this confusion, the term Phytophthora dieback will be used in this publication.

There are more than 50 species of *Phytophthora* found worldwide and all *Phytophthora* species cause plant disease. The three *Phytophthora* species that most commonly cause disease in native vegetation in Australia are *P.cinnamomi*, *P.citricola* and *P.megasperma*. *P.cinnamomi* is the most destructive of these three species. *P.cinnamomi* infests the largest area, is most widely distributed, infects the largest number of plants and is responsible for the most plant deaths (Weste, 1994).

## BIOLOGY AND ECOLOGY



Originally, *P.cinnamomi* was classified as a fungus, however it is now classified as an Oomycete or 'water mould'. *P.cinnamomi* spends its entire life in soil and plant tissue. Its spores are less than one hundredth of a millimetre in diameter, and therefore they cannot be seen without a microscope.

The food source of *P.cinnamomi* is the root and stem tissue of living plants.

*P.cinnamomi* attacks the roots of plants and causes them to rot. This rotting may extend in to the base of the plant. This rotting weakens or kills the plant by limiting the uptake of water and nutrients.

Of the 8000 species of vascular plants in the southwest of Western Australia are susceptible to infection by *P.cinnamomi* (Komorek et al 1994). Many of these plants are only found in the southwest of Western Australia. Some of the southwest's more common plants are susceptible, including Jarrah, Banksias, Grasstrees, Hibbertias, Hakeas and Dryandras.

Soil that is warm and moist provides the best conditions for *Phytophthora cinnamomi* survival and sporulation.

## HOW IT SPREADS

*P.cinnamomi* spreads quickly down slope because its microscopic spores move in surface and sub-surface water flows. It spreads more slowly up slope and on flat ground (approximately 1 metre/year) because it is restricted to movement in plant roots. *P.cinnamomi* can continue to grow within plants when their moisture content is greater than 80% (Shearer and Tippet, 1989)

However, human activity causes the most significant, rapid and widespread distribution of the pathogen. Road construction, earthmoving, driving dirty vehicles and stock movement all contribute to the increased spread of *P.cinnamomi*. Bush restoration activities may also inadvertently spread the pathogen, particularly when plants have been purchased from non-accredited nurseries, or when dirty tools are used.

Animals (native, stock and feral) can also spread *P.cinnamomi*, although this risk is much lower, as they have a lower risk of picking up and distributing infested soil.

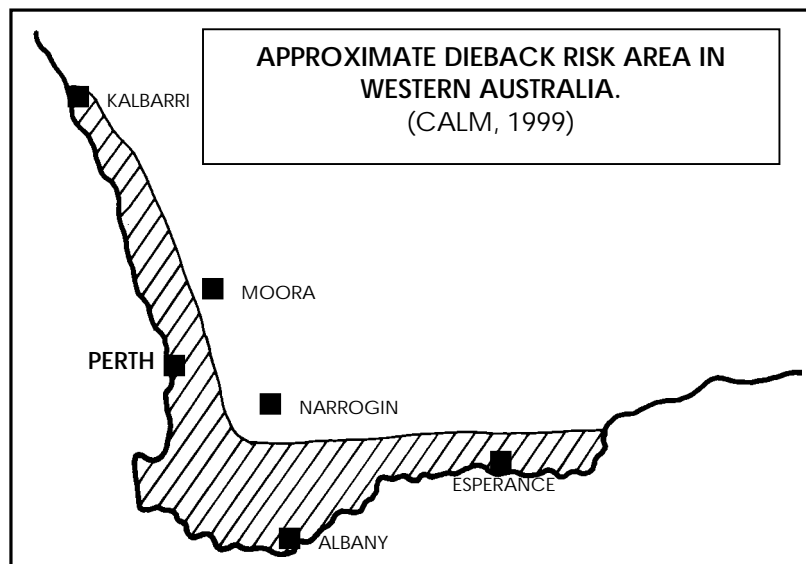
## HISTORY

*P.cinnamomi* is not native to Western Australia. It is thought to have arrived in the State in soil around the roots of live plants, brought in during European settlement in the late 1820's. The first unexplained death of Jarrah trees and shrubs in Western Australia was recorded in the early 1920's around Karragullen. Later, deaths were recorded in many other parts of the southwest forests. However it was not until the mid 1960's that a research scientist based at Kelmscott discovered that *P.cinnamomi* was causing tree deaths (Podger, 1968).

## GEOGRAPHY

*P.cinnamomi* is now widespread throughout the southwest of Western Australia, extending between Eneabba and Esperance. It has infested forest, heathland and woodland communities. *P.cinnamomi* is widespread in bushland in and around Perth.

*P.cinnamomi* is found throughout the landscape in areas that receive above 800mm annual rainfall. Where annual rainfall is between 600 and 800mm, *P.cinnamomi* tends to be confined to stream systems and road verges (especially table drains). In areas receiving less than 600mm annual rainfall, *P.cinnamomi* is restricted to natural water gaining sites, or sites that have been altered and receive excessive drainage. There is no record of *P.cinnamomi* in regions receiving less than 400mm annual rainfall (CALM, 1998).



*P.cinnamomi* is present in temperate climates throughout Australia, and throughout the world. It is also present in tropical/sub tropical climates. However, Western Australia suffers the greatest impact from this pathogen, due to the favourable environmental conditions, and the large number of susceptible species that are killed.

## RECOGNISING PHYTOPHTHORA DIEBACK

The presence of *P.cinnamomi* is deduced from the death of susceptible plants. Commonly used indicator plants include Jarrah, Banksias, Grass trees (*Xanthorrhoea*), Zamia Palms, Hibbertias, Dryandras and Hakeas. Other factors that could have caused plant death (eg. fire, insects, flooding, drought, chemicals, other pathogens etc) must also be discounted. Plant root and soil samples can be taken and tested to confirm field observations.

When the presence or absence of Phytophthora dieback is to be used as the basis for a detailed disease management strategy involving considerable resources,

assessment should be completed by an accredited dieback interpreter (refer to Part 9).



*Banksia menziesii* (left) and *Xanthorrhoea preissii* (right) are both susceptible to *Phytophthora cinnamomi*.

## INDUSTRY IMPACT

Plant death from *P.cinnamomi* is not restricted to native plants. A range of horticultural crops and ornamental plants are also susceptible to *P.cinnamomi*, and a number of industries are affected by *P.cinnamomi*.

The forestry industry suffers significant loss due to *P.cinnamomi*. Timber species susceptible to the pathogen include Radiata Pine (*Pinus radiata*) and Jarrah (*Eucalyptus marginata*) (Cahill, 1993). The presence of *P.cinnamomi* in forests, bushland, heathland, and in National Parks can have the potential to impact tourism in some areas.

Many ornamental and garden plants are also susceptible to *P.cinnamomi*, including Camellias, Azaleas, and Rhododendrons (Erwin & Ribeiro, 1996). *P.cinnamomi* causes significant losses to the nursery industry.

*P.cinnamomi* results in the loss of millions of dollars from Australia's horticultural industry. Horticultural crops, including apricot, peach, grapevines, kiwi fruit, pineapple, avocado, chestnut, walnut and macadamia nut, are all susceptible to *P.cinnamomi* (Cahill, 1993; Erwin & Ribeiro, 1996). A number of flower crops, most notably Proteas, are also susceptible (Cahill, 1993). These guidelines focus on the need to manage *Phytophthora* dieback in and near bushland, but the need to minimise spread of *P.cinnamomi* in horticultural areas should also be considered by Local Government.

## MANAGING PHYTOPHTHORA DIEBACK

The number of new *P.cinnamomi* infestations can be reduced by modifying activities that spread the pathogen, or by controlling access to high priority areas. Modifying activities may involve cleaning machinery, vehicles or footwear, scheduling activities for dry soil conditions, or using materials that are free of *P.cinnamomi*. Controlling access may involve track rationalisation, upgrading tracks, or restricting the access of off road vehicles.

The other tool that can be used to protect vegetation from *P.cinnamomi* is the chemical phosphite. Phosphite is a biodegradable fungicide that protects plants against *P.cinnamomi*. Phosphite works by boosting the plant's natural defences. Phosphite needs to enter a plant's water system to be effective, and this can be done by injecting it into trees, or spraying the foliage of understorey plants. Phosphite is not toxic to people or animals, and there is a very low pollution risk associated with it. Phosphite only provides temporary protection against *P.cinnamomi*, so treatment needs to be ongoing.

# GOAL / OBJECTIVES / POLICIES

This chapter suggests a goal and the appropriate objectives, policies, strategies and actions that a Local Government can adopt to manage *Phytophthora dieback*. These could be modified or customised to suit the needs or circumstances of a particular Local Government.

## Goal

To protect native remnant vegetation within the Local Government area by minimising the risk of introducing and spreading *Phytophthora cinnamomi*.

## Objectives

1. To implement *Phytophthora Dieback Management Procedures* to minimise the risk of Local Government operations introducing and spreading *P.cinnamomi*.
2. To identify reserves of high conservation value that are threatened by *P.cinnamomi*, that are located in, and managed by, the Local Government, and implement *Phytophthora Dieback Management Procedures*.
3. To ensure all large scale developments and activities approved by the Local Government, that have the potential to spread *P.cinnamomi* into high value bushland, use the appropriate *Phytophthora Dieback Management Procedures*.
4. To provide appropriate levels of information to the public on matters related to *P.cinnamomi*, and encourage residents and other land managers within the Local Government area to undertake appropriate actions to protect their properties from *Phytophthora dieback*.

To achieve this goal and these objectives, the following policies should be implemented.

**Policy 1** The Local Government formally recognises the significant threat of Phytophthora dieback to the natural values of the area.

**Policy 2** The Local Government to consider current activities and procedures, and review these activities and procedures with a view to adopting Phytophthora Dieback Management Procedures.

**Policy 3** The Local Government to identify bushland reserves of high conservation value and to act to protect these reserves from Phytophthora dieback.

**Policy 4** Relevant Local Government staff to receive Phytophthora dieback management training.

**Policy 5** Developments approved by the Local Government to contain conditions or recommendations regarding the implementation of Phytophthora Dieback Management Procedures.

**Policy 6** The Local Government to provide information to community conservation groups and other groups and individuals, to ensure the integrity of Local Government management activities in relation to Phytophthora dieback.

**Policy 7** The Local Government to regularly review its procedures and performance in relation to Phytophthora dieback.

**Policy 8** The Local Government to review new information and technologies, and include in policy when appropriate.

The following pages list each policy with the strategies and actions required.

## **Policy 1**

The Local Government formally recognises the significant threat of Phytophthora dieback to the natural values of the area.

### **Strategies**

1.1 Councillors and relevant employees to be provided with appropriate reference material regarding Phytophthora dieback, and attend presentations when appropriate.

1.2 Formal adoption of Phytophthora dieback policies by the Local Government.

### **Actions (& Responsibilities)**

**1.1.1 Written material provided to councillors and Local Government officers (Dieback Working Group).**

**1.1.2 Presentation regarding Phytophthora dieback made to councillors (Dieback Working Group).**

**1.2.1 Council to review reference information (Council).**

**1.2.2 Council to consider advertising for public submissions (Council).**

**1.2.3 Council to endorse the Phytophthora dieback policy and support the implementation of Phytophthora Dieback Management Procedures (Council).**



**Policy 2** The Local Government to consider current activities and procedures, and review these activities and procedures with a view to adopting Phytophthora Dieback Management Procedures.

## Strategies

2.1 Phytophthora Dieback Management Procedures should be implemented into all relevant Local Government operations.

## Actions (& Responsibilities)

- 2.1.1 Consider current operations and procedures and compare with the Phytophthora Dieback Management Procedures listed in this document (Planning, Engineering, Parks & Reserves, Environmental Officers).**
- 2.1.2 Identify any Phytophthora Dieback Management Procedures that may already be in place (Planning, Engineering, Parks & Reserves, Environmental Officers)**
- 2.1.3 Implement the remaining Phytophthora Dieback Management Procedures (Planning, Engineering, Parks & Reserves, Environmental Officers).**
- 2.1.4 Contractors to be provided with general Phytophthora dieback information, and specific instructions regarding changes to 'regular' practices, in accordance with Phytophthora Dieback Management Procedures (Contract Supervisor).**
- 2.1.5 Relevant Phytophthora Dieback Management Procedures to be included in contracts with all relevant contractors (Contract Supervisor).**

**Policy 3** The Local Government to identify bushland reserves of high conservation value and to act to protect these reserves from Phytophthora dieback.

## Strategies

3.1 Bushland reserves of high conservation value in the Local Government area should be identified, mapped for Phytophthora dieback, management plans prepared, and recommendations and Phytophthora Dieback Management Procedures implemented.

## Actions (& Responsibilities)

- 3.1.1 The following criteria should be used to identify bushland reserves of high conservation value:**
- **the presence of locally native flora and fauna, habitat values, the presence of flora declared rare or 'priority' by the Department of Conservation and Land Management.**
  - **the likelihood of *P.cinnamomi* being introduced.**
  - **the potential impact of *P.cinnamomi* (Environmental Officer).**
- 3.1.2 Map bushland reserves of high conservation value for *P.cinnamomi* occurrence (Environmental Officer to coordinate).**
- 3.1.3 Prepare and adopt Phytophthora dieback management plans for bushland reserves of high conservation value (Environmental Officer, Engineering Services, Parks and Reserves).**
- 3.1.4 Implement relevant Phytophthora Dieback Management Procedures (Environmental Officer, Engineering Section).**
- 3.1.5 Protect susceptible plant species in high conservation value reserves through the application of phosphite (Parks and Reserves Staff, Community Groups).**

## **Policy 4**

Relevant Local Government staff to receive Phytophthora dieback management training.

### **Strategies**

4.1 Identify the training needs of appropriate Local Government staff and provide training.

### **Actions (& Responsibilities)**

- 4.1.1 Identify staff affected by changes in operations as a result of implementing the Phytophthora Dieback Management Procedures and assess their level of knowledge regarding Phytophthora dieback operations. Staff likely to include work supervisors, leading hands, works crews, plant operators, etc. (Works Supervisor).**
- 4.1.2 Staff to complete nationally accredited Phytophthora dieback training course (available through Dieback Working Group or the Department of Conservation and Land Management).**

## **Policy 5**

Developments approved by the Local Government to contain conditions or recommendations regarding the implementation of Phytophthora Dieback Management Procedures.

### **Strategies**

5.1 Applications for large-scale developments/subdivisions located adjacent to high value bushland, to be approved conditional upon the inclusion of Phytophthora Dieback Management Procedures.

5.2 Applications approved for small to medium-scale developments etc, to contain recommendations regarding Phytophthora Dieback Management Procedures.

5.3 All applications for zoning certificates for rural and semi rural zones to include a Phytophthora dieback information brochure.

### **Actions (& Responsibilities)**

- 5.1.1 Identify large-scale development/subdivision applications located in or adjacent to bushland (Planning Section, Environmental Officer).**
- 5.1.2 Assess conservation value of the bushland (Planning Section, Environment Officer).**
- 5.1.3 Approval for large-scale development/subdivision adjacent to high value bushland to include the implementation of the appropriate Phytophthora Dieback Management Procedures (Planning Section, Environmental Officer).**
- 5.1.4 Monitor approved developments/subdivisions to ensure compliance with appropriate Phytophthora Dieback Management Procedures (Planning, Building, Engineering).**
  
- 5.2.1 Identify small to medium-scale development/subdivision applications in or adjacent to bushland or horticulture (Planning).**
- 5.2.2 Approval of development/ subdivision to include a recommendation regarding the implementation of appropriate Phytophthora Dieback Management Procedures (Planning).**
  
- 5.3.1 Identify areas in the Local Government area that support Phytophthora dieback susceptible vegetation, and include a general information Phytophthora dieback pamphlet when a zoning certificate or requisition order is requested (Planning).**

**Policy 6** The Local Government to provide information to community conservation groups and other groups and individuals, to ensure the integrity of Local Government management activities in relation to *Phytophthora dieback*.

## Strategies

6.1 Relevant agencies, companies, clubs and groups who use or manage Local Government land that contains or is adjacent to remnant vegetation, to be provided with appropriate information and details of changes to existing management arrangements.

6.2 Agencies, companies, clubs and groups who have a high risk of introducing or spreading *P.cinnamomi* to be provided with general *Phytophthora dieback* information material and encouraged to implement *Phytophthora Dieback Management Procedures*.

## Actions (& Responsibilities)

**6.1.1 Identify agencies, companies, clubs and groups who use or manage Local Government land that contains or is adjacent to remnant vegetation, and who undertake activities that have the potential to introduce or spread *P.cinnamomi* (Planning, Engineering, Environmental Officer).**

**6.1.2 Provide these groups with appropriate information regarding *P.cinnamomi*, and details of any management changes that are required, or management changes that may impact on their activities (Environmental Officer).**

**6.2.1 Identify large organisations and companies who undertake activities that could introduce or spread *P.cinnamomi* throughout the Local Government area, provide them with general *Phytophthora dieback* information and encourage them to implement the *Phytophthora Dieback Management Procedures* (Environmental Officer).**

**6.2.2 Actively promote *Phytophthora Dieback Management Procedures* to residents (Environmental Officer).**

**6.2.3 Ensure that general *Phytophthora dieback* information and *Phytophthora Dieback Management Procedures* are easily accessible to residents (Environmental Officer).**

**Policy 7** The Local Government to regularly review procedures and performance in relation to Phytophthora dieback.

### Strategies

7.1 Monitor the performance of personnel against training objectives.

7.2 Monitor success of implementation of Phytophthora Dieback Management Procedures.

7.3 Monitor contractor performance.

### Actions (& Responsibilities)

**7.1.1 Develop performance measures and assess (Staff Supervisor).**

**7.2.1 Regularly assess work sites to ensure Phytophthora Dieback Management Procedures are implemented (Staff Supervisor).**

**7.2.2 Reassess high value reserves to monitor the arrival or further spread of Phytophthora dieback (Environmental Officer to coordinate).**

**7.3.1 Develop performance measures and assess (Contract Supervisor).**

**Policy 8** The Local Government to review new information and technologies, and include in policy when appropriate.

## Strategies

8.1 Each Local Government to form a 'Phytophthora dieback Implementation Group', made up of staff members from Engineering, Parks and Gardens, Rangers, Works Supervisors, Planning and Field staff and Environmental Officers to discuss and monitor implementation of Phytophthora Dieback Management Procedures.

## Actions (& Responsibilities)

- 8.1.1 The Phytophthora dieback Implementation Group should meet annually to monitor and review its procedures for the first three years and thereafter as required or directed (Environmental Officer to coordinate).**
- 8.1.2 The Phytophthora dieback Implementation Group will consider advances in disease management made by other organisations eg. Department of Conservation and Land Management, Main Roads WA etc (Environmental Officer to coordinate).**
- 8.1.3 Consider feedback from Local Government staff involved in implementing Phytophthora Dieback Management Procedures and make the appropriate changes made to the operations (Supervisors to coordinate).**

# PHYTOPHTHORA DIEBACK MANAGEMENT PROCEDURES

The most effective way to manage *P.cinnamomi* is to determine its location within the area of operation. However, it is not practical (or financially feasible) to map *P.cinnamomi* occurrence throughout an entire Local Government area, or prior to each operation. Therefore, manage *P.cinnamomi* effectively in Local Government is to **modify operations that have a high risk of introducing or spreading Phytophthora dieback, when these operations are to occur at sites in or adjacent to high value remnant vegetation.**

However, if operations are to occur in reserves that are regionally significant or have extremely high conservation value, and the operations involves a large investment of resources, mapping of *P.cinnamomi* is recommended. An example of such an activity could be the construction or upgrading of a road through bushland, or the establishment of a gravel pit in a forested area.

In most cases, modifying the operation will not require a significant increase in time or costs. Good planning and some flexibility in works programming will ensure this modification can occur with minimal inconvenience.

The following are activities undertaken by Local Government that have a medium to high risk of introducing or spreading *P.cinnamomi* to bushland or horticultural areas:

- Road / Track construction
- Drain construction
- Maintenance activities
- Parks and Reserves maintenance
- Fire fighting activities
- Off road vehicle use by Ranger staff and other vehicles.

Local Government can also reduce the risk of private landholders introducing and spreading *P.cinnamomi* through the planning approval process. Conditions and/or recommendations can be applied to high-risk activities approved by the Local Government, such as subdivision, development, construction or clearing.



## ROAD & DRAIN CONSTRUCTION AND MAINTENANCE

Road construction, drain construction and maintenance operations have a high risk of spreading *P.cinnamomi*. These activities involve the deliberate and/or accidental movement of soil, water and vegetation, and can occur in or adjacent to bushland, bushland reserves and horticultural areas.

These operations also involve the use of large machinery and equipment, and this machinery can be moved between many sites in a relatively short period.



Phytophthora Dieback Management Procedures do not need to be implemented at all sites where road and drain construction and maintenance is to occur. Each work site should be assessed to determine if it is a High, Medium or Low priority. This assessment will be most successful and cause the least amount of inconvenience if it occurs during the planning stage of a works program. Once the assessment is completed, the appropriate Phytophthora dieback Management Procedures should be implemented

## **High Priority Sites**

### ▪ **Definition**

- Sites in or adjacent to forests, bushland and remnant vegetation with little or no disturbance, or
- Sites in or adjacent to forest/bushland reserves.



### ▪ **Phytophthora Dieback Management Procedures**

Planning	<ul style="list-style-type: none"> <li>▪ Phytophthora Dieback Management Procedures should be considered during the planning phase of the operation.</li> </ul>
Timing	<ul style="list-style-type: none"> <li>▪ Activities to occur in dry soil conditions ie scheduled between November and March and postponed during and following rainfall (grading of gravel roads can occur when the road is damp but not wet).</li> </ul>
Materials	<ul style="list-style-type: none"> <li>▪ Gravel, soil or sand brought onto the site is to be free of <i>P.cinnamomi</i>. These can be purchased suppliers who are accredited by the Nursery Industry Association. If the proposed works involve the supply of a significant amount of materials, it may be more cost effective to survey the site for <i>P.cinnamomi</i> first to confirm the site isn't already infested. If a site is infested, the materials do not need to be free of <i>P.cinnamomi</i>.</li> <li>▪ Stockpile topsoil and return it to the site in preference to importing fill.</li> <li>▪ Imported pipes, stone pitching materials and other construction materials to be free of mud and soil.</li> </ul>
Procedures	<ul style="list-style-type: none"> <li>▪ Stay within the construction zone and avoid moving into bushland areas.</li> <li>▪ If moving into bushland areas on foot, footwear is to be free of mud and soil.</li> <li>▪ Store gravel and other materials at the work site on a hard, dry, well-drained surface that does not drain towards vegetation, and is already clear of vegetation.</li> <li>▪ When grading: grade from upslope to downslope (when applicable), grading equipment is to be clean before commencing work, the angle of grader blade is to be adjusted to avoid carrying soil/gravel long distances and do not grade wider than prescribed.</li> </ul>
Vehicles and Machinery	<ul style="list-style-type: none"> <li>▪ Vehicles, machinery and equipment to be free of mud and soil when: <ul style="list-style-type: none"> <li>- Transporting gravel and other construction materials.</li> <li>- When arriving at a site.</li> <li>- When moving to another high or medium priority site (cleaning is not required when travelling between the site and the depot on sealed roads).</li> </ul> </li> </ul> <p>(There will be a reduced need for cleaning if the operation is completed in dry soil conditions). Cleaning will be easier, and have a lower risk of spreading Phytophthora dieback, if it is completed at a depot. However if clean down is to occur in the field:</p> <ul style="list-style-type: none"> <li>- Select a hard, well-drained surface eg a road well away from remnant vegetation. If possible, wash down in the area where you have been operating.</li> <li>- Minimise the use of water, and attempt to remove mud and soil with a brush or stick.</li> </ul> <ul style="list-style-type: none"> <li>▪ Park vehicles and machinery on cleared land.</li> </ul>
Soil Movement	<ul style="list-style-type: none"> <li>▪ Soil, gravel and plant material removed from any site should not be used at high or medium priority sites.</li> </ul>
Water	<ul style="list-style-type: none"> <li>▪ Scheme or bore water, or sterilised water to be used.</li> </ul>
Staff	<ul style="list-style-type: none"> <li>▪ Staff and contractors involved in road and drain construction and maintenance activities to receive training in Phytophthora dieback management.</li> <li>▪ Phytophthora dieback information to be included in field staff induction process.</li> </ul>

## **Medium Priority Sites**

### ▪ **Definition**

- Sites in or adjacent to bushland and remnant vegetation that may be suffering low to moderate disturbance eg. low density, large lot subdivisions.



### ▪ **Phytophthora Dieback Management Procedures**

Same as procedures for High Priority sites, except:

- The use of materials that are free of *P.cinnamomi* is encouraged, but is not essential (*P.cinnamomi* free materials are a limited resource. These materials should be used at high priority sites, before medium priority sites).
- Activities at high priority sites should be scheduled for dry soil conditions before medium priority sites.

## **Low Priority Sites**

### ▪ **Definition**

- Sites with no remnant vegetation.
- Sites in urban/residential/developed/industrial areas.



### ▪ **Phytophthora Dieback Management Procedures**

No Phytophthora Dieback Management Procedures are required.

However, in areas where there is some remnant vegetation or bushland:

- The use of materials (soil, gravel, sand) that are free of *P.cinnamomi* is encouraged (*P.cinnamomi* free materials are a limited resource. These materials should be used at high and medium priority sites, before low priority sites).
- When possible, equipment, machinery and vehicles arrive at the site in a condition that is free of mud and soil.

## BUSHLAND RESERVE MANAGEMENT

When *P.cinnamomi* spreads to a bushland reserve, it kills many susceptible plants, resulting in a permanent decline in the diversity of the bushland. It can also change the composition of the bushland, often increasing the number of grasses and weeds, and decreasing the number of trees and shrubs. Native fauna that rely on susceptible plants for survival are reduced in numbers, or eliminated from infested sites.

However, bushland that is infested with Phytophthora dieback still has important conservation values. It contains remnant vegetation that provides habitat for native fauna, and has other aesthetic and recreation values. It can also be rehabilitated with plants that are resistant to *P.cinnamomi*. Therefore, it is important to retain and maintain remnant bushland even when it is infested with *P.cinnamomi*.

It is essential that management activities undertaken in 'Bushland' reserves or reserves containing remnant vegetation have Phytophthora Dieback Management Procedures implemented.

The following Phytophthora Dieback Management Procedures will ensure that the risk of introducing and spreading *P.cinnamomi* to bushland reserves is minimised. However, management of bushland reserves will be most effective when the reserve has been surveyed for *P.cinnamomi* and a management plan has been prepared, that addresses *P.cinnamomi*, as well as all other threats.

Because *P.cinnamomi* kills many ornamental plants, it is also good practice to implement Phytophthora Dieback Management Procedures when operating in parks and gardens.

Dieback Free  
Bushland (Falls  
Park, Hovea).



Bushland  
infested with  
Dieback (Falls  
Park, Hovea).



Note: The diversity and density of vegetation has been reduced, but the bushland still contains important conservation values.

## ■ **Phytophthora Dieback Management Procedures for Bushland Reserves**

Management	<ul style="list-style-type: none"> <li>▪ If a Phytophthora Dieback Management Plan has been completed for the bushland reserve, then the recommendations should be implemented.</li> </ul>
Timing	<ul style="list-style-type: none"> <li>▪ Activities such as fire break maintenance, slashing and removal of woody weeds to occur in dry soil conditions is scheduled between November and March and postponed during and following rainfall.</li> </ul>
Bushland Restoration Activities	<ul style="list-style-type: none"> <li>▪ <u>Weeding</u> - If weeds are being manually removed, they should be immediately placed in a container, so plant material or soil is not dropped into other parts of the reserve.</li> <li>▪ <u>Revegetation</u> - If weeds and other disturbances are controlled, revegetation in bushland should not be necessary. Revegetation has a high risk of introducing <i>P.cinnamomi</i>, and should be avoided in bushland reserves that are free of <i>P.cinnamomi</i>. However, if revegetation is required: <ul style="list-style-type: none"> <li>- Consider direct seeding rather than planting seedlings.</li> <li>- Purchase plants from nurseries with Wholesale Accreditation from the Nursery Industry Association, or nurseries with excellent hygiene procedures. Community groups completing revegetation activities to be advised to do the same.</li> <li>- If moving from one part of a bushland reserve to another, or from an infested area to uninfested area, ensure all machinery, tools and equipment are free of mud and soil.</li> <li>- If using mulch, ensure that it has been well composted (the heating part of the composting process kills <i>P.cinnamomi</i>).</li> </ul> </li> </ul>
Access	<ul style="list-style-type: none"> <li>▪ Off road vehicles, motorcycles and horses to be kept out of bushland reserves.</li> <li>▪ Minimise the number of tracks in bushland reserves, and ensure that they have hard, dry and well-drained surfaces.</li> <li>▪ Avoid entering bushland reserves when the soil is wet and muddy, and stay on tracks.</li> <li>▪ Visitors to bushland reserves are to ensure that their footwear is free of mud and soil.</li> <li>▪ <u>When constructing a track:</u> <ul style="list-style-type: none"> <li>- Construct in dry soil conditions.</li> <li>- Map the location of <i>P.cinnamomi</i> prior to constructing the track.</li> <li>- The location of the proposed track should not cross from infested to uninfested.</li> <li>- In the uninfested area: Track to be constructed using clean machinery and tools. Materials that are free of <i>P.cinnamomi</i> to be used.</li> <li>- Consider constructing wooden walkways over muddy areas.</li> <li>- Materials that can be used to construct tracks include gravel that is free of <i>P.cinnamomi</i>, concrete, limestone or woodchips.</li> </ul> </li> </ul>
Fire Protection Activities	<ul style="list-style-type: none"> <li>▪ Mow, slash or use herbicide on fire breaks, rather than plough or grade.</li> <li>▪ When maintaining breaks by grading, do not grade wider than the existing graded area.</li> </ul>
Soil Movement	<ul style="list-style-type: none"> <li>▪ Minimise soil disturbance, mow, slash or use herbicide rather than grade or plough.</li> <li>▪ If soil, gravel, sand etc. is to be imported into a bushland reserve, these materials are to be sourced from a supplier who is accredited by the Nursery Industry Association to ensure they are free of <i>P.cinnamomi</i>.</li> <li>▪ Do not dump plant material or soil in bushland reserves.</li> </ul>
Vehicles, Machinery and Tools	<ul style="list-style-type: none"> <li>▪ All machinery and vehicles (including small tractors, ride on mowers, slashers and utes) to be free of mud and soil on tyres, mudflaps, body and underbody when entering a bushland reserve, when moved into <i>P.cinnamomi</i> free areas, and when moved from one bushland reserve to another.</li> <li>▪ All tools and equipment (including shovels, spades, trowels etc) to be free of mud and soil when entering a bushland reserve, when moved into <i>P.cinnamomi</i> free areas and when moved from one bushland reserve to another.</li> </ul>
Water Management	<ul style="list-style-type: none"> <li>▪ Any water used in bushland reserves to be from scheme or bore supply, or sterilised.</li> <li>▪ Do not discharge drainage water into bushland reserves.</li> </ul>
Communication	<ul style="list-style-type: none"> <li>▪ In public reserves, place signs at entrances to recommend avoiding access when the soil is muddy, and that visitors should keep on tracks.</li> </ul>
Roadsides	<ul style="list-style-type: none"> <li>▪ Slashers, tractors and other equipment used on roadsides to be washed down daily when operating in bushland areas.</li> </ul>
Protecting Vegetation	<ul style="list-style-type: none"> <li>▪ A program of phosphite treatment should be implemented at bushland reserves that contain Phytophthora dieback, contain threatened species or are likely to have Phytophthora dieback introduced.</li> </ul>
Staff	<ul style="list-style-type: none"> <li>▪ Shire staff and contractors involved in maintenance activities to receive training in Phytophthora Dieback Management Procedures for Bushland Reserves</li> <li>▪ Contracts for fire break maintenance to contain the relevant conditions listed above.</li> </ul>

## FIRE PROTECTION ACTIVITIES

Local Government has a major role in fire protection activities. Local Government officers enforce the Bush Fire Act and regulations, and assist residents to develop fire protection plans. Local Government also conducts various fire prevention education programs.

Local Governments are responsible for volunteer bush fire brigades, and appointed officers coordinate fire fighting in rural areas. Local Government's often provide financial assistance to volunteer fire brigades.

Therefore, Local Government can play an important role in ensuring that fire protection activities have minimal impact on the natural environment.



▪ **Phytophthora Dieback Management Procedures for Fire Protection Activities**

It is recognised and supported that Phytophthora Dieback Management Procedures should not hinder the primary objectives of saving life and property. However, during activities such as training, mopping up, prescribed burning etc, there is an opportunity to introduce Phytophthora Dieback Management Procedures

When training and/or prescribed burns are occurring at sites that are in or adjacent to bushland or remnant vegetation, the following Phytophthora Dieback Management Procedures should be implemented.

Hygiene	<ul style="list-style-type: none"> <li>▪ Machinery, vehicles and equipment to arrive at the site free of mud and soil.               <ul style="list-style-type: none"> <li>- To clean machinery use a brush, spade, bar or compressed air in preference to washing down with water.</li> <li>- Wash down at designated wash down points or on a hard, well-drained surface, that does not run off into bushland.</li> <li>- Clean machinery, vehicles and equipment before moving to another area.</li> </ul> </li> <li>▪ If you know the Phytophthora dieback status of the area, do not move from infested to uninfested areas unless the vehicle, machinery and equipment are free of soil and mud.</li> </ul>
Fire Breaks	<ul style="list-style-type: none"> <li>▪ Complete construction and maintenance of firebreaks during dry soil conditions. Schedule between November and March and postpone following rain.</li> <li>▪ Don't duplicate existing access.</li> <li>▪ Select strategic breaks that are low in the landscape.</li> <li>▪ Construct firebreaks to shed water and dry quickly.</li> </ul>
Prescribed Burning	<ul style="list-style-type: none"> <li>▪ Select burn boundaries on well formed hard surface roads.</li> <li>▪ Keep machinery movement to a minimum.</li> <li>▪ Avoid grading boundaries unless necessary. Consider alternatives such as slashing, hand raking and herbicide.</li> </ul>
Fire Suppression	<ul style="list-style-type: none"> <li>▪ Nominate clean down points for incoming and outgoing plant and vehicles.</li> <li>▪ Use hand tools to suppress the fire where this method will succeed. Use machinery only when necessary.</li> <li>▪ Use scheme or bore water for fire suppression whenever possible.</li> </ul>
Training	<ul style="list-style-type: none"> <li>▪ Training and practice sessions should not occur in or adjacent to bushland areas or horticultural crops in wet soil conditions.</li> <li>▪ All new and existing fire crew members to receive a copy of 'Phytophthora Dieback Information Brochure'.</li> <li>▪ Phytophthora dieback information to be included in induction process for new crewmembers.</li> </ul>



## PLANNING

The Local Government planning approval process provides an opportunity to advise landholders on how they can minimise the risk of introducing or spreading *P.cinnamomi*. There is also an opportunity to place conditions on developments to minimise the risk of their actions introducing and spreading Phytophthora dieback, particularly on sites that contain high value remnant vegetation.

## **Phytophthora Dieback Management Procedures for Large Scale Developments / Subdivisions**

### **Definition**

Large Scale Developments/Subdivisions are those that involve:

- Clearing of more than 5000m<sup>2</sup> of native vegetation, or
- Subdivision to create more than six lots, or
- Development – where site coverage exceeds 500m<sup>2</sup>.

When large scale developments/subdivisions are proposed in or adjacent to sites listed in Bush Forever, sites that are locally significant, or bushland (under public or private ownership) considered to have ‘high conservation value’, the following Phytophthora Dieback Management Procedures should be conditional to approval:

### ▪ **Phytophthora Dieback Management Procedures**

Mapping	<ul style="list-style-type: none"> <li>▪ The site is to be surveyed for Phytophthora dieback by a CALM accredited interpreter.</li> </ul>	
Timing	<ul style="list-style-type: none"> <li>▪ When possible/practical, the development should be completed in dry soil conditions (between November and March, and postponed following rain). This will reduce the need for cleaning vehicles and equipment. However, the issue of dust creation will also need to be considered. If dry soil conditions is not possible, greater attention will need to be spent on vehicle and equipment cleaning.</li> </ul>	
Drainage and Water	<ul style="list-style-type: none"> <li>▪ Water use during construction should be minimised. When water is necessary, it should be from scheme or bore supply or sterilised.</li> <li>▪ Water draining from the site is not to enter bushland.</li> </ul>	
Staff	<ul style="list-style-type: none"> <li>▪ Contractors and staff involved in the development/subdivision to be provided with Phytophthora dieback information material and to be made aware that the development/ subdivision is occurring with Phytophthora Dieback Management Procedures in place.</li> </ul>	
	<b>If the site is Phytophthora dieback Free</b>	<b>If the site is Phytophthora dieback Infested</b>
Materials	<ul style="list-style-type: none"> <li>▪ Gravel/sand/topsoil to be purchased from a Nursery Industry Association Accredited Soil Supplier (refer to Part 9).</li> <li>▪ Storage of gravel/sand/topsoil on site to be on a hard, dry well drained surface.</li> <li>▪ Construction materials such as pipes, rocks, timber, bricks etc, to be free of mud and soil when arriving at the site.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Any soil/sand/gravel/vegetation removed from the site should be stored at a site that is also infested with Phytophthora dieback, or a site where the pathogen will not have any impact.</li> </ul>
Vehicles & Machinery	<ul style="list-style-type: none"> <li>▪ All machinery, vehicles and equipment should arrive at the site free of mud and soil, particularly on tyres, mudflaps and underbody.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Vehicles and machinery exiting the site to be free of all mud and soil, particularly on the tyres, mudflaps and underbody (it is acceptable for vehicles and machinery to be taken to a cleaning facility on sealed roads).</li> </ul>
Land-scaping	<ul style="list-style-type: none"> <li>▪ Plants used in landscaping should be purchased from a Nursery with Wholesale Accreditation from the Nursery Industry Association, or from a nursery with excellent hygiene conditions.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Plants used in landscaping should be purchased from a Nursery with Wholesale Accreditation from the Nursery Industry Association, or from a nursery with excellent hygiene conditions. Species selected for the landscaping should be resistant to <i>P. cinnamomi</i>.</li> </ul>
Monitoring	<ul style="list-style-type: none"> <li>▪ A Phytophthora dieback survey should be completed 2 years after the completion of construction to determine the success of the Phytophthora Dieback Management Procedures.</li> </ul>	

### **Phytophthora Dieback Management Procedures for Medium Scale Developments / Subdivisions**

▪ **Definition**

Medium Scale Developments/Subdivisions are those that involve:

- Clearing of less than 5000m<sup>2</sup> of native vegetation, or
- Subdivision to create six lots or less, or
- Development (commercial or residential)– where site coverage is less than 500m<sup>2</sup>.

When medium scale developments are proposed in or adjacent to sites listed in Bush Forever, sites that are locally significant, or bushland (under public or private ownership) considered to have ‘high conservation value’, the following Phytophthora Dieback Management Procedures should be recommended:

▪ **Phytophthora Dieback Management Procedures**

Materials	Soil/sand/gravel brought on to the site should be purchased from a soil supplier accredited by the Nursery Industry Association (refer to Part 9).
Vehicles, Equipment, Machinery	All vehicles, machinery and equipment entering and leaving the site should be free of mud and soil (particularly on the tyres, mudflaps and underbody).
Timing	Schedule the development/construction to occur in dry soil conditions (November to March), if dust is unlikely to be an issue. This will reduce the chance of vehicles and machinery picking up infected mud/soil, and will reduce the need for cleaning vehicles and machinery.
Soil Movement	Any soil/gravel/plant material removed from the site should not be placed in or near bushland or horticultural crops.
Water	Minimise the amount of water used at the site, and do not allow water to drain into bushland.

A Phytophthora dieback information brochure should also be included with these recommendations.

### **Phytophthora Dieback Management Procedures for Rural and Semi-rural zoned properties.**

Include a Phytophthora dieback information brochure with all zoning certificates for rural and semi rural zoned properties.

## ALL LOCAL GOVERNMENT STAFF

The procedures listed below will be most relevant to staff working in planning, engineering, ranging, surveying and environmental health.

### **Phytophthora Dieback Management Procedures for all Local Government staff.**

- All vehicles, machinery, tools and equipment to be maintained in a condition that is free of all mud and soil.
- Staff completing work in bushland reserves or bushland areas of high conservation value and little disturbance, to ensure that their footwear is free of mud and soil when entering the site.

# GUIDELINES - CLEANING & STERILISING

## CLEANING

Removing all mud and soil from vehicles, machinery, tools and equipment is usually sufficient to minimise the risk of spreading *P.cinnamomi*. The following guidelines provide additional information on the most effective ways to 'clean down'.

### **Cleaning Vehicles and Machinery**

- Cleaning will be easier and more effective if it is completed at a depot or a permanent/designated cleaning area.
- If cleaning is to occur in the field,
  - Select a site with a hard, well-drained surface (eg. a road) that is well away from remnant vegetation. If possible, wash down in an area that is close to the area you have been operating in.
  - Minimise the amount of water used. Try to remove soil and mud when it is dry (a stiff brush may assist this process), and use a brush or stick to remove compacted soil.
  - Wash down on ramps if possible.
  - Do not allow mud and wash-down effluent to drain into bushland.
- Do not drive through wash-down effluent.
- Pay particular attention to mudflaps and tyres.

### **Cleaning Footwear**

- Try to remove mud and soil when it is dry.
- Remove as much mud and soil as possible with a brush or stick, and minimise the amount of water used.
- Collect all mud and soil removed in a bag or bucket. Dispose of this material at a site that is already infested with *Phytophthora dieback*, or a site that contains no remnant vegetation (do not allow this material to enter bushland).

**It may be useful for work crews to carry a small brush and plastic bag in their vehicles.**

## STERILISING

If you are entering very high value bushland or have come from a *Phytophthora dieback* infested area, you can take the extra precaution of sterilising tools and footwear. If you are propagating plants, sterilising tools and footwear is essential. Anything to be sterilised should first be cleaned so all soil and mud is removed.

### **Sterilising Equipment, Tools and Footwear**

Methylated spirits is suitable for sterilising small hand tools and footwear in the field. Place the methylated spirits in a spray bottle, spray to cover all surfaces, and allow time for it to soak into all soil material (a couple of minutes is sufficient).

Other equipment can be sterilised by soaking in a disinfectant such as bleach (containing the active ingredient sodium hypochlorite). Dilute the bleach (1 part

bleach to 10 parts water), soak the tools for a few minutes, and then rinse (follow manufacturer's safety instructions).

**Sterilising Water**

To sterilise water, add 6mL of sodium hypochlorite (eg. pool chlorine or bleach) to every 10L of water (follow manufacturer's safety instructions).

# PHYTOPHTHORA DIEBACK MANAGEMENT PLANS

A Phytophthora Dieback Management Plan is a document that lists the actions that can be implemented at a bushland reserve to reduce the risk of introducing or spreading *P.cinnamomi*. A Phytophthora Dieback Management Plan can be a stand 'alone document', but it will be most effective if it can be incorporated into an overall management plan for a reserve.

Bushland reserves and areas of remnant vegetation that meet the following criteria should have a Phytophthora Dieback Management Plan prepared:

1. High conservation value (supports native flora and fauna, has high habitat value, DRF or priority listed species are present).
2. Potential for *P.cinnamomi* to be introduced.
3. Potential medium to high impact if *P.cinnamomi* was introduced.

To prepare a Phytophthora dieback Management Plan, the location of *P.cinnamomi* in the reserve needs to be determined. To accurately determine the location of *P.cinnamomi*, you will need to employ the services of a professional Phytophthora dieback interpreter (refer to Part 9).

Once the reserve has been surveyed for *P.cinnamomi*, the Phytophthora dieback Management Plan can be prepared. The objective of *P.cinnamomi* management is to reduce the risk of further spread of *P.cinnamomi*, and to minimise the impact of existing infections.

Attached is an example of a Phytophthora Dieback Management Plan prepared for a bushland reserve in the Perth metropolitan region.

# **MANAGEMENT OF DIEBACK AT FALLS PARK, HOVEA.**

March 2000

Prepared by Sharon Kilgour  
For the Dieback Working Group



## The Dieback Working Group

The Dieback Working Group consists of representatives from local government, community conservation groups and state government agencies. The Group was formed in response to the lack of knowledge and management assistance about the plant disease in native vegetation known as ‘dieback’ which is caused by the introduced fungus *Phytophthora cinnamomi*. Since its formation in 1996, the Dieback Working Group has sought to:

- Increase awareness about the plant disease caused by *Phytophthora cinnamomi*.
- Encourage the adoption of disease prevention and management policies.
- Encourage the implementation of control measures to minimise the spread and impact of the fungus.

## Membership

City of Armadale	Department of Environmental
City of Canning	Protection
City of Cockburn	Friends of Ellis Brook
City of Fremantle	Ministry for Planning
City of Gosnells	Shire of Kalamunda
City of Melville	Shire of Mundaring
Department of Conservation and Land	Shire of Serpentine Jarrahdale
Management	Shire of Swan
Department of Land Administration.	Roleystone Dieback Action Group

## Acknowledgments

Funding for this publication and the Dieback Working Group was provided by the Federal Governments Natural Heritage Trust and the Shire of Kalamunda. Thanks to the members of the Friends of Falls Park (north and south), and to staff members at the Shire of Mundaring for their contributions to this document.



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**Appendix 1 - Managing *P.cinnamomi*– General Guidelines.**

**Appendix 2 – Suggestions for Signage.**

**Appendix 3 - Brochure for neighbouring landholders, visitors etc.**

**Appendix 4 – How to Spray and Inject, Equipment suppliers.**

**Appendix 5 – Useful Contacts**

# Introduction

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The purpose of this document is to provide specific guidelines regarding the management of dieback (caused by *Phytophthora cinnamomi*) at Falls Park. These guidelines should be integrated with the other management actions that occur at the site.

## ■ FALLS PARK

### ■ Vesting and Purpose

Falls Park (Reserve Number 12453) is vested with the Shire of Mundaring for the purpose of 'Parkland and Recreation'.

### ■ Location

Falls Park is located on the Darling Plateau, in the suburb of Hovea, Shire of Mundaring. It is located between Richardson and Falls Road, west of Gliddon Road. The reserve is approximately 22 hectares in size. For management purposes, the Park is split into 2 areas. Falls Park (south) is located south of Falls Road and is approximately 2 hectares. Falls Park (north) is located north of Falls Road and is approximately 20 hectares. See Map 1 for a location map of Falls Park.

Map 1 – Location of Falls Park.

## ■ Natural Features of the Reserve

Soils at Falls Park are classified as Dwellingup and Murray types. There are granite outcrops in the western section of the reserve.

The vegetation type of the reserve is Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia callophylla*) forest. Other overstorey species include Banksia, Allocasuarina and Persoonia. Overall, the vegetation in the Park is in good condition.

Jane Brook runs through Falls Park, south of Falls Road. As the remainder of Falls Park slopes down towards Jane Brook, there are numerous drainage lines running through the Park towards Jane Brook.

## ■ Impacts

Because the residential and urban development surrounding the Park is limited, the Park is still in relatively good condition. Weed invasion is moderate, but could pose a significant threat in the future. Rubbish dumping and clearing is minimal. The pattern of drainage in Falls Park has influenced the way in which *P.cinnamomi* has spread through the reserve. An inappropriate fire regime could also be a threat to this Park.

## ■ Management

The Shire of Mundaring is responsible for the management of Falls Park. At present, there is no management plan for the reserve. Two active community groups (Friends of Falls Park North and Friends of Falls Park South) complete most of the management and bushland restoration work at the Park.

An enquiry to “One Call WA – Underground Facility Location Enquiry” found that there are no facilities located in the reserve. A Telstra cable and Water Corp pipe are located in the road reserve along the northern part of Falls Road (this information was correct on 20/3/2000).

## ■ PHYTOPHTHORA CINNAMOMI (DIEBACK)

Dieback is the name used to describe the plant disease caused by the fungus *Phytophthora cinnamomi*. There are many species of *Phytophthora*, but *P.cinnamomi* causes the most severe and widespread damage to native vegetation. *P.cinnamomi* spends its entire life in the soil and plant tissue (it is not spread by wind). It attacks the roots of plants and causes them to rot. This kills the plant by stopping the uptake of water and nutrients.

Soil that is warm and moist provides the best conditions for *P.cinnamomi* because it produces millions of spores under these conditions, and the spores move in the soil water to infect plant roots. It spreads through plant tissue at a rate of about one metre each year on flat ground. However, human activity causes the most significant and devastating spread of *P.cinnamomi*. Road works, construction, earth moving, dirty vehicles, fencing, stock, and landscaping all contribute significantly to its spread by moving *P.cinnamomi* spores.

Up to 25% of native Western Australian plants are susceptible to *Phytophthora cinnamomi* (Komorek, 1994). Table 1 lists the major plant genera with species affected by *Phytophthora*.

Table 1 – Major plant genera with species affected by *Phytophthora* species.

PROTEACEAE	MYRTACEAE	EPACRIDACEAE	OTHER
Adenanthos	Agonis	Andersonia*	Allocasuarina
Banksia*	Beaufortia	Astroloma*	Anarthia
Conospermum	Calothamnus	Leucopogon*	Boronia
Dryandra	Calytrix	Lysinema*	Conostylis
Franklandia	Eremaea	Monotoca*	Dampiera
Grevillea	Eucalyptus	Sphenotoma*	Dasypogon
Hakea	Hypocalymma	Styphelia*	Daviesia
Isopogon*	Kunzea		Eutaxia
Lambertia*	Melaleuca		Gastrolobium
Persoonia*	Regelia		Hibbertia*
Petrophile*	Scholtzia		Hovea
Stirlingia*	Thryptomene*		Jacksonia
Synaphea	Verticordia*		Lasiopetalum*
Xylomelum			Latrobea
			Macrozamia
			Oxylobium
			Patersonia
			Phlebocarya
			Xanthorrhoea
			Xanthosia

\* indicates many species in the genus are severely affected.

A range of agricultural crops and ornamental plants are also susceptible to *P.cinnamomi*. These include peach and apricot trees, grapevines, avocados, radiata pine, camellias, azaleas and rhododendrons (Erwin & Ribeiro, 1996, Cahill, 1993).

*P.cinnamomi* is not native to Western Australia. It first arrived in Western Australia on soil around the roots of cultivated plants, shortly after European settlement. It was spread extensively throughout the southwest when infected gravel was used for road construction. *P.cinnamomi* is now widespread throughout the south west of Western Australia. It is confined to areas with more than 400mm annual rainfall, and extends between Eneabba and Esperance. It has infested forest, heathland and woodland communities, and is present in much of the bushland around Perth.

# *Phytophthora cinnamomi* at Falls Park

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## ■ OBJECTIVES

The objective of *P.cinnamomi* management should be to minimise the further spread of the pathogen, and to minimise the impact of existing infection. Preventing further spread involves controlling any human influenced spread, as the natural movement through the soil cannot be controlled. But to manage effectively, the exact location of the fungus must be determined (this is achieved by assessing soils and vegetation).

## ■ SURVEY

Falls Park was surveyed for the presence of *P.cinnamomi* in April 1999. The survey was completed by Glenn Tuffnell and Linda Collins from GLEVAN Dieback Consultancy Services.

Dieback survey involves observing the following:

- Death of plant species that are susceptible (indicator species).
- Total deaths – dieback kills plants completely and quickly.
- An age range in the deaths ie. old deaths and recent deaths.
- Death in a range of susceptible plant species.
- A vector that could have introduced the disease.
- Other factors that could have caused tree death.

Soil and plant samples are usually taken and tested in the laboratory to confirm field observations. The area surveyed is then categorised as infested, uninfested and uninterpretable.

To complete the survey, the entire Park was examined by the consultants, and all indicator species were scrutinised for patterns associated with *P.cinnamomi* infestation.

Six plant species were found to provide a good indication of *P.cinnamomi* presence at Falls Park. These are listed in Table 2.

Table 2. Plant species used to determine the presence of *P.cinnamomi* at Falls Park.

Adenanthos barbiger	Patersonia species
Banksia grandis – Bull Banksia	Xanthorrhoea gracilis
Macrozamia riedlei	Xanthorrhoea preissii – Grass Tree

Plant deaths that were thought to be caused by *P.cinnamomi* were sampled. This involved digging up the whole plant, and collecting parts of the root tissue and soil. A total of three samples were taken to determine the presence or absence of *P.cinnamomi*.

## ■ RESULTS

Approximately 50% of Falls Park is infested with *P.cinnamomi*. Refer to Map 2 for the location of *P.cinnamomi* infestation.

Description (from GLEVAN, 1999):

- *P.cinnamomi* infestation is present around the perimeter of the Park.
- Drought is thought to be the cause of *Banksia grandis* death in the transitional vegetation on the north western disease edge.
- A very small section of uninfested vegetation is present approximately half way down the eastern fire break and approximately 30 metres to the west. This area has is likely to have remained uninfested, due to subsurface water flows being diverted around this area (likely to be caused by a granite dyke which is just under the soils surface). This area will eventually become infested due to the movement of *P.cinnamomi* in plant roots.
- The section of the Park located south of Falls Road is entirely infested with *P.cinnamomi*.

Test Result: The three samples taken from the reserve were negative for *P.cinnamomi*. However other factors indicated to the interpreter that *P.cinnamomi* was present. Sample Note: Negative sample results do not mean that a site is free of *P.cinnamomi*, as it may have been missed during the sampling. However positive results mean that the pathogen is definitely present.

## ■ DISCUSSION

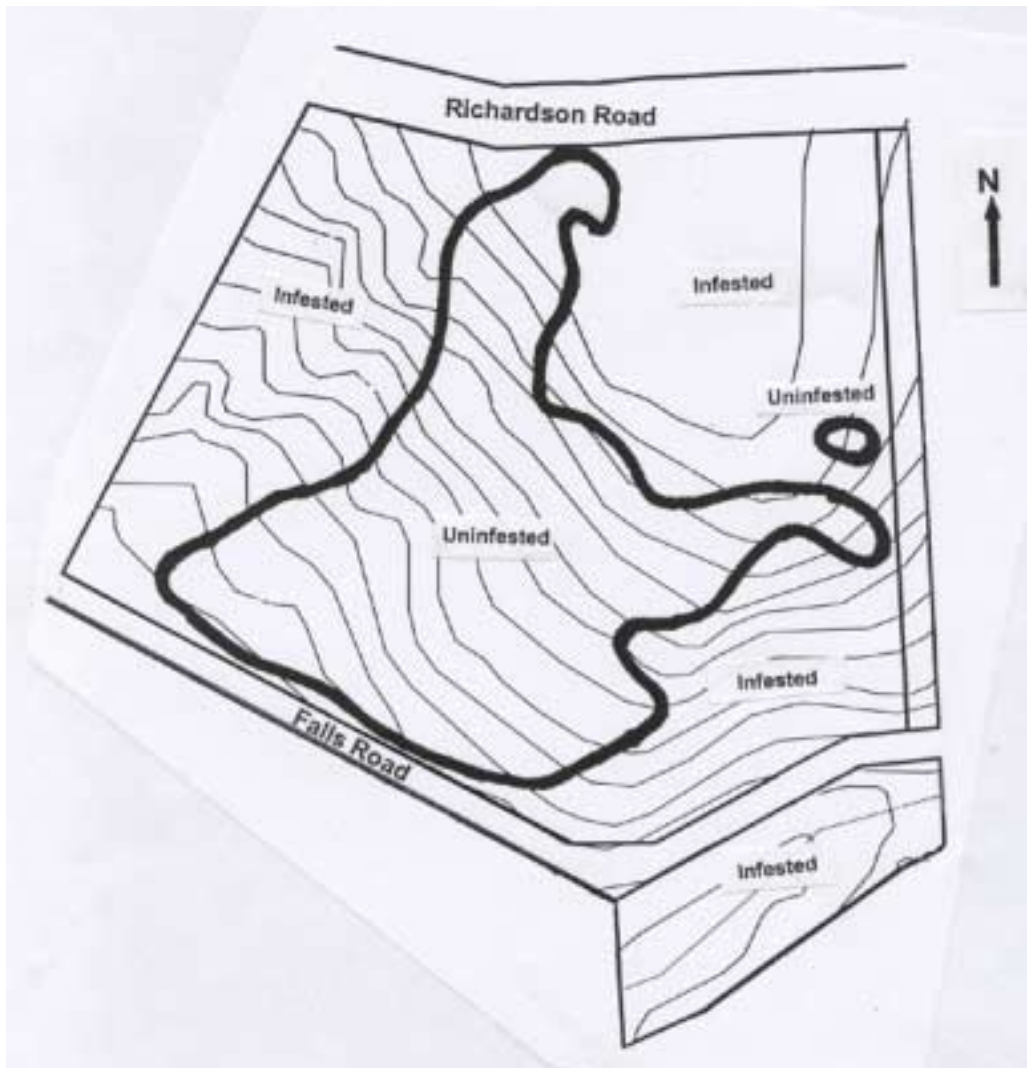
*P.cinnamomi* infestation at Falls Park will continue to spread, and over time, continue to kill susceptible plant species. Movement of *P.cinnamomi* will be most rapid downslope. The ultimate outcome will be a significant reduction in the number of susceptible species remaining in Falls Park. The time-frame by which this will occur is unknown. It may take years or decades.

Likely Cause of Entry: Although the activity or event that introduced *P.cinnamomi* to Falls Park is difficult to determine, road construction and/or road maintenance, residential development or vehicle access may have played a role.

Likely Cause of Spread: The pattern of infestation in Falls Park indicates that topography and human movement have contributed to the spread of *P.cinnamomi*. Steep slopes, and drainage runoff from Richardson Road are likely to have caused the fungus to spread from the north of the Park, to the south. Because all tracks are located in *P.cinnamomi* infested areas, it is likely bushwalking has also contributed to the movement of *P.cinnamomi* in Falls Park.

Impact: The vegetation in the north east corner is suffering the most significant impact. Disease expression was generally very good in the northern end of the Park, and along the firebreak which runs parallel to Falls Road in the south. In both of these areas the full range of indicator species can be seen expressing symptoms on the disease edge. Subtle disease expression is occurring on the western side of the rocky outcrop and also in the dense vegetation in the south eastern section of the Park. This may be due to the steep contours and fertile soils in the south eastern section, and the steep, dry conditions in the western side of the reserve. Disease expression in the area south of Falls Park Road is subtle, with *Xanthorrhoea preisii* occasionally being affected.

Map 2 – Location of *P.cinnamomi* infestation in Falls Park.





## ■ MANAGEMENT RECOMMENDATIONS AND ACTIONS

To prevent the further spread of *P.cinnamomi*, and to minimise the impact of existing infection at Falls Park, the following Management Recommendations and Actions should be implemented.

### Management Recommendation 1

No new tracks are to be constructed in Falls Park.

There are presently no plans to construct new, or realign existing walk tracks in Falls Park. However, if new track construction or track re-alignment is to occur in the future, the location should be planned to avoid passing from infested to uninfested sections of the reserve.

### Management Recommendation 2

No soil/gravel/mulch/plants to be brought into the uninfested parts of Falls Park. If these materials must be introduced, they must be *P.cinnamomi* free.

#### ACTION

- 2.1 Identify activities occurring at Falls Park that involves the movement or introduction of soil/gravel/mulch/plants eg track maintenance, revegetation.
- 2.2 Identify alternative techniques that could be used to avoid the movement of soil/gravel/mulch/plants.
- 2.3 If soil/gravel/mulch/plants must be introduced to the uninfested part of Falls Park, they should be tested to determine if it is free of *P.cinnamomi*, or should be purchased from a supplier accredited by the Nursery Industry Association (see Appendix 5).

### Management Recommendation 3

Any major works proposed in or adjacent to the Park that involves significant soil disturbance or involves the alteration of drainage patterns, to be assessed to determine potential impacts.

#### ACTION

- 3.1 Any major works proposed in or adjacent to the Park to be considered by the Shires Environmental Officer, in conjunction with Engineering staff.

### Management Recommendation 4

Communication to occur with surrounding landholders, visitors to the Park, facility providers and other stakeholders to inform them that *P.cinnamomi* is present, and how they can assist in slowing its spread.

#### **ACTION**

- 4.1 Determine the most frequently used entry point/s to Falls Park. Develop signage that is of an appropriate size, contains appropriate information and is designed to compliment other signs that may be erected in the future, or that are erected at reserves in the Shire of Mundaring. Erect signs at reserve entrances. (Refer to Appendix 2 for information on sign content).
- 4.2 Erect signs along walk tracks highlighting plants that have been killed by *P.cinnamomi* or an obvious infestation edge.
- 4.3 Distribute a brochure to neighbouring landholders outlining the *P.cinnamomi* status of the reserve and how visitors to the park can reduce the risk of *P.cinnamomi* spreading, eg remaining on tracks.
- 4.4 Use local newspapers and letter box drops to invite surrounding landholders to dieback treatment days, dieback information workshops, or interpretive bushwalks.
- 4.5 Telstra and Water Corp to be contacted in writing, and informed that *P.cinnamomi* is present in the road reserve along the northern part of Falls Road, and that their maintenance activities may potentially spread *P.cinnamomi* to other sites.

#### **Management Recommendation 5**

Maintenance activities (such as fencing, track maintenance etc) to occur in dry soil conditions, when possible/practical.

#### **ACTION**

- 5.1 Identify maintenance activities (such as fencing, track maintenance etc) that may be completed at Falls Park by the 'Friends' groups or by the Shire of Mundaring.
- 5.2 Identify the maintenance activities that can be completed during dry soil conditions, and schedule these for dry soil conditions.

#### **Management Recommendation 6**

Off Road Vehicles (ORV's), motorcycles and horses to be excluded from Falls Park, due to likelihood of these activities spreading *P.cinnamomi* to other bushland.

ORV's, motorcycles and horses are able to spread *P.cinnamomi* by picking up infested soil in their tyres and hooves. Because the tracks in Falls Park are all located in *P.cinnamomi* infested areas, horses and motorcycles entering the reserve and remaining on the tracks pose little risk to *P.cinnamomi* spreading in Falls Park. However, horses and motorcycles often stray from tracks, and have the potential to pick up infested soil in Falls Park and spread it to other bushland reserves. Horses and motorcycles also cause other forms of environmental degradation such as damage to plants, erosion and the spread of pest plants.

#### **ACTION**

- 6.1 Surrounding landholders to be contacted regarding their use of the Park for horse riding and motorcycling, and alternative options for these activities to be identified.

- 6.2 The Shire of Mundaring to support the prevention of horse and motorcycle entry to the reserve, and to assist 'policing' this issue.
- 6.3 The Shire of Mundaring to provide information when requested to horse riders and motorcyclists about where horse riding and motorcycle riding is appropriate.
- 6.4 Fencing Falls Park and providing 'pedestrian only' access points can be an effective method of preventing horse and motorcycle access. However this is an expensive option, and the overall benefit of this needs to be determined.

**Recommendation 7**

The Shire of Mundaring, Friends Groups and other groups undertaking on-ground works, to implement hygiene measures (refer to Appendix 1).

**ACTION**

- 7.1 Footwear, tools, machinery and equipment to be free of all soil when entering the uninfested parts of Falls Park.
  - 7.1.1 Footwear, tools, machinery and equipment to be free of all soil when leaving Falls Park.

**Management Recommendation 8**

A program of phosphite treatment to be implemented and *P.cinnamomi* infestation to be monitored.

Phosphite is a chemical that can protect plants that are susceptible to *P.cinnamomi*. Phosphite works by boosting the plants natural defences. Refer to Appendix 4 for more information.

**ACTION**

- 8.1 As Falls Park is a relatively large sized reserve, it is unlikely that the entire reserve can be treated with phosphite. Therefore phosphite treatment should be prioritised as follows:

<b>Priority 1</b>	Inject and spray susceptible vegetation that is priority or DRF listed, locally significant, or has special significance to the Park.
<b>Priority 2</b>	Inject and spray susceptible vegetation 5 metres downslope of the <i>P.cinnamomi</i> edge.
<b>Priority 3</b>	Inject and spray all susceptible vegetation within 5 metres of the <i>P.cinnamomi</i> edge.
<b>Priority 4</b>	Inject and spray all vegetation in the uninfested part of the reserve.
<b>Priority 5</b>	Inject and spray all susceptible vegetation in the reserve.

Refer to Map 3 for treatment priorities.

Although no formal flora survey has been completed, no plants that are listed by the Department of Conservation and Land Management as 'Priority' or 'Declared Rare Flora' have been identified in Falls Park. Considering the size of the Park and the infestation, Priority 1 and 2 are achievable using the

volunteer labour provided by the Friends of Falls Park group. Completing Priority 1 and 2 will take approximately three to four, 3 hour field sessions, using a large sized spray tank with approximately 10-15 people assisting.

- 8.2 The health of plants in the treated areas should be monitored. If there is no plant death, injection should be repeated every 3-5 years, and spraying every 2-3 years. Refer to Appendix 4 for further details regarding phosphite treatment.
- 8.3 Plant health along the rest of the *P.cinnamomi* edge should be monitored 3 monthly to determine areas of rapid spread. Any areas where rapid spread is occurring should be treated with phosphite.
- 8.4 The reserve should be re-surveyed by an accredited dieback interpreter every 3 years to determine the success of phosphite treatment, the success of other dieback control measures and identify areas where the infestation is spreading rapidly and requires treatment.

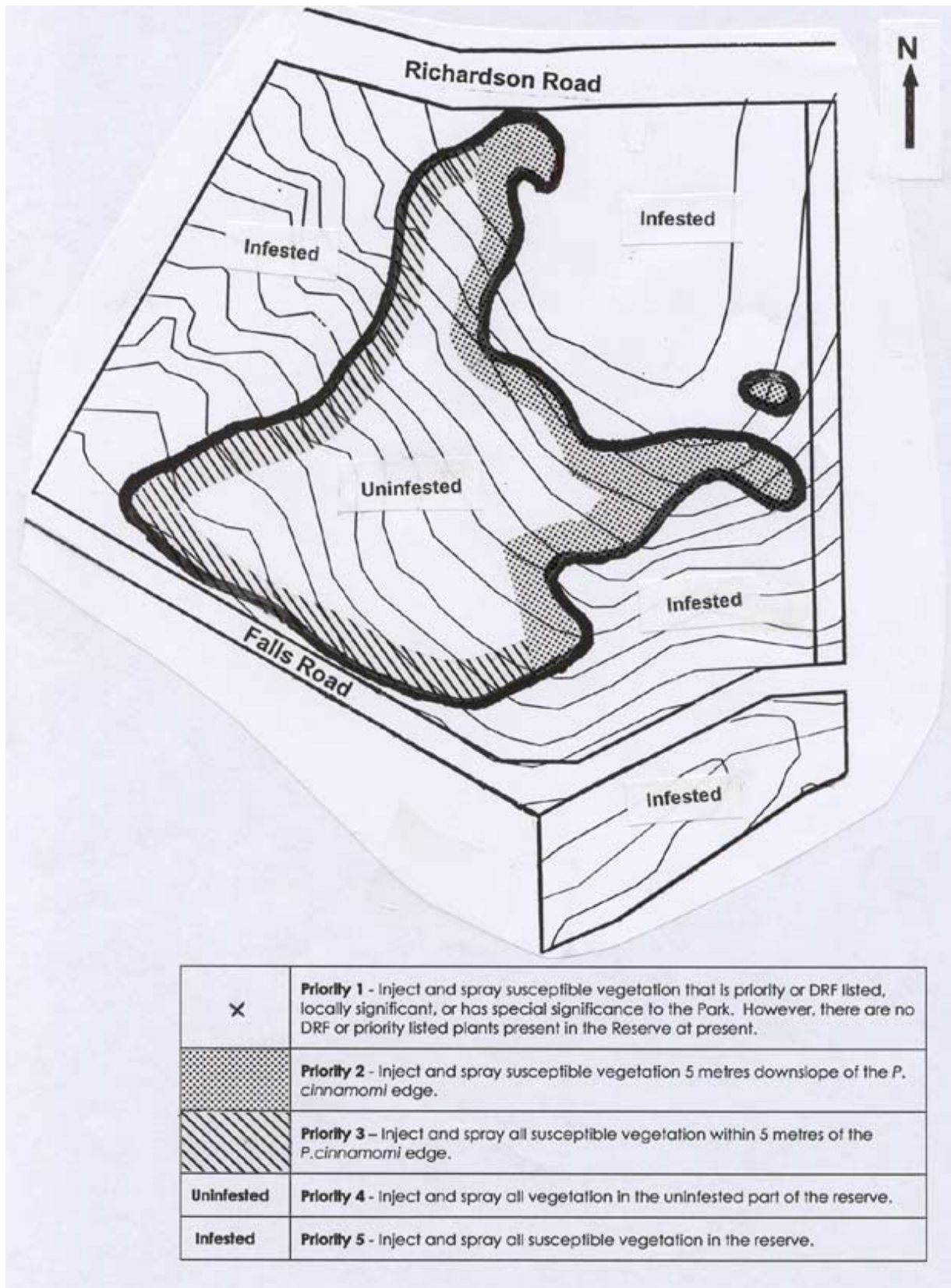
\*\* As of the 20 March 2000, the Friends of Falls Park had completed stem injection of trees 10 metres downslope of the *P.cinnamomi* edge.

#### **Recommendation 9**

The management guidelines listed in Appendix 1 to be considered in all management decisions, particularly in relation to bush restoration activities.

Implementing these recommendations will have other positive benefits for the conservation values of Falls Park, particularly in relation to the control of pest plants and erosion.

Map 3 – Phosphite treatment priorities in Falls Park



## ■ COSTS

This is an estimate of the costs required to implement the *P.cinnamomi* management plan over the next four years.

Management Action (over 4 years)	Estimated Cost
Signage	\$ 1000.00
Dieback Re-survey	\$ 1000.00
Treatment	
• Chemical	\$ 400.00
• Labour (12 hours, 15 people @ \$15/hour)**	\$ 2700.00**
• Hire of equipment	\$ 50.00
<b>TOTAL</b>	<b>\$ 2450.00</b>

\*\* Likely to be provided by a volunteer labour force.

### Financial Year Breakdown

	Signage	Treatment	Resurvey	TOTAL
2000 / 01	\$ 500.00	\$ 250.00		\$ 750.00
2001 / 02	\$ 500.00			\$ 500.00
2002 / 03		\$ 200.00	\$ 1000.00	\$1200.00
2003 / 04				

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# Appendix 1

Managing *Phytophthora cinnamomi*.  
General Guidelines



## Bushland Management

*Phytophthora cinnamomi* should be taken into consideration when planning the management of a bushland reserve, and when planning specific management activities. Adequate planning will ensure the risk of spreading *P. cinnamomi* is reduced at minimal cost and inconvenience.

### Dieback Control Measures

1. Where practical, schedule activities that involve soil disturbance for dry summer months (November – March). These activities should only occur when the soil is dry.
2. Minimise the number of tracks that pass through the bushland, and ensure the tracks are well drained.
3. Ensure that the bushland is well drained (dieback impact is greatest in wet sites). No drainage water should be discharged into bushland.
4. Minimise soil disturbance – consider mowing, slashing or using herbicide, rather than ploughing, or grading, whenever possible or practical.

If you know the location of the infestation:

5. Plan activities so they are completed in the uninfested parts of the bushland first, then move to the infested parts of the bushland.
6. Plan or alter track location so they do not pass through the uninfested parts of the bushland.
7. Mark the infection boundary with bright marking tape when undertaking works or activities, so the dieback free area is visible.

## Bush Restoration Activities

Bush restoration involves weeding, revegetation, fencing, rubbish removal. Most restoration activities can introduce or spread *P. cinnamomi*, in particular revegetation. Revegetation has the greatest risk of spreading *P. cinnamomi*, as it involves the introduction of plants and soil.

### Dieback Control Measures

#### Weeding

1. Complete weeding when the bushland is dry (when possible/practical).
2. If manually removing weeds, immediately place them in a bag (or similar) to prevent soil falling into other parts of the bushland.
3. Ensure all tools, equipment and footwear are free of mud and soil when entering bushland.

If you know the location of the infestation:

4. Complete weeding in the uninfested part of the bushland first.
5. Vehicles, tools, equipment and footwear to be free of all mud and soil upon entry to the uninfested parts of the bushland.

#### Revegetation

Revegetation should not be necessary in bushland. If weeds and other disturbances are controlled, natural regeneration will ensure the bushland is well vegetated. Revegetation also has a high risk of introducing *P. cinnamomi* into bushland; therefore it should be avoided whenever possible. However if revegetation is required:

1. Consider direct seeding, or purchase the plants from a nursery with excellent hygiene practises (Nurseries with Nursery Industry Association Wholesale Accreditation maintain very high standards of hygiene).
2. Only use mulch if it has been well composted (the heating part of the composting process kills *P. cinnamomi*).
3. Complete revegetation when the soil is moist but not wet.
4. Avoid vehicle access. If vehicle access is required, make sure the vehicle is free of mud and soil, and is restricted to a hard, dry surface.
5. Vehicles, tools and equipment to be free of all mud and soil upon entry and exit.
6. Footwear to be free of mud and soil upon entry and exit.

If you know the location of the infestation:

7. Vehicles, tools, equipment and footwear to be free of all mud and soil upon entry to the uninfested parts of the bushland.
8. Complete revegetation in the uninfested part of the bushland, before moving to the infested part of the bushland.

#### Suggested plants for revegetation:

- Infested areas – the majority of plants should be resistant to *P. cinnamomi*.
- Uninfested areas – the usual selection of locally indigenous plants should be used. Seedlings should be sprayed with phosphite once planted.
- Unsure – use a mixture of susceptible and resistant locally indigenous plants.

#### Fencing / Rubbish Collection / Other

1. All equipment, tools and footwear to be free of mud and soil when entering the bushland.

If you know the location of the infestation:

2. Vehicles, tools, equipment and footwear to be free of all mud and soil upon entry to the uninfested parts of the bushland.

## Earthworks / Maintenance / Vehicles

Activities such as track construction, and maintenance, and road and verge maintenance, vehicle movement etc. can involve the movement of soil, water or plant material. Therefore, these activities have a very high risk of spreading *P.cinnamomi* into bushland.

### Dieback Control Measures

1. Where practical schedule activities that involve soil disturbance for dry summer months (November – March) and when the soil is dry (includes activities on the adjacent road verges).
2. Minimise soil disturbance – consider mowing, slashing or use herbicide, rather than ploughing and grading, whenever possible or practical.
3. Complete activities in the uninfested part of the bushland, before moving to the infested part of the bushland.
4. In the uninfested parts of the bushland, or, if you are unsure of the infection status of the bushland:
  - Do not bring in soil/sand/gravel. If they must be brought in, they should be tested for the presence of *P.cinnamomi*, or from a supplier who provides dieback free materials, and transports and stores the materials hygienically (soil suppliers accredited by the Nursery Industry Association maintain high standards of hygiene).
  - Do not move soil/sand/gravel in from the infested part of the bushland.
  - Prevent vehicles and machinery entering. If they must enter, they must be free of soil and mud, and restricted to a hard, dry surface.
  - Footwear to be free of mud and soil when entering bushland.
  - Any water used in earthworks etc. should be from Mains supply or sterilised.
5. In the infested parts of the bushland
  - There is no restriction on the source of gravel/sand/soil.
  - Prevent vehicles and machinery entering. If they must enter, restrict them to hard, dry surfaces and they must be free of soil and mud when exiting the bushland (it is acceptable for these to be taken directly to a cleaning facility on sealed roads for cleaning).
  - Do not remove soil/sand/gravel from the infested part of the bushland. If it must be removed, it should be placed at a site that is also infested with *P.cinnamomi*.
  - Footwear to be free of mud and soil when exiting the bushland.

## Fire

Fire management can contribute to the introduction and spread of *P.cinnamomi*. Fire prevention activities, such as firebreak construction, can spread infested soil. The following procedures can be implemented into fire management activities without detracting from the priority of protecting life and property.

### Dieback Control Procedures

1. Schedule firebreak maintenance for dry summer months (November – March) and complete maintenance when the soil is dry.
  2. Vehicles, tools and equipment used in firebreak maintenance to be free of all mud and soil (particularly on tyres and mudflaps) when entering and exiting the bushland.
  3. Footwear to be free of mud and soil when entering and exiting the bushland.
  4. Minimise soil disturbance whenever possible – consider mowing, slashing or use herbicide to create firebreaks, rather than ploughing or grading.
  5. Construct firebreaks to shed water and dry quickly.
  6. Water used in mopping up activities to be from Mains supply.
  7. Rationalise firebreaks so the number of firebreaks is minimised.
- If you know the location of the infestation:
8. Commence firebreak maintenance and construction in the uninfested parts of the bushland, and then move into the infested parts.
  9. Vehicles, tools and equipment used in fire break maintenance to be free of all mud and soil (particularly on tyres and mudflaps) when entering the dieback free parts of the bushland, or when exiting the infested parts of the Park.
  10. Footwear to be free of mud and soil when entering the uninfested parts of the bushland, and when exiting the bushland.

## Protecting Vegetation

Although there is presently no cure for *P.cinnamomi* infection, a chemical is available, that can protect susceptible plants. Phosphite, also known as Phosphonate, is a biodegradable fungicide that protects plants against *P.cinnamomi* by boosting their natural defences. Phosphite controls most species of Phytophthora, including *P.cinnamomi*.

Phosphite should be applied to all susceptible vegetation in bushland if there is a risk of *P.cinnamomi* arriving. However, phosphite application is quite time consuming and labour intensive, so treatment should be prioritised.

#### **If the location of infestation is known:**

Priority 1 Treatment of DRF listed susceptible flora, or flora of significance to the reserve.

Priority 2 – Treatment of all vegetation within 5 metres down slope of the infestation edge.

Priority 3 – Treatment of all vegetation within 5 metres of the infestation edge.

Priority 4 – Treatment of significant susceptible vegetation.

Priority 5 – Treatment of susceptible vegetation located 5 metres either side of all access tracks located in the uninfested part of the bushland.

Priority 6 – Treatment of all vegetation in the uninfested part of the bushland.

Priority 7– Treatment of susceptible vegetation in the infested part of the bushland.

#### **If the location of infestation is unknown:**

Priority 1 – Treatment of DRF listed susceptible flora, or flora of significance to the reserve.

Priority 2 – Treatment of all vegetation within 5 metres down slope of any dead/dying vegetation.

Priority 3 – Treatment of all vegetation within 5 metres of any dead/dying vegetation.

Priority 4 – Treatment of vegetation within 5 metres of the bushland boundary.

Priority 5 – Treatment of all susceptible vegetation located 5 metres either side of all access tracks.

Priority 6 – Treatment of vegetation within 5 metres of tracks/paths which pass through the bushland.

Priority 7 – Treatment of all susceptible vegetation in the bushland.

Spraying will provide 2-3 years protection and injection will provide 3-5 years protection.

#### **Control Measures**

1. Treat susceptible vegetation in bushland with Phosphite as per the above priorities and the length of protection.
2. Monitor plants and tree health to determine the time for reapplying treatment. If there is no tree or plant death re-spray plants every 3 years, and re-inject trees every 5 years.

If you know the location of the infestation:

3. Re-survey the bushland every 3 years (using qualified or experienced interpreters) to determine the success of treatment procedures, and identify new infections.

## **Access**

Bushland reserves usually have unrestricted access and are often traversed by numerous tracks and paths. This greatly increases the likelihood of *P.cinnamomi* being introduced or spread in bushland.

#### **Control Procedures**

1. Prevent vehicle, motorcycle, bicycle and horse riding access to the bushland.
2. Encourage visitors to avoid visiting the bushland when it is wet, and to keep to existing tracks.
3. Tracks to be maintained in a good condition and kept well drained.
4. Minimise/rationalise the number of tracks that pass through the bushland.
5. Interpretive signs to be placed at entrances to the bushland, explaining the *P.cinnamomi* status of the bushland, and how visitors can help to stop its spread.
6. Footwear to be free of mud and soil when entering and exiting bushland.

If you know the location of the infestation:

7. Realign existing tracks, to stop them passing from the infested to the uninfested parts of the bushland.
8. Avoid constructing new tracks that pass through the uninfested parts of the bushland.
9. Avoid walking between the infested and uninfested part of the bushland when the soil is wet.
10. Interpretive signs to be placed at entrances to the bushland, explaining the *P.cinnamomi* status of the bushland, and how visitors can help to stop its spread.
11. Footwear to be free of mud and soil when moving into the uninfested parts of the bushland.

## **Communication**

It is essential that all groups and organisations involved with a bushland are made aware of the dieback status of the bushland. If the bushland is infested, stakeholders must be made aware of the location of the infestation.

### **Control Measures**

1. Observe activities occurring in or adjacent to the bushland that could introduce or spread *P.cinnamomi*. Find out if the activity had *P.cinnamomi* 'Control Procedures' in place. If not, contact the Environment Officer at the local Council, or the relevant authority.
2. Erect signs at entrances to the bushland explaining that the bushland is under threat from *P.cinnamomi* (See Appendix 2).

If you know the location of the infestation:

3. Erect signs at the entrances to the bushland explaining the dieback status of the bushland (See Appendix 2).
4. Discuss the dieback status of the bushland with neighbouring landholders.
5. In public reserves - prepare and distribute a brochure to surrounding landholders explaining the dieback status of the bushland (See Appendix 3).
6. In public reserves – hold a 'wildflower' walk in spring and highlight the disease impact, its potential impact, and how visitors can prevent it spreading.
7. In public reserves – place signs along walk tracks next to live susceptible plants and dead plants that have been killed by the fungus.

## **Horses / Livestock / Animals**

Hard hooved animals such as horses and cattle can contribute to the spread of dieback by picking up soil in their hooves. Soft footed animals such as native fauna and dogs have a much lower risk of spreading dieback.

### **Dieback Control Measure**

- Hard hooved animals should be excluded from bushland.
- If hard hooved animals must enter bushland, their hooves should be free of mud and soil when entering and exiting, and they should be kept on hard, well-drained tracks.

## **Off Road Vehicles and Motorcycles**

Off Road Vehicles and motorcycles can contribute to the spread of dieback by picking up soil in tyres.

### **Dieback Control Measure**

- Off Road Vehicles and motorcycles should be excluded from bushland.

# Appendix 2

## Suggestions for Signage

## SUGGESTED SIGNS FOR RESERVE ENTRANCES

The wording, content and style of the signs can be changed if *P.cinnamomi* is known to be present at the site. It should also be changed to compliment the style of other signs at the reserve, and to accommodate budget restrictions.

### Option A (Suited to a detailed display board / information board / poster etc)

#### **Dieback in (name of reserve)**

Dieback is a disease caused by the fungus *Phytophthora cinnamomi* (Pc). Pc kills thousands of native plants, including many wildflowers. Pc creeps through the soil and rots the roots of plants.

Steps have been taken to stop the spread of Pc and protect the plants in (name of reserve). Plants in this bushland have been treated with an 'environmentally friendly' fungicide (phosphite) to give them 3 years protection from Pc.

To stop the spread of Pc, visitors to are asked:

1. Not to enter when wet.
2. To remain on tracks.
3. To ensure that footwear and bike tyres are free of mud and soil when entering and leaving the bushland.
4. Not to remove soil or plant material.

For more information contact the Shire/City of \*\*\*\*\*

### Option B

#### **Dieback in (name of reserve)**

(name of reserve) contains the fungus *Phytophthora cinnamomi* (Dieback) which kills many native plants.

To stop the spread of *Phytophthora cinnamomi*, visitors are asked:

1. Not to enter when wet.
2. To remain on tracks.
3. To ensure that footwear and bike tyres are free of mud and soil when entering and leaving the bushland.
4. Not to remove soil or plant material.

For more information contact the Shire/City of \*\*\*\*\*

### Option C

#### **Save our Wildflowers (name of reserve) contains dieback**

For more information contact the Shire/City of \*\*\*\*\*

**Option D** (Suited to a site that is free of P.cinnamomi)

**Beware of Dieback**

Dieback kills hundreds of native plant species and is present in many bushland reserves around Perth. Fortunately (name of reserve) is dieback free.

To keep (name of reserve) free of dieback, visitors are asked:

1. **Not to enter when wet.**
2. **To remain on tracks.**
3. **To ensure that footwear is free of mud and soil when entering and leaving the bushland.**
4. **Not to introduce soil or plant material.**

For more information contact the Shire/City of \*\*\*\*\*

**Option E** (Suited to a site that is free of P.cinnamomi)

**Save our Wildflowers**  
(name of reserve) is in a high risk dieback area.

For more information contact the Shire/City of \*\*\*\*\*

**Option E**

**Please Keep Out**

**This are is infested with Dieback.**

## SUGGESTED SIGNS FOR WALK TRACKS

This plant (name) has been killed by  
Phytophthora cinnamomi (Dieback)

This plant (name) is susceptible to  
Phytophthora cinnamomi (Dieback).

Keep on the track to avoid spreading  
Phytophthora cinnamomi (Dieback).

# Appendix 3

## Brochure for Visitors / Neighbouring Landholders

(Information in this brochure can be included in another publication)



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## WHAT YOU CAN DO

Local residents and users of Falls Park can help to stop the spread of dieback in Falls Park by following these guidelines:

- Stay on the tracks.
- Avoid entering the dieback free parts of the Park (refer to signs in the Park), or make sure footwear is free of mud and soil when entering this area.
- Avoid muddy areas when walking in the Park.
- Do not dump soil or plants in the reserve.
- Join the 'Friends of Falls Park' and assist them to undertake dieback protection activities, and other bushland protection activities.

To avoid introducing dieback on to your own property, make sure your footwear is free of mud and soil when leaving Falls Park and do not remove soil or plants from the Park.

You could also consider treating susceptible plants on your own property with phosphite to protect them from dieback.

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## CONTACTS AND FURTHER INFORMATION

For more information on dieback in the Shire of Mundaring, or Falls Park, contact:

- Bushcare Coordinator at the Shire of Mundaring, phone 9290 6666.
- Friends of Falls Park (north), phone 9295 4334.
- Friends of Falls Park (south), phone 9295 4467.

For more information about dieback:

- The Roleystone Dieback Action Group, phone 9397 6813 (a/h), website: [www.quokka.murdoch.edu.au/~rdag/](http://www.quokka.murdoch.edu.au/~rdag/)

Dieback Treatment Kits can be hired from:

- Roleystone Dieback Action Group, phone 9397 6813.
- Wildflower Society, Eastern Hills Branch, phone 9572 1697.
- Friends of Talbot Road, Stratton, phone 9255 1490.



Natural Heritage Trust  
Helping Communities Helping Australia

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**Dieback**  
**in**  
**Falls Park**



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## WHAT IS DIEBACK ?

Dieback is a plant disease caused by a microscopic fungus in the soil. The scientific name of the fungus is *Phytophthora cinnamomi*. *P. cinnamomi* attacks the roots of plants and causes them to rot.

## WHICH PLANTS ARE KILLED ?

Dieback kills up to 25% of native plant species in south-west Western Australia.



Some of the south-west's more common plants are susceptible including Jarrah, Banksias, Grasstrees (*Xanthorrhoea*), Persoonias (SnottyGobbles), Sheoaks, and Hibbertias (native buttercup).

Xanthorrhoea's are very susceptible to dieback.

Some plants are resistant to dieback, including Marri (Red Gum), Wattles, grasses and sedges.

A range of horticultural crops and garden plants can also be killed by dieback, including Peaches, Apricot's, Avocado's, Camellias, Azaleas and Rhododendrons.

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## HOW DID IT GET TO WA ?

The fungus that causes dieback is not native to Western Australia. It is thought to have arrived in the State in soil around the roots of live plants, shortly after European settlement.

## DIEBACK DISTRIBUTION

Dieback is now widespread throughout the south-west of Western Australia. It is confined to areas with more than 400mm annual rainfall, and extends between Eneabba and Esperance. It infests forests, heathlands, and woodlands. *P. cinnamomi* is present in much of the bushland in and around Perth.

## HOW DIEBACK SPREADS

*Phytophthora cinnamomi* spends its entire life in soil and in plant tissue. Its natural movement through the soil is relatively slow, although it will spread more rapidly downslope.

However it is human activity that causes the most rapid and widespread distribution of this fungus. Any activity that disturbs or moves soil (road construction, house building, earth moving, driving dirty vehicles on bush roads) can contribute to the spread of *P. cinnamomi*.

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## DIEBACK IN FALLS PARK



It is difficult to work out exactly how dieback was introduced into Falls Park. It is possible that it was introduced during road construction, road maintenance activities, or during residential development on land surrounding the Park.

The relatively steep slopes of the Park are contributing to the rapid spread of dieback through the Park. Other factors that may have contributed to its spread are: drainage runoff, motorcycles, horses, and to a lesser degree, bushwalkers.

# **Appendix 4**

**How to Spray and Inject, and  
Equipment Suppliers.**

# Spraying and Injecting Vegetation

Although there is no chemical that will eradicate *P.cinnamomi*, we are fortunate that a chemical is available that can protect susceptible plants. Phosphite, also known as Phosphonate, is a biodegradable fungicide that protects against disease caused by *P.cinnamomi*. Phosphite works by boosting the plant's natural defences.

Phosphite controls many species of Phytophthora, including *Phytophthora cinnamomi*. Phosphite is not toxic to people or animals; its toxicity is similar to table salt. There is a very low pollution risk associated with phosphite. When phosphite is sprayed on to the foliage of plants, it is applied at a very low rate, so any phosphite that reaches the soil is bound to the soil and does not reach the water table.

Phosphite is available from most large nurseries and rural supply stores. Treating plants with phosphite is inexpensive. A medium sized Jarrah tree costs less than \$0.50 to treat.

Phosphite needs to enter a plant's water transport system to be effective. This can be done by injecting phosphite into trees, or spraying the leaves of understorey plants. Phosphite not only protects plants from *P.cinnamomi* infection, it can also help a plant to recover if it is already infected. If a Jarrah tree is showing signs of infection, treatment with phosphite can help to save it.

Injecting a tree with phosphite provides about three to five years of protection from *P.cinnamomi*. Spraying with phosphite provides protection for about two to three years. Because it only provides temporary protection, treatment needs to be ongoing, and included in bushland management and action plans.

## Injecting Trees

### Equipment

- Injecting phosphite can be done using large syringes or with specially made stem injection equipment. If you are injecting more than 1 or 2 trees, a tree injector is recommended. It will save you time and effort, and will be more effective.
- Cordless drill with 7/32" or 5.5mm drill bit.
- Chisel (only needed to remove bark if injecting Jarrah).
- Phosphite (Fosject 200 or an equivalent chemical).

### Safety

- Phosphite has a toxicity similar to table salt. It will sting eyes and cuts, but causes no permanent damage. However, people with sensitive skin may find that it can irritate the skin.
- Follow the safety instructions on the side of the pack, and wear long pants and shirt, PVC gloves and safety glasses or sunglasses.
- Spray in a downwind direction, so the spray does not blow back on to you.

### Timing

The best time to inject a tree is when water is moving within the tree. Water movement is usually greatest in spring and summer, but injection will also be successful in autumn. Injecting in the morning can be more successful than in the afternoon.

### Preparation

Dilute 1 part Fosject 200 with 2 parts water.

### Procedure

- ① Drill a hole into the tree. Injection needs to be in the sapwood, so do not drill any deeper than 3-4 cm. Drill the hole at a height so injecting will be comfortable ie waist height. The hole should be drilled at a slight downward angle.
- ② Drill a hole every 20cm around the tree trunk (this is approximately one hand width). Multi stemmed trees need holes in all stems.
- ③ Follow the instructions that will come with the tree injector regarding its set up and use.
- ④ Insert the nozzle of the syringe or injector into the drilled hole and twist slightly to get a good seal. **SLOWLY** push/pump the solution into the tree. Make sure the solution is taken up by the tree and does not flow out of the hole. A total of **20ml** of the solution should be injected into **each** hole.
- ⑤ Repeat in 3 to 5 year's time.

# Spraying Plants

The solution for spraying is much weaker than for injecting, and contains a small amount of surfactant (Synertrol Oil / Spray Aid) to hold the droplets on the leaf surface until it is absorbed. A surfactant approved for use on native plants could be used instead of Synertrol Oil – seek advice from your local nursery. Not all understorey plants are at risk, but it is easier to spray all plants.

## Equipment

- Backpack sprayer (ensure it is clean and has not recently contained herbicides etc).
- Synertrol oil / Spray Aid or other approved surfactant.
- Phosphite (Fosject 200).

## Safety

- Phosphite has a toxicity similar to table salt. It will sting eyes and cuts, but causes no permanent damage. However people with sensitive skin may find it irritates the skin.
- Follow the safety instructions on the side of the pack, and wear long pants and shirt, PVC gloves and safety glasses or sunglasses.
- Take care when using sharp implements such as drills and chisels.

## Timing

Spraying is most effective in spring, summer and autumn. Spraying should occur when rain free days are forecast at least 2 days ahead.

## Preparation

Mix 250ml of Fosject with 100ml of Synertrol oil. Shake well. Before the Synertrol oil and Fosject begin to separate, place in the backpack and add 10 litres of water. Ten litres is a comfortable weight to carry. Use the solution immediately and mix frequently.

## Procedure

- ① Place the backpack spray unit on your back and adjust the straps so it is comfortable, and the pumping lever is on the side that you prefer. Adjust the nozzle so it gives a course spray so the spray doesn't blow away from the plants.
- ② Soak the plants until all leaf surfaces are wet. All understorey plants, including grass trees, should be sprayed, Ten litres of solution should last about 15-20 minutes.
- ③ Repeat in 2-3 years.

# Equipment Suppliers

**Dieback treatment equipment is available from:**

Roleystone Dieback Action Group: 9397 6813

Roleystone Hardware: 9397 5643

Wildflower Society - Eastern Hills Branch (Shire of Mundaring): 9572 1697

Nature Reserves Preservation Group (Shire of Kalamunda): 9454 4828.

Bassendean Preservation Group: 9279 9913.

Friends of Talbot Road Reserve, Stratton: 9255 1490

**Phosphite (Fosject 200 or equivalent):** The supplier of the spraying/injection equipment, or your local community conservation group may have Phosphite available. Alternatively, Phosphite can be purchased from a rural/agricultural chemical supply store.

**Surfactant (Synertrol Oil/Spray Aid):** The supplier of the spraying equipment, or your local community conservation group may have Synertrol Oil / Spray Aid available. Alternatively Synertrol Oil / Spray Aid can be purchased from Mirco Bros. Ph 9410 2233, or ask your local rural chemical supply store. A surfactant approved for use on native plants can be used instead – but seek advice from your local nursery.

# Appendix 5

## Useful Contacts

## Dieback Interpretation Services

- GLEVEN Dieback Consultancy Services (Glenn Tuffnell) Phone (08) 9496 3336.
- Fungus Doctors (Matt Reynolds) Phone (08) 9582 9215.
- Department of Conservation and Land Management, Swan Region (Abe van de Sande) Phone (08) 9474 7045.
- Simon Watkins, South-West. Phone (08) 9840 1244.

## Laboratories for Testing Soil and Plants for *P.cinnamomi*

- Department of Conservation and Land Management – Vegetation Health Service. Phone (08) 9474 7045.
- Curtin University, Elaine Davison. Phone (08) 9351 3106.
- Agriculture WA, Peter Woods. Phone (08) 9368 3693.
- Hart Simpson and Associates. Phone (08) 9388 3972.

## Dieback Treatment Contractors

Injection and spraying contractos.

- R&J Dieback Protection Services. Phone (08) 9537 8243.

## Nurseries & Landscaping Suppliers

- Contact the Nursery Industry Association for an updated list of Accredited Wholesale Nurseries and Landscape suppliers. Phone (08) 9325 8252.
- Peter Woods from Agriculture WA will sample soil and other materials and determine if they are free of *P.cinnamomi* – Phone (08) 9369 3693.

## For Further Information

- The Environment Officer or Parks Officer at your local Council.
- Roleystone Dieback Action Group - Ian Colquhoun (08) 9397 6813
- Your local community conservation group.

## Web Sites of Interest

Roleystone Dieback Action Group  
Environment Australia  
Department of Conservation and Land  
Management  
AgWest Plant Laboratories

[quokka.murdoch.edu.au/~rdag/](http://quokka.murdoch.edu.au/~rdag/)  
[www.biodiversity.environment.gov.au/threaten/plans/tap/index.htm](http://www.biodiversity.environment.gov.au/threaten/plans/tap/index.htm)  
[www.calm.wa.gov.au](http://www.calm.wa.gov.au) (run a search on 'dieback' or 'Phytophthora cinnamomi').  
[www.agric.wa.gov.au/agency/agwest/plantlabs/](http://www.agric.wa.gov.au/agency/agwest/plantlabs/)

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# STAFF TRAINING

A nationally accredited Phytophthora dieback training course for Local Government works crews and supervisors has been developed. For more information about this training course, contact the Dieback Coordinator at the Perth office of Department of Conservation and Land Management (for contact details refer to Part 9).

The Learning Outcomes, Session Plan and Course Notes of this training course are included in this section.



# MANAGING PHYTOPHTHORA DIEBACK

## Guidelines for Local Government

# TRAINING COURSE

<b>Session</b>	Managing Phytophthora dieback in Local Government - Training for Local Government Works Crews and Contractors.
<b>Trainer</b>	
<b>Date</b>	
<b>Time</b>	
<b>Venue</b>	
<b>Training Objective</b>	To provide participants with knowledge of the pathogen <i>Phytophthora cinnamomi</i> and the skills to carry out hygienic field operations.
<b>Training Conditions</b>	Participants will have access to an environment conducive to assessment, including adequate lighting, no visual or audible distractions and comfortable seating.
<b>Assessment Method</b>	A multi choice / short answer take home questionnaire.

# Learning Outcomes and Assessment Criteria

## Learning Outcome 1 – Impact

Demonstrate knowledge of the problems associated with the disease caused by the plant pathogen *Phytophthora cinnamomi*.

Assessment Criteria	1.1	Describe the impact <i>P.cinnamomi</i> has had on various areas / industries.
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## Learning Outcome 2 - Biology

Describe the biology of *P.cinnamomi* and its interaction with and consequences for its hosts.

Assessment Criteria	3.1	Describe the living requirements of <i>P.cinnamomi</i> .
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Assessment Criteria	3.2	Describe the different levels of impact of <i>P.cinnamomi</i> .
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Assessment Criteria	3.3	Describe the modes by which <i>P.cinnamomi</i> spreads.
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Assessment Criteria	3.4	Describe how you determine the presence or absence of <i>P.cinnamomi</i> .
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## Learning Outcome 3 – History and Distribution

Outline the history of the introduction and spread of *P.cinnamomi* in WA and describe the distribution of the related root-rot disease in the southwest.

Assessment Criteria	2.1	Outline the history and background of <i>P.cinnamomi</i> related disease.
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Assessment Criteria	2.2	Describe the pattern of distribution of <i>P.cinnamomi</i> root rot disease in the southwest.
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## Learning Outcome 4 – Risk

Identify high-risk activities and high priority sites.

Assessment Criteria	4.1	Describe high-risk activities.
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Assessment Criteria	4.2	Describe how to identify high-risk sites.
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## Learning Outcome 5 – Control Procedures

Identify the *P.cinnamomi* control procedures applicable to Local Government operations.

Assessment Criteria	5.1	Describe 6 <i>P.cinnamomi</i> control procedures for road and drain construction and maintenance that can reduce the risk of spreading <i>P.cinnamomi</i> .
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Assessment Criteria	5.2	Describe 4 <i>P.cinnamomi</i> control procedures for parks and reserves management that can reduce the risk of spreading <i>P.cinnamomi</i> .
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Assessment Criteria	5.3	Identify other activities you complete that could be considered high risk, and how would you minimise this risk.
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Assessment Criteria	5.4	Describe the appropriate clean-down procedure for vehicles or machinery.
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## Learning Outcome 6 – Local Information

Describe dieback distribution in the local area.

# Session Plan

Time	Content	Aids
0 – 10	<p><b>Introduction</b></p> <p>Welcome and introduction of trainer</p> <ul style="list-style-type: none"> <li>• Recognition of CALM’s input, accreditation assistance and NHT funding.</li> <li>• Domestic arrangements.</li> <li>• Course Aims</li> <li>• Course Overview               <ul style="list-style-type: none"> <li>- Phytophthora dieback – impact, biology, history, etc.</li> <li>- Risk</li> <li>- Control Procedures</li> <li>- A Local Perspective</li> </ul> </li> <li>• Course Assessment – Nationally Accredited competency based training program.               <ul style="list-style-type: none"> <li>- Multiple choice / short answer take home questionnaire.</li> </ul> </li> </ul>	<p>White board</p> <p>Overhead</p> <p>Overhead</p>
10 – 20	<p><b>1. Impact</b></p> <ul style="list-style-type: none"> <li>• Slides of infested areas, susceptible species etc.               <ol style="list-style-type: none"> <li>1. Dead Jarrah on an infested site.</li> <li>2. Dead Dryandra on infested site.</li> <li>3. New Holland honey eater on kangaroo paw. Many flowering plants that provide food for the honeyeater, especially banksias, are susceptible to <i>P.cinnamomi</i>.</li> <li>4. Honey possum on <i>Banksia coccinea</i> flower – a species particularly threatened by <i>P.cinnamomi</i>.</li> <li>5. Western Spinebill on banksia flower – Banksias are highly susceptible species.</li> <li>6. Butterfly on Xanthorrhoea flower – another susceptible species.</li> <li>7. Dryandra flowers – another species at risk.</li> <li>8. Dieback is a serious problem for the nursery industry – not only native plants but hundreds of ornamental and garden species.</li> <li>9. Avocado tree – one of many horticultural species susceptible to <i>P.cinnamomi</i>.</li> </ol> </li> <li>• Impact on biodiversity is a disaster of ‘global significance’.</li> <li>• Socio-economic impact – costs to agriculture, horticulture, and timber industry.</li> <li>• Visual amenity changes impact recreation and tourism.</li> </ul>	<p>Slides</p> <p>Overhead</p>
20 - 80	<p><b>2. Phytophthora dieback</b></p> <p>Description</p> <ul style="list-style-type: none"> <li>• Lives mainly in soil.</li> <li>• Similar to a fungus.</li> <li>• Over 50 species of Phytophthora worldwide, but <i>P.cinnamomi</i> is most common in Australia.</li> <li>• Moisture dependent.</li> <li>• Food – root and stem tissue of living plants.</li> </ul>	<p>Overhead PC plate</p> <p>Lesion on branch</p>

	<p>Biology</p> <ul style="list-style-type: none"> <li>• Pathogen is a mass of tiny white threads.</li> <li>• Reproduces by producing spores. Two types: <ul style="list-style-type: none"> <li>- Zoospores are produced in favourable conditions, quickly, move in water and invade quickly. Short lived.</li> <li>- Chlamydospores are large, tough and long-lived. Survive harsh and unfavourable conditions, transported in soil and plant material.</li> </ul> </li> <li>• Pc invading a plant</li> <li>• Very wide host range. Approx. 25% of species are susceptible. Includes Banksia, Dryandra, Hakea, Grevillea, Persoonia, Xanthorrhoea.</li> <li>• How to identify if Pc is present</li> <li>• Not possible to eradicate the pathogen from infested sites. Once susceptible hosts have been removed, it will survive on resistant plants.</li> <li>• Dieback will occur when you get: pathogen + host + suitable environment (+ time).</li> </ul> <p>Levels of Impact</p> <ul style="list-style-type: none"> <li>• No apparent disease.</li> <li>• Highly destructive.</li> <li>• Variable – few deaths in patches.</li> <li>• Balanced – complete replacement with resistance species.</li> </ul> <p>How do you know if its present</p> <ul style="list-style-type: none"> <li>• Deduced by the death of susceptible species.</li> <li>• Individual plants die quickly (except Jarrah) and there is no recovery.</li> <li>• Need to be able to discount other factors that could have caused death.</li> </ul> <p>Patterns of Infestation</p> <ul style="list-style-type: none"> <li>• If the pathogen is present, water will also be infested, and the pathogen will be present downstream from the infestation.</li> <li>• If the pathogen is present high on a slope, then the areas downslope will become infested in time.</li> <li>• More likely to be present in wetter sites.</li> </ul> <p>History</p> <ul style="list-style-type: none"> <li>• First symptoms of dieback observed in 1921.</li> <li>• <i>P.cinnamomi</i> was identified to be the cause of dieback in 1964.</li> <li>• <i>P.cinnamomi</i> was introduced in infected root balls of orchard stock around the time of European settlement (early 1880's).</li> <li>• In mid 1900's gravel underneath dying patches of forest was used to build roads, therefore inadvertently spreading <i>P.cinnamomi</i> throughout the southwest.</li> <li>• Post WW2 – the introduction of machinery for logging and clearing increased spread.</li> <li>• Result is a combination of infested and uninfested areas over thousands of hectares of native vegetation – both private and public.</li> </ul> <p>Distribution</p> <ul style="list-style-type: none"> <li>• Distribution affected significantly by rainfall. Does not occur in deserts or low rainfall areas.</li> </ul>	<p>Overhead</p> <p>White Brd Overhead</p> <p>Susceptible plants</p> <p>Overhead</p> <p>Slides Overhead</p> <p>Overhead</p> <p>Overhead</p> <p>Overheads</p>
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	<ul style="list-style-type: none"> <li>• Wide distribution across temperate climates.</li> <li>• Australian distribution</li> <li>• West Australian distribution</li> </ul> <p>Spread</p> <ul style="list-style-type: none"> <li>• Modes <ul style="list-style-type: none"> <li>- root to root contact</li> <li>- Pc spore movement through soil</li> <li>- Animal</li> <li>- Human</li> </ul> </li> <li>• Not possible to stop its spread through the soil, root to root contact or native animals.</li> </ul> <p>Can reduce 'human' caused spread by implementing 'hygiene' strategies ie be clean when entering uninfested areas.</p>	<p>Overheads</p> <p>Brainstorm list of LG causes of spread.</p>
80 – 95	<b>Break</b>	
95 - 130	<p>4. Risk</p> <p>Need to identify High and Medium Risk activities AND work sites that are of High Priority.</p> <p>High Risk Activities</p> <ul style="list-style-type: none"> <li>• Direct movement of soil, gravel, sand.</li> <li>• Wet conditions.</li> <li>• Use of heavy vehicles, heavy equipment, large machinery.</li> <li>• Introduction of plants or non-scheme water.</li> </ul> <p>Medium Risk Activities</p> <ul style="list-style-type: none"> <li>• Use of vehicles, hand tools, small machinery.</li> <li>• Footwear in wet conditions.</li> </ul> <p>Low Risk Activities</p> <ul style="list-style-type: none"> <li>• Footwear in dry soil conditions.</li> <li>• Native animals.</li> </ul> <p>Most local government activities are considered high or medium risk. Need to take steps to reduce this risk.</p> <p>Site Priority</p> <p>Important to balance effort against risk. There is no point having dieback control measures in place when you are working in areas that are likely to be already infested with dieback, or when it doesn't matter ie sports oval.</p> <ul style="list-style-type: none"> <li>• High priority sites. <ul style="list-style-type: none"> <li>- Located in or adjacent to bushland, or remnant vegetation, that appears to be in good condition, and there is little other disturbance.</li> <li>- LG owned bushland reserves.</li> </ul> </li> <li>• Medium priority sites. <ul style="list-style-type: none"> <li>- Located in or near bushland that has a low / moderate level of disturbance.</li> </ul> </li> <li>• Low priority sites. <ul style="list-style-type: none"> <li>- Residential areas.</li> <li>- Developed areas.</li> <li>- Bushland that is already infested.</li> </ul> </li> </ul>	<p>Prioritise brainstorm list – white board.</p> <p>Overheads</p>
130-160	<p><b>5. Phytophthora Dieback Management Procedures</b></p> <p>What do CALM do?</p> <p>Identify High / Medium Risk Activities</p> <p>Identify High, Medium, and Low Priority Sites.</p> <p>Dieback Control Procedures for Road/Drain</p>	<p>Overhead</p>

	<p>Construction/Maintenance for High Risk Sites.</p> <ul style="list-style-type: none"> <li>• Plan ahead.</li> <li>• Timing – dry soil conditions.</li> <li>• Materials – use in situ, or certified dieback free.</li> <li>• Procedures <ul style="list-style-type: none"> <li>- Store materials on hard, dry, well-drained surfaces.</li> <li>- Vehicles, equipment, machinery to be free of mud and soil when arriving at site.</li> </ul> </li> <li>• Soil Movement <ul style="list-style-type: none"> <li>- Recycle dieback free materials only.</li> <li>- Dispose of materials at low risk sites.</li> </ul> </li> <li>• Water – use scheme water, and filling stations to be dry and well drained.</li> </ul> <p>Medium Risk Sites</p> <ul style="list-style-type: none"> <li>• Same as above but not necessary to use certified dieback free materials.</li> </ul> <p>Low Risk Sites</p> <ul style="list-style-type: none"> <li>• No change to current practise.</li> </ul> <p>Cleandown</p> <ul style="list-style-type: none"> <li>• Free of clods &amp; mud on all parts, but not dust and grime. Minimise water use, and best to do at depot.</li> </ul> <p>Dieback Control Procedures for Parks and Reserves. Appropriate for bushland reserves or reserves with remnant vegetation</p> <ul style="list-style-type: none"> <li>• Timing – dry soil conditions.</li> <li>• Bush Restoration – direct seed if possible, use dieback free plant stock.</li> <li>• Materials – use dieback free soil, sand, gravel.</li> <li>• Soil Movement <ul style="list-style-type: none"> <li>- Minimise soil disturbance.</li> <li>- Do not dispose of soil in bushland areas.</li> </ul> </li> <li>• Machinery – vehicles, tools and machinery to be free of soil on arrival.</li> <li>• Water – water filling sites to be dry and scheme water to be used.</li> </ul>	<p>Overhead</p> <p>Overhead</p>
160-175	<p><b>6. Local Information</b></p> <ul style="list-style-type: none"> <li>• Sites / areas known to be infested <i>with P.cinnamomi</i>.</li> <li>• Interactions with CALM.</li> </ul>	
175-180	<p><b>7. Conclusion / wrap up.</b></p>	



# MANAGING PHYTOPHTHORA DIEBACK

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Guidelines for Local Government

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## COURSE NOTES

Prepared by the Dieback Working Group 2000

# The Dieback Working Group

## BACKGROUND

In 1996, the Canning Catchment Co-ordination Group initiated a working party to develop a draft policy on managing Phytophthora dieback. Local Governments located in the areas of Perth most prone to Phytophthora dieback, and relevant State Government Departments, were requested to provide a representative to participate in the preparation of this document.

The “Dieback Working Group” was formed in 1996. The Dieback Working Group met on four occasions to develop a draft document for Local Government, based on the Department of Conservation and Land Managements Hygiene Manual (1992). In 1998, the Working Group obtained funding from the Natural Heritage Trust to appoint a project Coordinator. The role of this Coordinator was to facilitate the adoption of this policy document within Local Government, and to raise awareness of Phytophthora dieback within Local Government and the wider community.

Since its formation, the Dieback Working Group has sought to:

- increase awareness and understanding about Phytophthora dieback
- encourage the adoption Phytophthora dieback prevention and management policies
- encourage the implementation of management procedures to minimise the spread and impact of the pathogen

## MEMBERSHIP

- City of Armadale
- City of Canning
- City of Cockburn
- City of Fremantle
- City of Gosnells
- City of Melville
- City of Swan
- Department of Conservation and Land Management (CALM)
- Department of Environmental Protection
- Department of Land Administration
- Eastern Metropolitan Regional Council (EMRC)
- Friends of Ellis Brook Valley
- Ministry for Planning
- Roleystone Dieback Action Group
- Shire of Kalamunda
- Shire of Mundaring
- Shire of Serpentine Jarrahdale

## ACKNOWLEDGEMENTS

Funding for this publication and for the Dieback Working Group has been provided by the Bushcare program of the Natural Heritage Trust. Generous support and assistance has also been provided by the Shire of Kalamunda. Special thanks to staff at the Shire of Kalamunda who assisted the preparation of the Phytophthora Dieback Management Procedures.

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Contributions provided by Kevin Vear (CALM) and John Nicolson (EMRC).

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# 1. INTRODUCTION

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Phytophthora dieback is a deadly plant disease that can devastate our forests, woodlands and heathlands. The disease is caused by the introduced fungus *Phytophthora cinnamomi*.

Human activity causes the most significant, rapid and widespread distribution of this fungus. Road construction, earth moving and dirty vehicles and machinery contribute significantly to the spread of *P.cinnamomi*.

Organisations such as the Department of Conservation and Land Management (CALM), Alcoa and Main Roads WA follow procedures to minimise the risk of their activities spreading *P.cinnamomi*.

Local Government staff who complete operations such as road construction, earth moving, and bushland management can also take steps to reduce the risk of these operations contributing to the spread of Phytophthora dieback.

These course notes have been prepared to compliment the nationally accredited 'Managing Phytophthora dieback in Local Government' training course.

## 2. PHYTOPHTHORA DIEBACK

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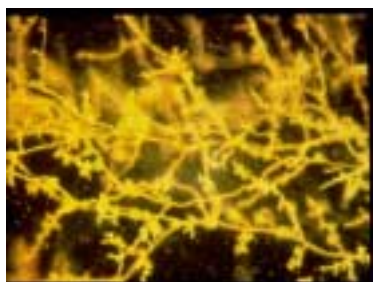
### WHAT IS PHYTOPHTHORA DIEBACK?

The term Phytophthora dieback refers to the deadly plant disease caused by the pathogen *Phytophthora cinnamomi*. Phytophthora dieback is also known as 'dieback' and 'Jarrah dieback'. Unfortunately, these names have contributed to incorrect information and confusion about the pathogen. For example, in other parts of Australia, the term 'dieback' is used to describe tree decline caused by salinity, drought, insect damage etc. The name 'Jarrah dieback' is also misleading as hundreds of different plant species are susceptible. Therefore, to overcome this confusion, the term 'Phytophthora dieback' will be used in this publication.

There are more than 50 species of *Phytophthora* found worldwide and all *Phytophthora* species cause plant disease. The three *Phytophthora* species that most commonly cause disease in native vegetation in Australia are *P.cinnamomi*, *P.citricola* and *P.megasperma*. *P.cinnamomi* is the most destructive of these three species. *P.cinnamomi* infests the largest area, is most widely distributed, infects the largest number of plants and is responsible for the most plant deaths (Weste, 1994).

### BIOLOGY AND ECOLOGY

Originally, *P.cinnamomi* was classified as a fungus, however it is now classified as an Oomycete or 'water mold'. *P.cinnamomi* spends its entire life in soil and plant tissue. Its spores are less than one hundredth of a millimetre in diameter, and therefore it cannot be seen without a microscope.



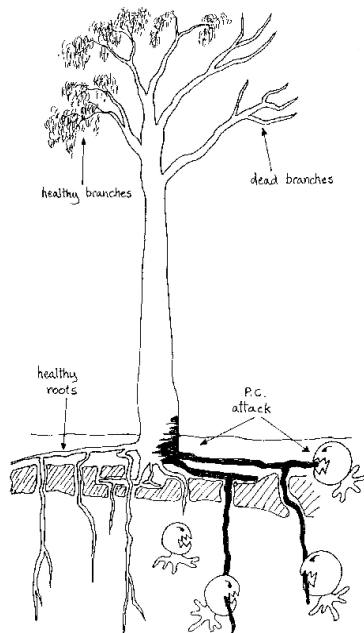
Hyphal swellings of *P.cinnamomi*



Spore sacs of *P.cinnamomi* release zoospores that swim in free water and



*P.cinnamomi* grown on agar plate

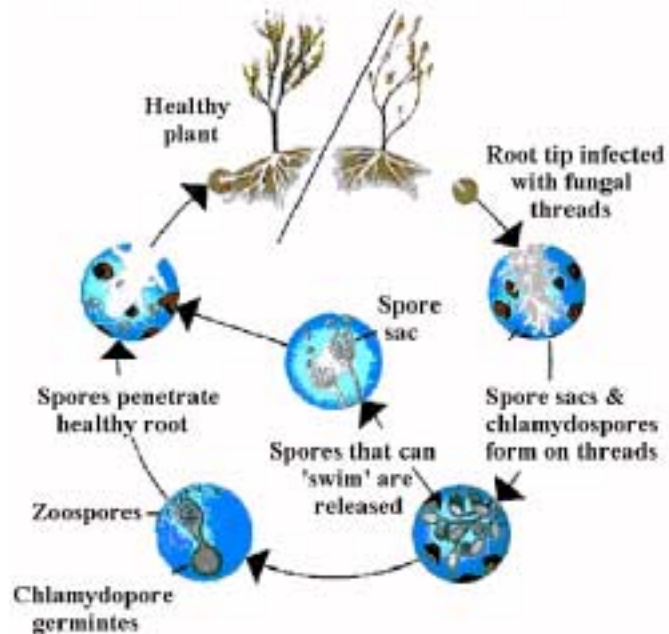


The food source of *P.cinnamomi* is the root and stem tissue of living plants. *P.cinnamomi* attacks the roots of plants and causes them to rot. This rotting may extend in to the base of the plant. This rotting weakens or kills the plant by limiting the uptake of water and nutrients.

It is estimated that about 25% of the 8000 vascular plants in the south-west of Western Australia are susceptible to infection by *P.cinnamomi* (Komorek, 1994). Many of these plants are only found in the south-west of Western Australia. Some of the south-west's more common plants are susceptible, including Jarrah, Banksias, Grass Trees, Hibbertias, Hakeas and Dryandras.

Soil that is warm and moist provides the best conditions for *Phytophthora cinnamomi* survival and sporulation.

Generalised Life Cycle of *Phytophthora cinnamomi*



### Process of Plant Invasion

1. *P.cinnamomi* spores are chemically attracted to plant roots.
2. *P.cinnamomi* spores extend a tube (hyphae) into a root cell.
3. The tube (hyphae) invades the root cell and feeds off the sugars and starches in the root.
4. A lesion is formed (rotting tissue).
5. Plants either respond by
  - blocking the lesion with resistant cells (resistant species), or,
  - the lesion cannot be blocked and the plant eventually dies (susceptible species).

### Spore Types

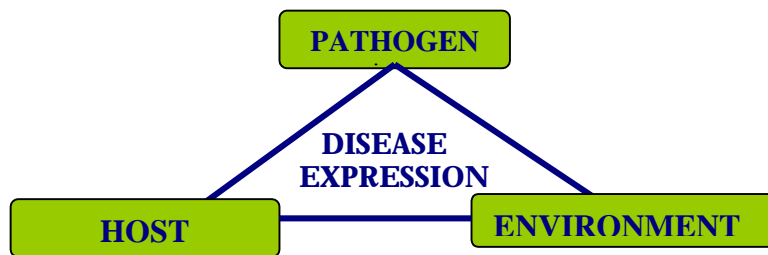
To reproduce, *P.cinnamomi* produces 2 different types of spores: zoospores and chlamydospores.

Zoospores – are very small and swim to new plants to cause new infections. They are short-lived and fragile but are produced in large numbers. Zoospores enable *P.cinnamomi* to spread from one plant to the next. Zoospores can also be carried along in moving water.

Chlamydozoospores - are large sized spores that are tough and long-lived. They are produced under unfavourable conditions. They may be transported in soil or roots and then germinate to cause a new infection when they encounter favourable conditions.

## Disease Triangle

Phytophthora dieback disease will occur in time, when you get a pathogen, a host, and a suitable environment. This can be demonstrated as a disease triangle.



Disease Expression: A combination of a pathogen, host and correct environmental conditions, which results in either some host deaths (low impact), or many host deaths (high impact).

Environment: Factors which act on an individual organism during its lifetime eg. temperature, soil type, moisture levels.

Host: The plant which is invaded by a pathogen and from which the pathogen derives its energy

Pathogen: Any organism or factor causing disease.

Removal of any factor from the equation of this triangle means that disease cannot exist at the site.

## Level of Impact

The effect of *P.cinnamomi* on plant communities varies greatly due to variability within and between plants in their response to *P.cinnamomi*, and variation in the environment.

The impact *P.cinnamomi* has on remnant vegetation can be classified as one of the following:

- 1. No apparent disease.** Applies to Karri, Wandoo forest, which contains no/few susceptible species.
- 2. High impact.** Very destructive - applies to Banksia woodland and heathland
- 3. Variable impact.** Erratic deaths, sometimes no deaths. Unpredictable. Applies to forest/woodland where Jarrah is the dominant tree component.
- 4. Replacement of all susceptible species with resistance species.** Little or no death. Usually results in Marri/Dryandra woodland.

## Environmental Factors

Soil (pH, fertility, moisture, texture), vegetation and temperature have significant influence on the presence, occurrence and level of impact of *P.cinnamomi*.

### Temperature

- Optimum growth range 15°C to 30°C
- Optimum temperature for spore production 25°C to 30°C
- Temperatures < 0° or > 35°C are unfavourable to the survival *P.cinnamomi*

### Soil

- pH - optimum pH 5-6 (acidic)  
- calcareous sands in coastal areas are generally alkaline and generally not compatible with *P.cinnamomi*.
- Fertility - Infertile sandy gravels are more compatible to *P.cinnamomi* because there is good movement of water and few antagonistic microflora.
- Moisture - Moisture is critical for survival of *P.cinnamomi* in the soil and for spore production  
- The most favourable environment for *P.cinnamomi* requires the soil to have a moisture content that still allows for an aerobic situation. Saturated soils become anaerobic and therefore don't contain enough oxygen to favor spore production
- Texture - Large pores in coarse textured soils favor dispersal of *P.cinnamomi*.

### Vegetation

- Some vegetation stands are hostile to the development of *P.cinnamomi*, for example, *Acacia pulchella* causes high ammonia levels which are hostile to *P.cinnamomi*
- Dense vegetation on fertile soils has a high level of antagonistic microflora in the soil. These antagonistic microflora consume *P.cinnamomi*.

## HOW IT SPREADS

### Movement through Soil / Root to Root Contact

*P.cinnamomi* spreads quickly down slope because its microscopic spores move in surface and sub-surface water flows. It spreads more slowly up slope and on flat ground (approximately 1 metre/year) because it is restricted to movement in plant roots (root to root contact).

### Animals

Introduced stock, such as cattle and sheep, have hard hooves, and are able to pick up and move soil in their hooves (and potentially *P.cinnamomi* spores). However the movement of stock through the landscape is generally limited. Therefore stock makes a relatively small contribution to the spread of *P.cinnamomi*. Native animals and other 'soft footed' animals pick up very little soil, and therefore do not contribute significantly to the spread of *P.cinnamomi*.

### Humans

Human activity causes the most significant, rapid and widespread distribution of *P.cinnamomi*. Road construction, earth moving and driving dirty vehicles on bush roads contributes significantly to the increased rate of spread of *P.cinnamomi*. Bush restoration activities may also inadvertently spread the pathogen, particularly when plants have been purchased from non-accredited nurseries, or when dirty tools are used.

## HISTORY

*Phytophthora cinnamomi* is not native to Western Australia. It is thought to have arrived in the state in soil around the roots of live plants, shortly after European settlement in the late 1820's.

The first recorded occurrence of trees 'dying back' was made in 1921

In the mid 1900's, gravel underneath dying patches of forest was used to build roads, therefore inadvertently spreading *P.cinnamomi* throughout the southwest. The other main contributor to the spread of *P.cinnamomi* was the use of heavy machinery following WW2, particularly for logging and clearing operations.

The cause of the 'dying back' in native forests was not identified as *Phytophthora cinnamomi* until 1964. By the time it was realised that *P.cinnamomi* caused death in native vegetation, it had been spread extensively throughout the southwest.

The result is a combination of infested and uninfested areas over thousands of hectares of native vegetation.

## GEOGRAPHY

### World Wide

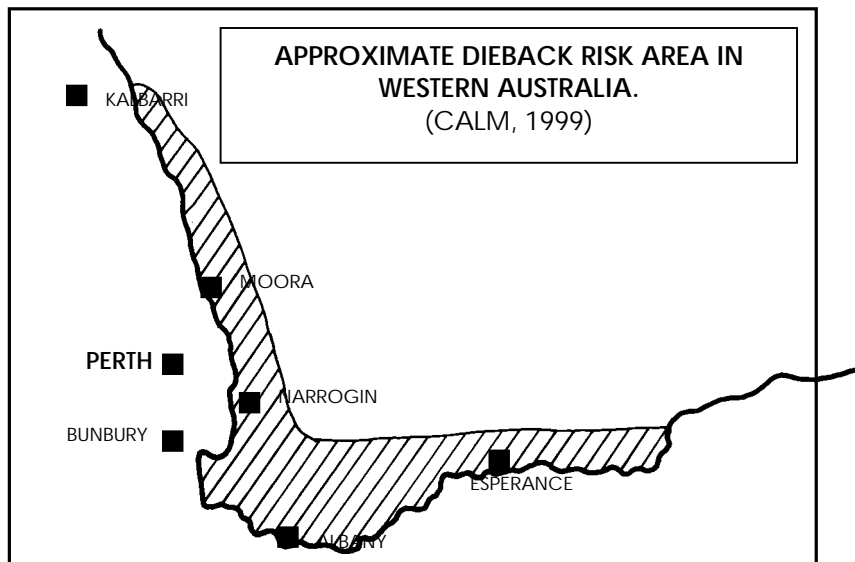
*P.cinnamomi* and the associated root-rot disease have a very wide geographical distribution. It is present in all continents except Antarctica. Its distribution is extensive in North America, South America and Africa.

### Australia

Most states of Australia contain *P.cinnamomi*. Whilst Western Australia has the most serious and significant problem with the pathogen, Victoria, Tasmania and South Australia also have problems with *P.cinnamomi*.

### Western Australia

In WA, *P.cinnamomi* is now widespread throughout the southwest of the state between Eneabba and Esperance. *P.cinnamomi* is found throughout the landscape in areas that receive above 800mm annual rainfall. Where annual rainfall is between 600 and 800mm, *P.cinnamomi* tends to be confined to stream systems and road verges (especially table drains). In areas receiving less than 600mm annual rainfall, *P.cinnamomi* is restricted to natural water gaining sites, or sites that have been altered and receive excessive drainage. There is no record of *P.cinnamomi* in regions receiving less than 400mm annual rainfall (CALM, 1998).



## RECOGNISING PHYTOPHTHORA DIEBACK

The presence of *P.cinnamomi* is deduced from the death of susceptible plants. Commonly used indicator plants include Jarrah, Banksias, Grasstrees (*Xanthorrhoea*), Zamia Palms, Hibbertias, Dryandras and Hakeas. Other factors that could have caused plant death (eg. fire, insects, flooding, drought, chemicals, other pathogens etc) must also be discounted. Plant root and soil samples can be taken and tested to confirm field observations.

As well as observing disease indicator species, the following vegetation features can be used to indicate the presence of *P.cinnamomi*:

- Total deaths – dieback kills plants completely and quickly.
- An age range in the deaths ie old deaths and recent deaths.
- Death in a range of susceptible plant species.
- A vector that could have introduced the disease.
- Other factors that could have caused tree death.

Soil and plant samples can also be taken and tested in a laboratory to confirm field observations.

When the presence or absence of Phytophthora dieback is to be used as the basis for a detailed disease management strategy involving considerable resources, the assessment should be completed by an accredited dieback interpreter.



*Banksia menziesii* (left) and *Xanthorrhoea preissii* (right) are both susceptible to *Phytophthora cinnamomi*.



Plant genera with species known to be affected by *Phytophthora* (CALM, 1999).

PROTEACEAE	MYRTACEAE	EPACRIDACEAE	OTHER
Adenanthos	Agonis	Andersonia*	Allocasuarina
Banksia*	Beaufortia	Astroloma*	Anarthia
Conospermum	Calothamnus	Leucopogon*	Boronia
Dryandra	Calytrix	Lysinema*	Conostylis
Franklandia	Eremaea	Monotoca*	Dampiera
Grevillea	Eucalyptus	Sphenotoma*	Dasyopogon
Hakea	Hypocalymma	Styphelia*	Daviesia
Isopogon*	Kunzea		Eutaxia
Lambertia*	Melaleuca		Gastrolobium
Persoonia*	Regelia		Hibbertia*
Petrophile*	Scholtzia		Hovea
Stirlingia*	Thryptomene*		Jacksonia
Synaphea	Verticordia*		Lasiopetalum*
Xylomelum			Latrobea
			Macrozamia
			Oxylobium
			Patersonia
			Phlebocarya
			Xanthorrhoea
			Xanthosia

\* indicates many species in the genus are severely affected.

Common Plants that are Susceptible to *Phytophthora cinnamomi*.

Northern and Central Jarrah Forest	Swan Coastal Plain	Southern Jarrah Forest
<i>Allocasuarina fraseriana</i> – Sheoak	<i>Hibbertia hypericoides</i>	<i>Allocasuarina fraseriana</i> – Sheoak
<i>Leucopogon verticillatus</i> – Tassel Flower	<i>Verticordia nitens</i>	<i>Allocasuarina humilis</i>
<i>Eucalyptus marginata</i> – Jarrah	<i>Adenanthos sericea</i>	<i>Dasyopogon hookeri</i>
<i>Patersonia rudis</i> – Hairy Flag	<i>Adenanthos cygnorum</i> – Woolly Bush	<i>Leucopogon verticillatus</i>
<i>Adenanthos cygnorum</i> – Woolly Bush	<i>Dryandra nivea</i> – Dryandra	<i>Patersonia occidentalis</i>
<i>Banksia grandis</i> – Bull Banksia	<i>Dryandra sessilis</i> – Parrot Bush	<i>Eucalyptus marginata</i> – Jarrah
<i>Banksia littoralis</i> – Swamp Banksia	<i>Banksia attenuata</i> – Slender Banksia	<i>Adenanthos barbiger</i>
<i>Dryandra sessilis</i> – Parrot Bush	<i>Banksia littoralis</i> – Swamp Banksia	<i>Banksia grandis</i> – Bull Banksia
<i>Isopogon sphaerocephalus</i>	<i>Banksia menziesii</i>	<i>Banksia ilicifolia</i>
<i>Persoonia elliptica</i>	<i>Xanthorrhoea</i> species	<i>Banksia quercifolia</i>
<i>Persoonia longifolia</i> – Snotty Gobble	<i>Isopogon formosus</i> – Cone Flower	<i>Dryandra nivea</i>
<i>Macrozamia reidley</i> – Zamia Palm	<i>Lomandra odora</i> – Tiered Mat Rush	<i>Dryandra sessilis</i>
<i>Xanthorrhoea gracilis</i> – Slender Grasstree	<i>Conospermum stoechadis</i> – Smoke Bush	<i>Xanthorrhoea gracilis</i>
<i>Xanthorrhoea preissii</i> – Grasstree	<i>Macrozamia reidley</i> – Zamia Palm	<i>Xanthorrhoea preissii</i>

## INDUSTRY IMPACT

Plant death from *P.cinnamomi* is not restricted to native plants. A range of horticultural crops and ornamental plants are also susceptible to *P.cinnamomi*, and a number of industries are affected by this pathogen.

The forestry industry suffers significant losses due to *P.cinnamomi*. Timber species susceptible to the pathogen include Radiata Pine (*Pinus radiata*) and Jarrah (*Eucalyptus marginata*) (Cahill, 1993). The impact *P.cinnamomi* has on native forests, bushland reserves, heathlands and National Parks can also impact on the tourism value of these areas.

Many ornamental and garden plants are also susceptible to *P.cinnamomi*, including camellias, azaleas, and rhododendrons (Erwin & Ribeiro, 1996). *P.cinnamomi* causes significant losses to the nursery industry.

*P.cinnamomi* results in the loss of millions of dollars from Australia's horticultural industry. Horticultural crops, including apricot, peach, grapevines, kiwi fruit, pineapple, avocado, chestnut, walnut and macadamia nut, are all susceptible to *P.cinnamomi* (Cahill, 1993, Erwin & Ribeiro, 1996). A number of flower crops, most notably Proteas, are also susceptible (Cahill, 1993). These guidelines focus on the need to manage Phytophthora dieback in and near bushland, but the need to minimise spread of *P.cinnamomi* in horticultural areas should also be considered by Local Government.

## MANAGING PHYTOPHTHORA DIEBACK

The number of new *P.cinnamomi* infestations can be reduced by modifying activities that spread the pathogen, or by controlling access to high priority areas. Modifying activities may involve cleaning machinery, vehicles or footwear, scheduling activities for dry soil conditions, or using materials that are free of *P.cinnamomi*. Controlling access may involve track rationalisation, upgrading tracks, or restricting the access of off road vehicles.

The other tool that can be used to protect vegetation from *P.cinnamomi* is the chemical phosphite. Phosphite is a biodegradable fungicide that protects against plants against *P.cinnamomi* (refer to Part 7 for more information on Phosphite).

# 3. PHYTOPHTHORA DIEBACK POLICY

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A Local Government needs to develop, adopt and implement a policy that suits their particular needs and circumstances. However, the following goals, objectives and policies are an example of what could be included in a Local Government Phytophthora dieback policy.

## GOAL

To protect native remnant vegetation within the Local Government area by minimising the risk of introducing and spreading *Phytophthora cinnamomi*.

## OBJECTIVES

1. To implement Phytophthora Dieback Management Procedures to minimise the risk of Local Government operations introducing and spreading *P.cinnamomi*.
2. To identify reserves of high conservation value that are threatened by *P.cinnamomi*, that are located in, and managed by, the Local Government, and implement Phytophthora Dieback Management Procedures.
3. To ensure all large scale developments and activities approved by the Local Government, that have the potential to spread *P.cinnamomi* into high value bushland, use the appropriate Phytophthora Dieback Management Procedures.
4. To provide appropriate levels of information to the public on matters related to *P.cinnamomi* and encourage residents and other land managers within the Local Government area to undertake appropriate actions to protect their properties from Phytophthora dieback.

## POLICIES

1. The Local Government formally recognises the significant threat of Phytophthora dieback to the natural values of the area.
2. The Local Government to consider current activities and procedures, and review these activities and procedures with a view to adopting Phytophthora Dieback Management Procedures.
3. The Local Government to identify reserves of high conservation value and act to protect these reserves from Phytophthora dieback.
4. Relevant Local Government staff to receive Phytophthora dieback management training.
5. Developments approved by the Local Government to contain conditions or recommendations regarding the implementation of Phytophthora Dieback Management Procedures.

6. The Local Government to provide information to community conservation groups and other groups and individuals, to ensure the integrity of Local Government management activities in relation to Phytophthora dieback.
7. The Local Government to regularly review its procedures and performance in relation to Phytophthora dieback.
8. The Local Government to review new information and technologies, and include in policy when appropriate.

# 4. RISK

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## ACTIVITY RISK

It is important to balance effort against risk. Phytophthora dieback management in Local government should focus on activities that have a high to medium risk of introducing or spreading *P.cinnamomi*.

### High Risk Activities

High Risk Activities are defined by having a high likelihood of moving soil, sand or gravel. This movement can be deliberate or accidental. The movement of these materials is considered a high risk, because *P.cinnamomi* is transported in these materials. High-risk activities undertaken in Local Government include:

- The deliberate movement of soil, sand and gravel (earthmoving).
- The construction of roads or drains.
- The use of heavy vehicles and large machinery.
- Completing activities in wet soil conditions when soil is likely to stick to vehicles and machines in large amounts.

### Medium Risk Activities

These activities have a moderate risk of moving soil, sand or gravel, and therefore a moderate risk of introducing *P.cinnamomi*.

- Use of vehicles, hand tools, small machinery
- Footwear in wet conditions.

### Low Risk Activities

These activities have a low risk of introducing *P.cinnamomi*.

- Footwear in dry soil conditions.

## SITE RISK

Phytophthora dieback management should also focus on sites where there is remnant vegetation/bushland of high/medium conservation value, and where there is a low risk of *P.cinnamomi* being introduced by other activities (High/Medium Priority Sites). There is little point taking precautions to minimise the risk of introducing Phytophthora dieback if there is no remnant vegetation present, and/or if there are other high risk activities occur at the site that do not have Phytophthora dieback Management Procedures in place.

# 5. PHYTOPHTHORA DIEBACK MANAGEMENT PROCEDURES

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## HOW CALM MANAGES PHYTOPHTHORA DIEBACK

The most effective way to manage Phytophthora dieback is to determine the location of infections within the area of operation. The Department of Conservation and Land Management (CALM) has the resources and expertise to map Phytophthora dieback at potential work sites, categorise their sites as infested, uninfested, uninterpretable, protectable and unprotectable, and implement the appropriate management procedures. Unfortunately this management approach is not usually practical and cost effective for Local Government.

## PHYTOPHTHORA DIEBACK MANAGEMENT IN LOCAL GOVERNMENT

The most practical (and in most cases, cost effective) way to manage *P.cinnamomi* in Local Government involves modifying operations that have a high risk of introducing or spreading Phytophthora dieback. This modification is only required when the operation is to occur in or near sites with vegetation that has medium or high conservation value.

Unlike CALM, it is generally not practical for most Local Governments to map the location of *P.cinnamomi* at each work site. However, if an operation is to occur in a reserve of high conservation value and involves a large investment of resources, mapping of *P.cinnamomi* is recommended. This will ensure that management procedures such as using *P.cinnamomi* free gravel are not implemented unnecessarily.

**In most cases, modifying the operation will not require a significant increase in time or costs. Good planning and some flexibility in works programming will ensure this modification can occur with minimal inconvenience.**

The following activities undertaken by Local Government have a medium to high risk of introducing or spreading *P.cinnamomi* to bushland or horticultural areas:

- Road construction
- Drain construction
- Maintenance activities
- Parks and Reserves maintenance
- Fire fighting activities
- Off road vehicle use by Ranger staff and other vehicles.

Local Government can also reduce the risk of private landholders introducing and spreading *P.cinnamomi* through the planning approval process. Conditions and/or recommendations can be applied to high-risk activities approved by the Local Government, such as subdivision, development, construction or clearing.

## ROAD AND DRAIN CONSTRUCTION AND MAINTENANCE

Road and drain construction and maintenance activities have a high risk of introducing *P.cinnamomi* as they involve the deliberate and/or accidental movement of soil, water and vegetation, and can occur in or adjacent to bushland, bushland reserves and horticultural areas.

These activities also involve the use of large machinery and equipment, and this machinery can be moved between many sites in a relatively short period.

